Implementing a Kanban Replenishment System at Reliant Medical Group

A Major Qualifying Project Report
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In Collaboration With

Reliant Medical Group
Atrius Health

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Acknowledgements

Abstract

The goal of this project is to develop a standard Kanban Supply Replenishment System for primary care supplies at Reliant Medical Group. This System is expected to decrease time for the medical assistants and reduce the inventory costs for the company. A pilot replenishment system was developed, tested and improved at their clinical site in Spencer, Massachusetts before being implemented in their other clinical sites. A complete instruction manual is also developed as a reference.

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1. Introduction

Following the remarkable success of the Toyota's production system, a lot of companies have begun to adopt and apply lean principles to their organization. Lean principles are used to preserve value while eliminating the amount of waste which ranges from time, defects, inventory, work in progress, defects and overproduction. Nowadays lean principles are not only limited to manufacturing, they have been applied to other industries such as finance, retailing, distribution and healthcare.

Reliant Medical Group is a healthcare organization that has been applying lean principles across its organization for more than 3 years. The kaizen promotion office has been working on several projects aimed at promoting lean thinking and lean principles across the organization since its creation 3 years ago.

It has been estimated that most of their clinical sites at Reliant have about 30% of overstock items and a vast majority of these items have a limited shelf life. When they expire, the company has to discard them and it is an extra cost that the company has to incur. In the previous years, the cost of the obsolete items was covered by the insurance company but due to a change of policy, it will not be covered anymore. So there is a real need for a better system that can reduce the inventory level and the inventory cost.

This is why the Kaizen Promotion Office decided to implement a Kanban supply replenishment system for their primary care supplies across their several clinical sites throughout Massachusetts. The Kanban replenishment system will allow the company to have a pull replenishment system and a visual method for automating stock replenishment. The Kanban

system was developed, tested and improved at their clinic in Spencer and if positive results are obtained, the kanban system will then be implemented to the other clinical sites.
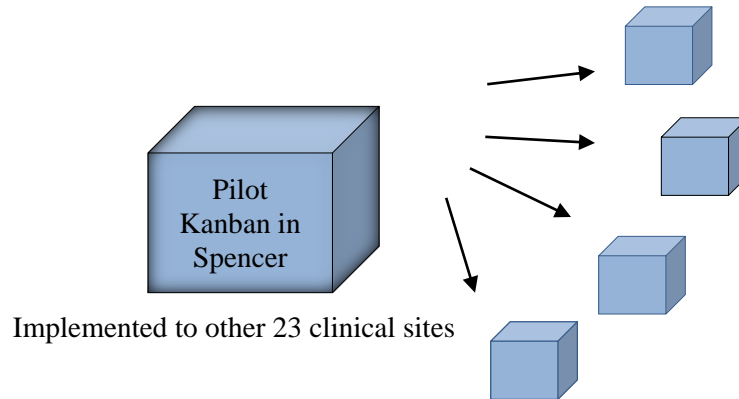
2. Background

2.1 Company's Profile

Reliant Medical Group was founded in 1929 and it was the first medical practice to be implemented in Central Massachusetts. It was previously known as Fallon Clinic but the name was changed in October 2011. The company is an affiliate of Atrius Health: an alliance of 5 medical groups in Massachusetts. It has more than 23 clinical sites throughout Central Massachusetts with over 260 physicians. The company has been owned and run by physicians. It is currently the leading healthcare provider in Central Massachusetts with more than one million patient visits annually. (Healthcare Information and Management Systems Society, 2011; Reliant Medical Group, 2012)

Reliant Medical Group provides patients with a full range of primary care services and over thirty different specialties, from podiatry to vascular surgery. It also offers other services

such as density testing, MRI exams, diabetic and nutritional counseling to patients. (HIMISS, 2011)

The company has been recognized as a leader in the healthcare delivery innovation, which uses a proactive approach to patient care. In addition to having proactive approach to patient care, the medical group has taken another step forward by implementing lean principles and it is currently in its third year of the lean journey. The group has a kaizen promotion office which is promoting lean thinking and lean principles across the several clinical sites and levels of the organization. One of their current projects is the development of a standard Kanban replenishment system in their primary care supply closets. The closets house medical supplies for exam rooms, orthopedic supplies and nursing supplies. Their clinic in Spencer has been chosen to be the site where the new Kanban system will first be developed, implemented and tested for the first time.

2.2 Clinical Facility in Spencer

The clinic in Spencer is of medium size compared to the other clinical sites owned by Reliant Medical Group. The site has three main departments: Internal Medicine, Orthopedic and Pediatric departments. Each of the department has its own supply closet which is maintained by the medical assistants in the department.

2.3 Terminologies

2.3.1 5S

5S is a lean methodology used to create and maintain an organized and disciplined workplace. 5S stands for Sort, Set in Order, Shine, Standardize and Sustain. Sort involves removing all the supplies, information, equipment and materials from the work area that are not

being used. Set in order involves establishing a unique and appropriate location for the required items. The goal of settings things in order is to provide a simple and visual system for storage and retrieval. Shine involves returning equipment as close as possible to its original solution and keep it that way. Standardize means setting standards and implement ways to measure procedures to implement the first 3s and ensure that procedures are being adhered to. Sustain includes setting a continuous improvement culture where the company long term goals are in line with its business goals and strategies.(Dolcemascolo, 2011)

2.3.2 Kaizen

Kaizen is a Japanese concept that was introduced around World War II and its English translation means continuous improvement. "Kai" means to correct and "Zen" means good.   It is a system that involves the participation of everyone in an organization- every employee from upper management to the cleaning crew. Every person in the organization is encouraged to come up with small ideas and suggestions about how to improve the organization on a regular basis. It is a continuous process. Many companies such as Toyota have implemented Kaizen and it has been known to have successful results.(Hudgik, 2012)

2.3.3 Kanban

Kanban is a Japanese word that means visual card and it is a concept often associated with lean and just-in-time (JIT) production. It is a scheduling system that specifies when to produce, what to produce and how much to produce. It operates for a pull production system where every production line pulls just the number and type of components the process requires, at just the right time. Kanbans are effective because they help simplify planning and adjust production to meet changing customer demand of up to + or – ten percent. They help speed the

process flow and hence reduce lead time. Supplies are not delivered until they are needed, reducing waste and cutting storage costs. (Institute of Manufacturing,University of Cambridge,)

2.3.4 PFEP (Plan For Every Part)

The Plan For Every Part (PFEP) is a key element of a lean material handling system. A PFEP is a document or database that contains information about every part: how each part is purchased, packaged, stored, received and delivered to its point of use. This information is already present in an organization but it is usually scattered among many employees hence making it almost invisible. The PFEP allow all the information to be stored in one place and rendered accessible to everyone in the facility.

2.3.5 General Standard Work

The general standard work is a document that contains the all the steps needed to complete a process. It documents the best practices that the employees should adopt in order to perform a uniform work with little or no variation. Standardized work is another lean tool that is often neglected but it serves as the basis for future improvements. The general standard work also helps in training new employees and serves as a reference for an existing process.

2.4 Current Supply Replenishment System
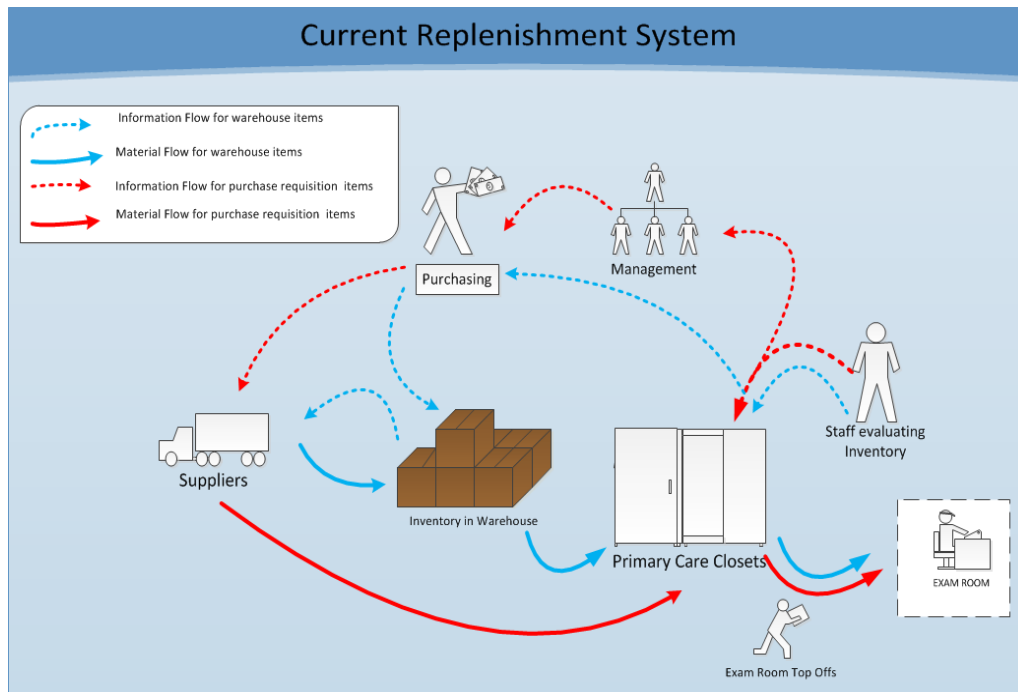
Figure 2. Current Replenishment System.

Each clinical site of Reliant Medical across Massachusetts has its own medical supplies replenishment system and each department such as internal medicine or the pediatric department orders its own supplies. Each department has its own primary care closet which is where the main inventory is stored. The primary closet is used to top off the supplies in the exam rooms when they are running low. The supply closets are usually maintained by medical assistants who are also responsible for verifying the inventory level and ordering medical supplies.

Each supply closet has two types of items: warehouse items and purchase requisition items. Warehouse items include commonly used items such as bandages, gloves and band aids. Purchase requisition items are items that are not supplied by the warehouse, they are ordered

directly from the supplier and they need special approval before they are ordered. They include items such as flu and vaccination shots.

With the current replenishment system, most clinics order medical supplies once a week and the supplies are delivered twice a week. For instance, the Spencer site has two delivery days Wednesday and Friday. Orders placed by Monday are delivered on Wednesday and orders placed by Wednesday are delivered on Friday.

In order to check the inventory level, the medical assistants have to go through each item in the closet and perform a visual inventory in order to know what is missing. The fact that the inventory evaluation is done manually is the major problem of the current replenishment because:

1. The process of evaluating inventory, restocking and organizing items in the primary care closets is a time consuming process which is non-value added for the medical assistants. Their only value added time is the time they spend with patients.

2. The medical assistants take a long time to place an order. To place a warehouse order, they have to flip through a lot of pages and write down the order quantity on the order form. The order forms are very long and contain all the items that the warehouse offers. Each department will usually order only a few items mentioned on the list.

3. The inventory evaluation being manual and the medical assistants having to go through many items in the supply closet lead to a high probability of making errors when placing orders. The errors in turn lead to high chances of running out of certain items.

4. The medical assistants tend to order more than what they need since they like to have a safety buffer in order to avoid running out of products.

5. Overstocking of medical supplies which expire leads to wastage and high inventory costs

During summer 2011, a pilot Kanban system was implemented at a few of the clinical sites but for most of the locations, the kanban system was not working efficiently. The problems encountered were:

1. The Kanbans cards were getting lost since the cards did not have a fixed place on the shelf

Figure 3. Loose Kanban Cards.

2. There was confusion about what supplies to order and the medical closets with Kanban cards took longer to organize than the ones without the Kanban cards.

3. Wrong placement of cards on the shelf

4. The cards were not always pulled at the trigger point

5. Cards were hard to locate on the shelf since they were not very obvious

Figure 4. Cards hard to locate on shelf.

6. Running out of supplies or having to order more supplies than what was on the card

7. Errors on cards

8. Too much information on card- it was hard to find the needed information
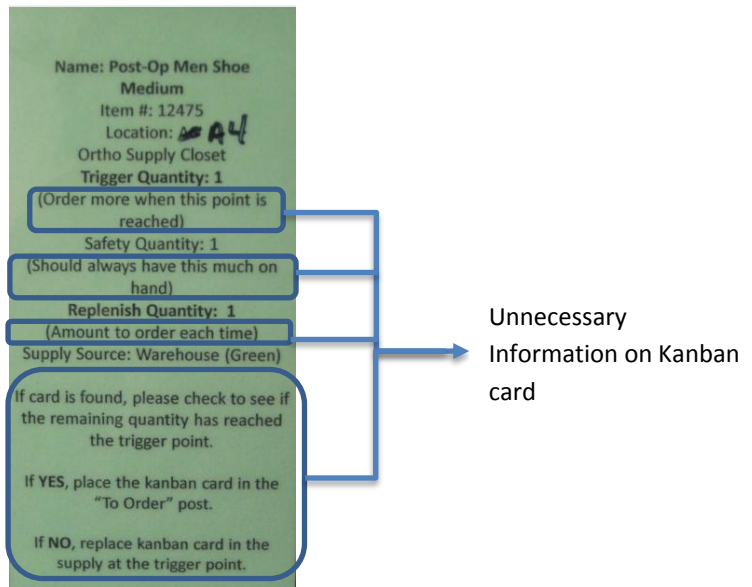
Figure 5. Previous kanban card with too much information.

The Kaizen Promotion Office at Reliant Medical Group is now trying to troubleshoot the problems with the actual Kanban system and come up with another pilot Kanban replenishment system. The office is aiming at implementing a standard and functional Kanban system at each of their clinical site. Each site will manage its own replenishment system independently and medical assistants will still be in charge of the system. The Kanban system is, however, expected to produce the following results:

1. Prevent too much inventory from building up and freeing more storage space

2. Prevent long lead time and backorders

3. Reduce inventory and logistics costs

4. Easier management and organization of the medical supplies for the medical assistants. The replenishment system is expected to reduce the non-value added time for the medical assistants.

5. Level loading of their primary supplies according to the demands of each clinical site. The orders placed are expected to be in shorter amount but on a more frequent basis.
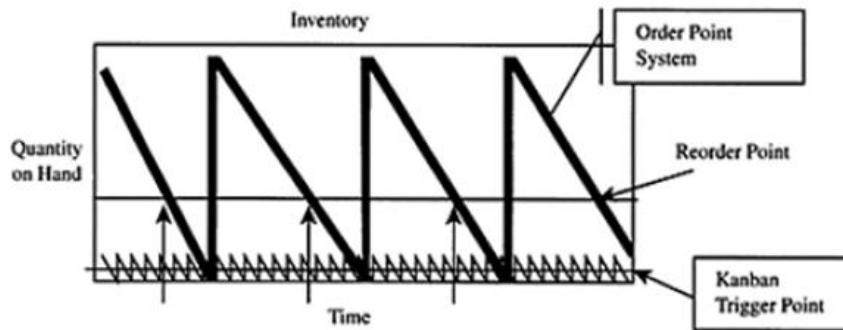
Figure 6. Order Point System v/s Kanban System. (Wisdom E-university Knowledge Center, 2010)

3. Methodology
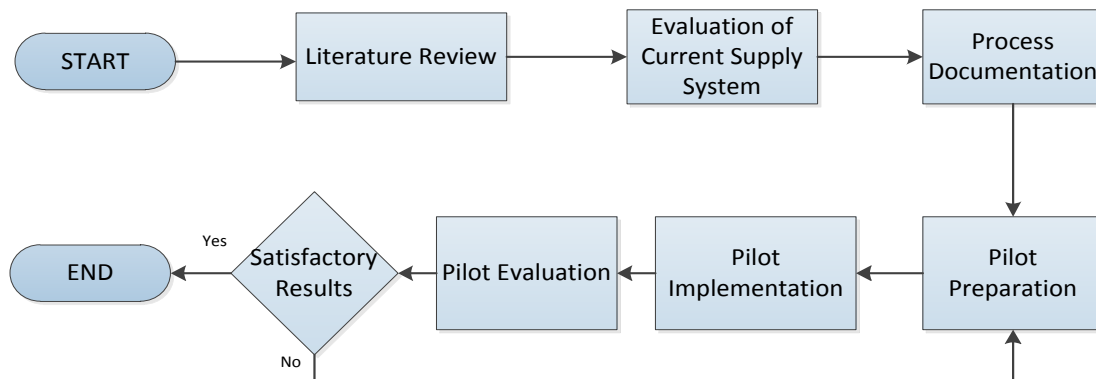
Figure 7. Methodology flow chart.

3.1 Literature Review

Literature review was the first step of the project and it involved collecting background information about Reliant Medical Group and the services it offers in order to become more

familiar with the project. It also involved going through the technical terms that were mentioned in the project description in order to get a better understanding of the project.

3.2 Evaluation of Current Supply System

The evaluation of the current supply system was done by first visiting several clinical sites across Massachusetts. An overview of the current supply replenishment system and the organizational structure of the company were obtained. This phase allowed us to identify the problems of the current evaluation system, the constraints and different decision variables for the new supply replenishment system.

Visual evaluations of the current storage closets were performed by taking pictures of the medical closets and talking to the medical assistants and sites managers. The following questions were also asked to the medical assistants:

Table 1. Questions asked to medical assistants during site visit.

With Kanban	Without Kanban
1. How well is it working for you? 2. What works well? 3. What isn't working? 4. Too much of anything? 5. Running out of anything? How often are you running out? 6. Who orders the supplies? 7. Who restocks the shelves? 8. How do you know how to restock?	1. Who figures out what to order and how? 2. How do you order supplies? How often? 3. Who orders the supplies? 4. Who restocks the shelves? 5. What works well with your current system? 6. What isn't working? 7. Too much of anything? 8. Running out of anything? How often are you running out?

3.3 Process Documentation

After each site visit, the notes taken and the answers to the questions asked to the Medical Assistants were documented in a single spreadsheet. At the end of the site visits, all the notes were reviewed in order to identify the common issues that various sites were facing

Holden - 02/06/12
Met with Marc Rosales and MA's
- Overall not happy with the current kanban system
- Not enough cards / missing cards
- Errors on cards, wrong locations/order numbers
- Wish we could do something about sheets, forms, and paperwork
- Wrong labels on shelves
- Having to order case quantities is impacting the storage space
- Didn't train on how the kanban works
- Didn't feel like they were involved
- Not happy with their PCIS experience (may not be effective in the tier 1 & 2 processes)

Figure 8. Notes taken during site visit.

3.4 Pilot Preparation

The pilot preparation included using the purchasing report from the two previous years of each department in Spencer for the PFEP document. The total volume of medical supplies purchased was used to calculate the daily consumption rate of every item in the primary care closets.

With the help of the medical assistants the frequency, day and time of ordering as well as the time taken for the supplies to be delivered were identified and entered in the PFEP. The supplier's minimum order quantity was also entered and all the information gathered was used to determine the supply closet safety stock, trigger and replenishment quantities.

The information entered in the PFEP was then validated by comparing the supplies listed on the PFEP with the actual number of supplies in the closets and other assorted locations. The PFEP was then updated; supplies that were not listed on the report but are currently used were added and supplies listed on the report but were no longer in use were removed.

3.5 Pilot Implementation

The pilot implementation involved setting up the supply closets with Kanban Cards at a clinical site. New medical supplies were ordered, and the standard work for the medical assistants was developed. Once the medical supplies were received, the PFEP was updated once more. Kanban cards were then made for each medical item in the primary care closets and the supplies were rearranged in the closets together with the cards. The medical assistants were then trained by the team to use the Kanban cards and learn how the replenishment system functioned.

3.6 Pilot Evaluation

After the implementation, the new replenishment system was then evaluated for about a month. The medical assistants were asked for feedback and performance measures were used to assess the new system.

Site Variables

The constraints identified for the project were

1. Some clinical sites have multiple closets with the same medical supplies
2. Different size closets at each of the site
3. Some departments also have space limitations
4. All the sites have a different usage for each of the medical supply items

Criteria for the new replenishment System

A criterion was then established for the new replenishment system.

- Every kanban card has a specific place on the shelf
- The cards need to be more visible
- Cards need to be simple with only the required information

- All the cards have be of one standard size

- There should be no mistakes on the cards

- Minimize unpacking process for restocking shelves- the supplies should be left inside the packaging as much as possible and the packaging can itself be the container

- Make supply locations easier to find

- Each supply must have its own location and must be visible

- The supplies should be grouped by classification

- One time Kanban should be used for seasonal product

- For multiple storage areas of, each closet will have a Kanban card which when pulled will draw supplies from the main supply closet

Counter Measures

Following the criteria developed for the new replenishment system developed, a set of countermeasures were put in place to ensure that the criteria was followed.

- Using 5S methodology

  - The supplies were grouped together by their type

  - Items that are used on a frequent basis should be closer and easier to reach

  - The items should be grouped by their size or their packaging as much as possible

  - All the orthopedic supplies must be placed together

2. Placement of shelf should include some identification

  - Lines

  - Clear bins or containers

- Packaging as supplies as much as possible

- Color Coded Shelves

3. Cards

 -The cards should be made out of bright and fluorescent colors in order to be

conspicuous

 - Every card should have a place on the shelf and should be affixed

 - The information the card should be minimal with only the required information

- The information on the card should also be grouped by the process: triggering the card,

ordering the supplies and placing the card back in the supply closet

4. Analysis and Results

4.1 Plan For Every Part (PFEP)

The PFEP is a central document that contains all the information about each of the item in the

supply closet. A PFEP was developed for the clinic in Spencer and for every department. It

contains the following information:

- The item number

- The item description

- The purchase type : Warehouse or Purchase Requisition Item

- Information about Supplies that are in the supply closet

1. Unit of Measure for each of the supply: roll, case, bottles, pack

2. Location of Supply in the closet room

3. Daily Consumption calculated; all the calculations can be found in appendix 1.

1. Frequency of Reordering: the number of days between reorder points

2. Lead time for replenishment which is the number of days between the order and the receipt of the order

3. Replenishment Quantity which is the quantity ordered or purchased from the warehouse

- Reorder Information

1. Trigger Quantity which is the quantity remaining in the supply closet when kanban is triggered

2. Safety Stock of each item is the number of supplies for two days

   1. Replenishment Method

   2. Unit of Measure from Supplier: roll, case, bottles, pack

- Inventory on hand

1. Minimum Order Quantity from Supplier

2. Comments that medical assistants might have

									Supply Closet Data						Re-order Information	
PART ID	PART DESCRIPTION	Purchase Type	Total QTY	Unit of Measure (UOM)	Location	Daily Consumption	Frequency of Re-ordering (days)	Lead-time to replenish (days)	Replenishment Qty (of UOM stored on the shelf)	Trigger Qty (of UOM stored on the shelf)	Safety Stock (of UOM stored on the shelf)
12168	191320 PAD, ALCOHOL PREP MEDIUM 2 PLY	Warehouse	20	Box	Exam 15, 16, 17 - cabin	0.03953	7	3	1	1	1
12170	508716 APPLICATOR, COTTON TIP 6" NS	Warehouse	7	Box	Counter top	0.01383	7	3	1	1	1
12229	409742 GLOVE, EXAM SMALL "LATEX FREE"	Warehouse	112	Box	Wall. Cabinet top shelf.	0.22134	7	3	3	3	1
12230	409743 GLOVE, EXAM MEDIUM "LATEX FREE"	Warehouse	202	Box	Wall. Cabinet top shelf.	0.39921	7	3	4	4	1
12231	409744 GLOVE, EXAM LARGE "LATEX FREE"	Warehouse	126	Box	Wall. Cabinet top shelf.	0.24901	7	3	3	3	1
12239	51208 HEMOCULT DEVELOPER	Warehouse	104	Each	Cabinet bottom shelf.	0.20553	7	3	3	3	1

Figure 9. Screenshot of PFEP.

4.2 New Replenishment Process

Based on the problems with the previous replenishment system, the Kaizen promotion team wanted to move to a more synchronized replenishment process where:

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- A Kanban card is pulled at the trigger point

- The order quantity is the written on the order sheet

- The Kanban card is then placed in the card holder while waiting for delivery

- The order sheet is then faxed to the warehouse for regular stock item

- The order is received

- The supplies are then organized on the shelf together with the Kanban cards

4.3 Kanban Cards
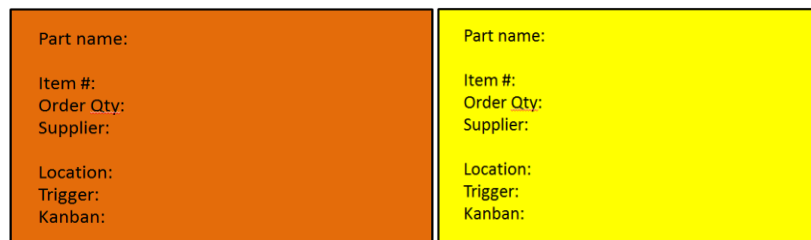
Figure 10. Orange card for warehouse item, Yellow Card for Purchase requisition item.

After removing the unnecessary information from the previous cards used and using the input from the medical assistants, new Kanban cards were designed. Orange cards are used for the regular warehouse items and yellow cards are used for purchase requisition items and for items with seasonal variation. Purchase requisition items are items that are directly ordered from supplier and they do not come from the warehouse. They are items that need special approval from the administration before they are placed. An example of such item would be flu shots. The Kanban cards were designed using the input of the medical assistants. They were asked in what order they would like the card information to be arranged.

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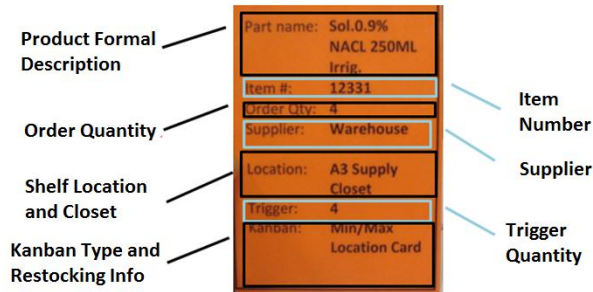
Figure 11. Kanban Card Layout.

4.3.1 -Bin replenishment system

A 2-bin replenishment system is used as an inventory control method where each item in the supply closet is stored equally in 2 containers. Each container has a Kanban card attached to it and when items are used, they are pulled from a single bin. Once the bin is used up, the Kanban card is pulled and an order is placed for replenishing the item. The second bin has enough items to last until the order placed is delivered. The 2 bin system is also subdivided into smaller categories as follows:

- **2-Bin As Packaged** – It is used for items who come in boxes or packages that can be used as bins

- **2-Bin Small** –It is used for items that will be stored in small bins

- **2-Bin Medium**- It is used for items that will be stored in medium bins

- **2-Bin Large** - It is used for items that will be stored in large bins

Figure 12. 2 bin system.

4.3.2 Bin replenishment system

A 1-bin system works in a similar way as the 2-bin system except that the trigger quantity is zero. All the items are in one bin and only one Kanban card is used. This system is used for items that are rarely used; the replenishment time is shorter than the frequency of the item usage. It is also used for items that have other alternatives in the closets i.e they can be substituted by other items present in the supply care closet. Just like 2 bin replenishment system, the 1 bin system can be subdivided into 4 different sub categories: 1-Bin as Packaged, 1-Bin Small, 1-Bin Medium, 1-Bin Large.

4.3.3 Min-Max system

It is used when the trigger quantity and the order quantity are not necessarily equal. It is also for items that cannot be placed in bins due to their size and space limitations. Some of items were placed on the shelf and some were left in their own package. In order to cause the trigger point, a min-max system was used. This system limits the amount of primary care supplies that can be ordered since the amount ordered cannot exceed the maximum quantity on the shelf and the minimum quantity ensures that the clinic does not run out of the supplies.   The min/max was also subdivided into 3 subcategories as follows:

1. **Shelf Mount-** When the medical assistant see shelf mount written on the card, this means that they have to look for the card holder on the shelf. The card holder might be visible or it might be between packages of the product. The card is affixed to the card holder and the card is pulled and an order is placed when the card becomes visible.

2. **Insert-** This means the card is inserted in some container, product dispenser or shoe holder together with the product

3. **Insert with card holder-** This means that the card is affixed on the product with some type of fastener.

4. **Location Card-** This means the Kanban card is not placed in front of the product but is on the shelve somewhere between the supply items and medical assistant has to look for it.
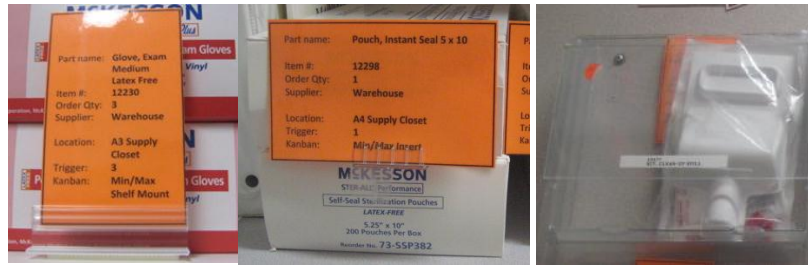
Figure 13. Min-max replenishment system (Shelf mount, insert w/ card holder, insert).

4.3.4 Affixing Cards

Since the Kanban cards were getting lost and misplaced in the old system, Velcro strips and small plastic pockets were used to affix the cards to the bins. For min and max products, card holders and inserts were used to keep all the cards in place.
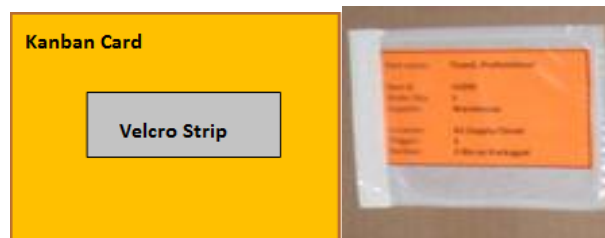
Figure 14. Affixed cards.

4.4 Supply Closets

Figure 15. Internal Medicine primary closets before and after.

After the cards were made and the medical supplies were ordered, all the primary care items were removed from the supply closets. The closets were then modified by the maintenance team to create more shelve space and accommodate the bins. The primary care items were placed in bins and min-max items were prepared. A 5S activity was then performed in order to group the supplies by their type and their size. For instance all the items used to clean wounds such as hydrogen peroxide and oxygenated water were placed next to each other, and then grouped together by their size. All the items that are commonly used were placed within easy reach i.e. on the middle shelf near the door for greater convenience.

5S- Most commonly used items placed within easy reached and near door. Items were also grouped by their type and

Figure 16. Supply closets after 5S and kanban implementation.

The shelves have also been divided into smaller regions A1,A2, A3, B1, B2 etc and clearly labeled in order to make it easier for the medical assistants to find items on the shelf. Arrows have been used to indicate the direction of where to start using Kanban items in the supply closets.

Figure 17. Use of arrow to indicate direction of Kanban item in supply closet.

4.5 Warehouse Order and Purchase Order Forms

The previous order form for the warehouse was at least 6 pages long and it contained all the items that were provided by the warehouse. However most items listed were not actually ordered by the clinical sites. The form is a standard form used by all the clinical sites to request items from the warehouse. To place an order, a medical assistant would have to go through all the pages, select the items needed and enter the desired quantity before faxing the order. After some discussions with the warehouse manager, we found out that the existing order forms were not necessary but when an order is placed, the warehouse needed the following information: item

number, the item description, the quantity the unit of material and the clinical site is requesting it in order to process the purchase request.

So new order forms were designed and each supply closet now has its own order forms. Each closet has 2 order forms: a form for regular warehouse items and another one for purchase requisition items. All order forms are a page long which reduces the time medical assistants spend on ordering. The new order form has all the required information from the warehouse and only contains items present in the supply closets. The order quantity has already been entered for every item and a medical assistant just need to check the items needed, enter their name and put the date to place an order. The quantity on the order forms matches the order quantity on the Kanban cards.

Supply Closet Requisition

Charge Acc #: 40 025-2100					Warehouse Use: Req#				
Deliver to: SPE.INT.MED					Fax #: 508-407-7765				
Requisitioned By:			EXT:		Date:				

Order (X)	Quantity	Units of Measure	Item Number	Item Description	Order (X)	Quantity	Units of Measure	Item Number	Item Description
	1	BX	12170	APPLICATOR, COTTON TIP 6" NS		1	BX	12375	TAPE, POROUS 2"X10yds
	1	BX	12171	APPLICATOR, COTTON TIP 6" STERILE		1	BX	12380	TAPE, CLOTH 1\2"X10YDS. "LF"
	2	BX	12184	BANDAID, SHEER PATCH 1.5 X 1.5		1	BX	12381	TAPE, CLOTH 1"X10YDS. "LF"
	2	BX	12186	BANDAID, 1"		1	BX	12384	TAPE, PAPER 1"X10YDS. "LF"
	2	BX	12187	BANDAID, 2"		1	BX	12385	TAPE, PAPER 2"X10YDS. "LF"
	5	EA	12188	BOWL, EMESIS DISPOSABLE		1	BX	12391	TONGUE DEPRESSOR, 6" NON-STER.
	3	EA	12196	BOWL, 1 QUART STERILE DISPOSABLE		1	BX	12393	TOWEL, OVAL FENESTR. 18X26" STER.
	1	EA	12208	DRESSING, TELFA 2X3" STERILE (WRAPPER CONTAINS LATEX)		1	BX	12394	TOWEL, PLAIN 18X26" STER.
	1	EA	12209	DRESSING, TELFA 3X4" STERILE (WRAPPER CONTAINS LATEX)		1	CS	12395	TOWEL, PROFESSIONAL
	1	EA	12211	DRESSING, VASEL. 3"X9" ST		1	CS	12396	UNDERPADS (CHUCKS) 28x30
	1	TB	12214	SPECULUM, EAR 2.75 DISP.		1	BG	12398	TUBE, THROAT CULTURE
	1	TB	12215	SPECULUM, EAR 4.25 DISP.		1	BX	12403	SPECULUM, VAG. COOPER SMALL FOR PAP LIGHT
	3	BX	12229	GLOVE, EXAM SMALL "LATEX FREE"		3	EA	12405	WATER, DISTILLED GALLON
	6	BX	12230	GLOVE, EXAM MEDIUM "LATEX FREE"		1	CS	12407	PEAK FLOW, MOUTH PIECE
	3	BX	12231	GLOVE, EXAM LARGE "LATEX FREE"		2	EA	12477	KIT, CLEAN-UP SPILL
	2	BX	12238	HEMOCULT SLIDE		10	EA	12492	SANITARY NAPKINS (MAXI THINS)
	1	BX	12239	HEMOCULT DEVELOPER		15	BX	12509	KLEEN TISSUE, FACIAL

Figure 18. New order sheet.

4.7 Training of the Medical Assistants

Once the Kanban system has been set up and it has been calibrated to the items that have already been ordered. The medical assistants were trained and a general standard work booklet was made especially for them which contain instructions about how to use the Kanban system.

The general standard work booklet will be used in the future to train medical assistants and a copy can be found in Appendix 3.

4.6 Evaluation

After the Kanban System was implemented, the system was evaluated to see if the implementation was successful and effective. An evaluation sheet was made and the medical assistant in charge of each closet was asked to fill it each week. For each occurrence of an event mentioned on the sheet, the medical assistants were asked to put a check mark on the sheet.

Evaluation Checklist ⊩⊩	Week 3/28/12		Week 4/4/12		Week 4/11/12	
CARDS	Internal Med	Pediatry	Internal Med	Pediatry	Internal Med	Pediatry
1. Any missing or lost cards						
2. Cards not well affixed or falling. (Any problem with the velcro?)						
3. Unsure where to place cards						
4. Incorrect Information on cards -wrong item number,product description etc				II		
5. Items on card does not match item on shelves (Misplaced Card)						
6.Any problems with the cards holder? Are they coming off?						
SHELVE ITEMS						
1. Running out of Items			I		I	
2. Bins have more items than what's written on the cards			I			
3.Any items you cannot locate?						
ORDERING						
1.Ordering takes longer than before (visual inspection)						
2.Any errors in Ordering?			I		I	
3.Any missing items on the ordering form?						

Figure 19. Evaluation checklist.

In the first week no error was reported but in the second week the internal medicine department started to run out of items and there was also an error in ordering. For the items running out, the medical assistants were walked through the procedures of what they should do if such occurrence happens. They should first determine if the running out was a one-time occurrence or not. If not, they should increase the trigger quantity so that the card is pulled earlier with a higher quantity of stock on the shelf that is going to last during the replenishment

process. If increasing the trigger quantity does not work, the replenishment quantity should then be increased. The error in ordering was because the same order sheet was sent twice to the warehouse. There was a miscommunication among the medical assistants about who was supposed to send the order form.

In the third week, the internal medicine department ran out of an item because the Kanban card was not pulled at the right time. In order to prevent this from happening, the training of the medical assistant was reinforced so that they properly follow the procedures.

4.8 Results

Despite a few errors with the system, the Kanban system has generated satisfactory results. The order quantity has been reduced significantly compared to what was ordered in the previous years. This is shown in Fig. 20 for a given time period in the year 2010, 2011 and 2012 for the internal medicine and pediatric department.
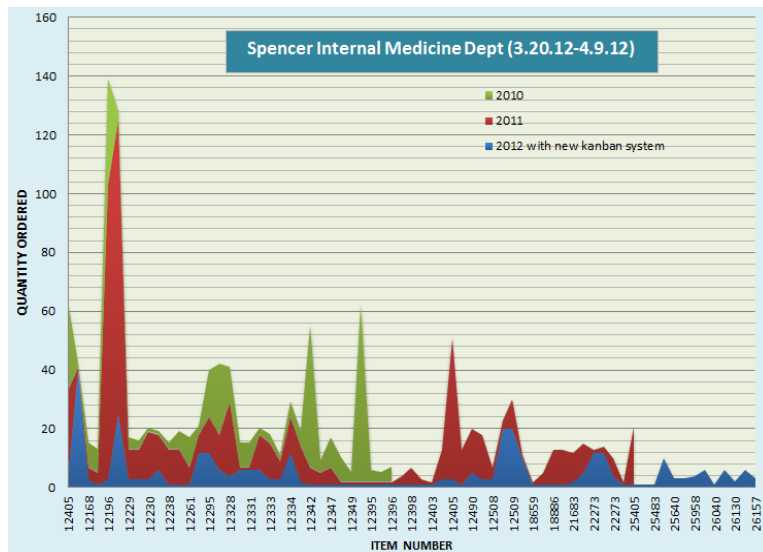
Figure 20. Graph of order quantity for internal medicine.
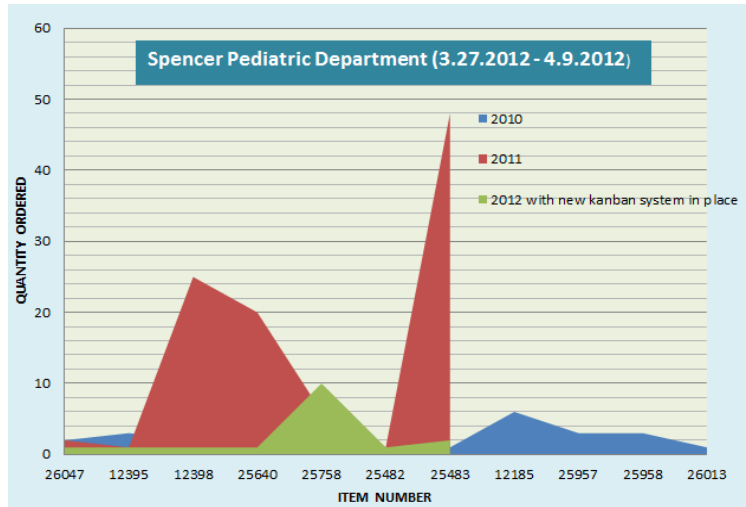
The annual cost savings for the IM department was also estimated by comparing the average order costs before and after the system was implemented for 9 days. The amounts of money saved per day and per year were then calculated. The same calculations were repeated for the pediatric department except a time period of 7 days was used.

Table 2. Amount of money saved by the internal medicine department.

Internal Medicine Department	Cost
Amount of money saved / 9 days	$137
Amount of money saved / day	$15.20
Forecasted Amount of money saved / year/site	$3872

Table 3. Money saved by the pediatric department.

Pediatric Department	Cost
Amount of money saved / 7 days	$81.83
Amount of money saved / day	$11.69
Forecasted Amount of money saved / year/site	$2981

Table 4. Implementation cost breakdown.

Implementation Cost Breakdown	
Bins (3 sizes)	800
Card Holders	26
Shoe Holders	60
Paper for cards	24
Lamination Pouches	50
Misc Hangers & Fasteners	50
Velcro	75
Double Sided Foam tape	46
Label Cartridges	50
Plastic Sleeves	35
Total	$ 1,216.00

Table 4 shows the itemized cost of implementing the Kanban system at the clinic in Spencer. The cost savings in Spencer was then calculated by adding the savings from both the internal medicine and pediatric department. If the Kanban system is implemented to all clinical sites, the company is expected to save about $ 155,549 annually like shown in Table 5.

Forecasted annual savings for the internal medicine department	$ 3,782.00
Forecasted annual savings for the pediatric department	$ 2,981.00
Total forecasted savings for the Spencer	$ 6,763.00
Forecasted annual savings for 23 clinical sites	$ 155,549.00
Cost of implementation for Spencer	$ 1,216.00
Return on Investment	3 months

In addition to the smaller order quantities and lower inventory costs, other results from the Kanban system include:

- Faster Ordering Process with shorter order forms. The ordering time has been reduced from 2-3 hours per week to 20 minutes per week.

- Ordering is now done 2-3 times per week instead of once per week.

- Less time spent by medical assistants in locating and restocking items on shelf. The shelves are now clearly labeled and it is easier to find items.

5. Recommendations

- In the long term, use the Kanban system to gradually switch to a "Breadtruck Resupply System" to ensure a constant, agile and reliable supply of primary care items. In a "Breadtruck Resupply" system, the suppliers come in and replace what has been used in the

primary care closets. This system will remove the medical assistants completely from the replenishment process and further reduce their non-value added time.

- Use a Kanban system for the medicine cabinets as well. The Kanban system implemented only targets primary care supplies and exclude medicine cabinets. Medicines have a limited shelf life as well and a Kanban system can help reduce overstocking of these items as reduce their inventory costs.

6. Industrial Engineering Design Capstone Requirement

ABET is a non-profit and non-governmental accrediting agency for academic programs in the disciplines of applied science, computing, engineering, and technology. (ABET, 2011) Since the industrial engineering program at WPI is accredited by ABET, every student is asked to include the engineering design component in their project. ABET's definition of design is

"Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic science and mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective. Among the fundamental elements of the design process are the establishment of objectives and criteria, synthesis, analysis, construction, testing and evaluation."

The design requirements for ABET have been satisfied for this project since a new Kanban replenishment system has been designed to replace the previous system. The previous system has been thoroughly analyzed before developing the new one and constraints such as space limitations and non-uniform primary closets have been identified in the process. These problems were resolved by having different types of Kanbans such as the min-max system where

primary care items were left in their original packaging as much as possible. Items placed in container bins use up more of the shelf space. The min-max system is also more flexible than the other system and can be used in any primary care closets.

In order to develop the Kanban system, mathematics, basic sciences and engineering principles were used as well. They were used to develop the Plan for Every Part (PFEP) which determines the information on the Kanban cards. The projects also made use of lean manufacturing principles such as Kanban, 5S and 2 bin systems etc. Once the project was implemented, the project was then tested for about 3 weeks and the medical assistants were given a weekly evaluation checklist to fill. The order quantity, ordering time and the inventory costs were also used as measures for the new system. At the end of the project, a general standard work was also developed that provide guidelines about how to proceed with the implementation of the Kanban system at the other clinical sites.

7. Conclusion

The project demonstrates the application of typical lean manufacturing principles in a healthcare environment. Despite a few errors with the implementation of the Kanban replenishment system at the clinic in Spencer, the new system has been successful in reducing the inventory costs and the non-value added time for the medical assistants. Extra inventory and non-value added time are both considered as waste or muda in lean manufacturing terminology. The replenishment of primary care supplies is now being pulled by the demand: the medical items that have been used in the exam rooms on patients.

In addition, the medical assistants are now ordering supplies two to three times a week and it is taking them twenty minutes to do so. They used to order supplies once a week and were spending two to three hours to do so. The fact that they are ordering more often also brings them closer to the supplier and also reduces the chances they run out of primary care items. The ordering process is now less tedious for the medical assistants since they do not have to spend a lot of time performing a visual inventory evaluation or struggle to maintain the previous non-functional Kanban system in place. They are also less likely to make errors in ordering.

The results of this project depended on making small changes to get great results: modifying the order forms, introducing Kanban cards, making a general standard work and performing 5S activities in the supply closets. This is what leans is about: small changes bring big results.

Appendix 1- Calculations for the PFEP

- Daily Consumption $= \dfrac{\text{Total Volume purchased in 24 months}}{\text{Number of working days in 24 months}}$

- Trigger Quanity:

    if Trigger quantity $<$ Minimum Order Quantity,

    then trigger quantity $=$ Minumum order Quantity

    else

Daily Consumption Rate $*$ (Lead time for replenishment + Frequency of Ordering)

- Safety Stock $=$ 2 x Daily Consumption
- Replenishment Quanity

    if minimum order quantity

        $<$ Daily Consumption Rate x (Lead time for replenishment

        $+$ Frequency of Ordering)

    then Replenishment Quanity $=$ minimum order quantity

    else

    daily consumption rate $*$ (frequency of re-ordering + lead-time to replenish)

    or

    7 X consumption rate whichever is greater.

Appendix 2- Clinical Site Documentation after Every Visit

Millbury - 01/31/12 IM & PEDI

Met with Diane Dwyer, Tracy Hagerstrom, Sheri Demers, Helen Trujillo
 - IM closet was set up by KPO (not ortho) and PEDI was set up by the Millbury staff.
 - 2 closets and 1 cabinet area for all supplies in IM, all supplies in PEDI in one closet area.
 - The one in IM is not working well but is being maintained by Tracy. PEDI is functioning well but still requires a lot of labor.
 - Some cards missing and they are not all being used as written. Worried about stock outs.
 - Not always sure where to place them. In PEDI, the cards must have a place and is made obvious.
 - Tracy and Sheri both maintain the closets and do the ordering. Supplies are ordered 1x/wk.
 - PEDI is using bright florescent colors for their cards and are either affixing them with velcro or slid into bin slots.

Spencer - 02/02/12 IM & PEDI

Met with most of the MA's along with Edi and John Howard
- Having trouble finding things. Asked if closets could be alphabetized - cwould consider a list that is alphabetized.
- Almost running out of some products and having to order more than kanban card indicates.
- Deliveries are twice a week but the picking cycle is at least a week long - it may be a week before supplies ordered are delivered even though there may be a delivery from the warehouse scheduled sooner than that.
- Wiping out the supply closet when weekly room topoffs are done. Most are done on Thursday.
- The cards are placed inconsistently when the room is restocked. Not obvious.
- Ordering is going well and is faster than in the past.

Auburn - 02/02/12 IM & PEDI
Met with Michael Callahan and 2 MA's
- No Kanban Supply in place
- Different Size Closets at different ends of the building- Supplies are split among the closets
- Split closets - long walking distance when looking for supplies
- Consistent Ordering - Once per week. Supplies that need to be ordered are written on whiteboard
- Space is not a constraint- Supplies just need to be reorganized
- Some supplies are ordered in too large quantities
- May need to reorganize linen - having delivery problems with supplier - consider constraining the space with visual cues
- One person orders 1x/week
- Using white board to track what they use/need
- They have a real need to control ortho supplies

Westboro - 02/03/12 IM & PEDI
Met with JoAnn Rudge and MA's

- No kanban in place
- People write down what they want ordered. This seems to work for them
- Ordering 1x/week and supplies ordered arrive in about a week
- Doesn't take very long to place an order
- PEDI orders on Fri and gets by next Fri. If needed sooner, he calls and they bring it in on the next scheduled delivery
- Get Office Depot stuff on Mon
- PEDI MA orders for Specialties and they need help streamlining this process - takes up a lot of time in that many things are not from the warehouse.

Webster - 02/06/12
Met with Bernice Courtemanche & MA's, Nursing lead
- Kanban cards present in their main closet
- 2 closets filled with supplies + 1 closet filled with top off supplies
- Max of 2 boxes of supplies on hand
- Lots of text on the kanban cards
- Not all items have cards and errors with order numbers and labels
- Need a sort of map to locate the supplies
- Ordering of products goes very well with the kanban
- Excellent system in place for expiration dates - manual system

Holden - 02/06/12
Met with Marc Rosales and MA's
- Overall not happy with the current kanban system
- Not enough cards / missing cards
- Errors on cards, wrong locations/order numbers
- Wish we could do something about sheets, forms, and paperwork
- Wrong labels on shelves
- Having to order case quantities is impacting the storage space
- Didn't train on how the kanban works
- Didn't feel like they were involved
- Not happy with their PCIS experience (may not be effective in the tier 1 & 2 processes)

PLA PEDI - 02/08/12
Met with Kyleen Roman (per Cherie Jerz)
- There is a kanban set up and overall they like it
- They had to correct errors on cards and labels
- Also had to correct errors on trigger quantities
- When velcro is used, it seems to go missing (may be an exam room issue)
- They order 3x/week and get their orders from the warehouse in 2 - 3 days (1 -2 weeks for purchased supplies)
- Cards are going missing, this may be related to PUC and their unfamiliarity with the kanban system
- Would like a fixed placement with the cards
- Too much writing on the cards
- The kanban makes it easy to order

PLA IM - 02/08/12
Met with Carolyn Tretheway
- Does not have a kanban system
- 1 person doing the ordering and stocking.
- Order 1x/week
- No redundancies in closets
- Some supplies are stored in back of others on the shelves
- Bulkier items and exam room supplies in 1 closet
- Ortho supplies in 1 supply closet in boxes and buckets
- People write on white board if they need anything
- Visually looking at supplies to determine ordering need
- Carolyn asked if the KPO team can look at the differences between the new and old exam rooms during circle backs

North Lake Ave - 02/08/12
Met with Jessica Foley and Melissa Fournier
- No kanban in place
- Supplies are ordered 1x/week
- Closets were very orderly
- Multiple locations for both regular supplies and ortho - no redundancies
- They don't have a problem with over ordering or running out
- visually determining their supply need

Leominster FP - 02/09/12
- No kanban in place
- Orders placed at least once per week
- Delivery days-Wednesday and Friday
- Few backorders
- Medical assistants frequently go through closets and visually inspect what's missing
- They note what's missing and the medical assistant in charge of ordering will place order from warehouse
- No top off cards in exam rooms
- Supplies stored in 3 closets
- No problem with under or over ordering

Leominster IM - 02/09/12
- No kanban in place
- Delivery days- Wednesday and Friday
- On average- 1.5 hour spent per week on odering and maintaining closets
- Top off done once per week
- Kanban cards in exam rooms
- At the beginning of the kanban system, they were running out of supplies since the MA did not know how much to order
- Some medical supplies last for about a month in the closet
- Check off sheet used and is working

Fitchburg FP - 02/09/12
- No kanban in place
- Space is not a constraint and closet is well organized
- Ordering once a week
- Never short of medical supplies- Lots of inventory on hand for some medical supplies
- Delivery days are Wednesday and Friday
- Orders placed just by looking at what is missing
- 2 weeks supply of linen
- Half hour spent per week on medical closets - putting supplies on shelves

May St. IM - 02/10/12
Met with Debra Cannalonga
- Kanban in place
- Some cards are missing
- Not pulled when needed or put back in same place
- They like it when it works, not working consistently
- Order 1x/week - 3 days to 1 week for delivery
- Ordering more than card indicates
- More than 1 person orderingand stocking - having a problem with double ordering

May St. PEDI - 02/10/12
Met with Debra Cannalonga
- Kanban in place
- Some cards missing
- Order 1x/week
- Overordering from time to time
- They like it overall
- PEDI closets are being revised in March

Milford PEDI & IM - 02/10/12
Met with Linda Veneziano
- Kanban in place
- Using cards to know when to order but not pulled from shelf
- Using clipboards with checklist for ordering
- Using the cards to determine ordering amount
- Using a bigger laminated label in florescent pink for shelf labels
- Treatment room is not set up and would like to
- Missing several cards
- Would really like it if the warehouse could notify the department of anything on backorder
- Idea: use a swipe for supples removed from closet - orders and simultaneously attaches to claim in Epic
- Idea: use the kanban cards to fax order to the warehouse

Appendix 3- General Standard Work for Medical Assistants

STANDARD WORK
Kanban Supply Replenishment System for Supply Closets

PURPOSE
- REDUCE TIME SPENT PERFORMING VISUAL EVALUATION OF INVENTORY.
- MINIMIZE INVENTORY ERRORS.
- FACILITATE ORDERING PROCESS.

KEY TERMS

KANBAN: Visual signal used to trigger replenishment.

TRIGGER QTY: Quantity where order should be placed.

ORDER QTY: The amount that should be ordered when trigger quantity is reached. *Amount ordered should not exceed or be lower than the replenishment qty.*

2 BIN SYSTEM: Supplies are in equal quantities in 2 containers.

1 BIN SYSTEM: Supplies are in one container and Trigger Qty is zero.

Min/Max: Trigger is initiated when a minimum level is reached. Location Card can be used to control the maximum level.

1

STANDARD WORK
Kanban Supply Replenishment System for Supply Closets

2 BIN SYSTEM

In bins

As packaged

Min/Max System Location Card- Cards on shelves or between product

1

2

3

2

45

STANDARD WORK
Kanban Supply Replenishment System for Supply Closets

KANBAN CARDS

Part name:
Item #:
Order Qty:
Supplier:
Location:
Trigger:
Kanban:

Part name:
Item #:
Order Qty:
Supplier:
Location:
Trigger:
Kanban:

Orange Card: Item from Warehouse   Yellow Card: Purchase Requisition Item

KANBAN CARD INFO

Part Name

Order Qty

Location on Shelve

Kanban Replenishment Method: 2 bin, 1 bin or min/max

Part name:	Sol.0.9% NACL 250ML Irrig.
Item #:	12331
Order Qty:	4
Supplier:	Warehouse
Location:	A3 Supply Closet
Trigger:	4
Kanban:	Min/Max Location Card

Item Number

Supplier

Trigger Qty

3

STANDARD WORK
Kanban Supply Replenishment System for Supply Closets

PROCESS STEPS

1. TRIGGER POINT IS REACHED
   - Bin/ Container is empty
   - Cards are reached or become visible

Container empties out   Cards become visible

4

STANDARD WORK
Kanban Supply Replenishment System for Supply Closets

PROCESS STEPS CON'T

2. REMOVE THE CARD AND CONTAINER/PACKAGE FROM SHELF

3. PLACE THE ORDER
- Check the item needed on the appropriate order sheet. There should be a checkbox for every item.
- Fax order to the warehouse.

Supply Closet Requisition

Charge Acc #: 40 025-2100	Warehouse Use: Req#
Deliver to: SPE.INT.MED	Fax #: 508-407-7765
Requisitioned By: EXT:	Date:

Order (X)	Quantity	Units of Measure	Item Number	Item Description	Order (X)	Quantity	Units of Measure	Item Number	Item Description
	1	BX	12170	APPLICATOR, COTTON TIP 6" NS		1	BX	12375	TAPE, POROUS 2"X10yds
	1	BX	12171	APPLICATOR, COTTON TIP 6" STERILE		1	BX	12380	TAPE, CLOTH 1\2"X10YDS. "LF"
	2	BX	12184	BANDAID, SHEER PATCH 1.5 X 1.5		1	BX	12381	TAPE, CLOTH 1"X10YDS. "LF"
	2	BX	12186	BANDAID, 1"		1	BX	12384	TAPE, PAPER 1"X10YDS. "LF"
	2	BX	12187	BANDAID, 2"		1	BX	12385	TAPE, PAPER 2"X10YDS. "LF"
	5	EA	12188	BOWL, EMESIS DISPOSABLE		1	BX	12391	TONGUE DEPRESSOR, 6" NON-STER.
		EA	12196	BOWL, 1 QUART STERILE DISPOSABLE		1	BX	12393	TOWEL, OVAL FENESTR. 18X26" STER.
	1	EA	12208	DRESSING, TELFA 2X3" STERILE (WRAPPER CONTAINS LATEX)		1	BX	12394	TOWEL, PLAIN 18X26" STER.
	1	EA	12209	DRESSING, TELFA 3X4" STERILE (WRAPPER CONTAINS LATEX)		1	CS	12395	TOWEL, PROFESSIONAL
	1	EA	12211	DRESSING, VASEL 3"X9" ST		1	CS	12396	UNDERPADS (CHUCKS) 28x30
	1	TB	12214	SPECULUM, EAR 2.75 DISP.		1	BG	12398	TUBE, THROAT CULTURE

Simply check box for the item needed

5

STANDARD WORK
Kanban Supply Replenishment System for Supply Closets

PROCESS STEPS CON'T

4. PLACE THE CARD in container for the **WAITING ON ORDER** cards.

6

STANDARD WORK
Kanban Supply Replenishment System for Supply Closets

PROCESS STEPS CON'T

5. UPON RECEIPT OF THE ITEM, PLACE ITEMS IN BINS (if in bins) AND ON SHELF.   PLACE CARDS BACK ON SHELF/BIN/PACKAGE.

Part Name and Item Number on Card <u>MUST</u> match the Part Name and Item Number on the Shelf.

Part name:	Gauze, Sponge 2 x 2 Unster
Item #:	12337
Order Qty:	2
Supplier:	Warehouse
Location:	A3 Supply Closet
Trigger:	2
Kanban:	2 Bin Medium

12337
GAUZE, SPONGE 2x2 UNSTERILE

7

STANDARD WORK
Kanban Supply Replenishment System for Supply Closets

PROCESS STEPS CON'T

REMINDER: Do not forget to ROTATE the newly received supplies behind or under the older supplies so older supplies continue to be used first.

For example: TOP TO BOTTOM USAGE

PULL ITEMS FROM TOP ROW FOR USAGE

NEWLY REPLENISHED ITEMS SHOULD GO HERE

8

STANDARD WORK
Kanban Supply Replenishment System for Supply Closets

8. When pulling supplies from rows or columns, <u>START</u> where the arrow is placed and continue pulling supplies from the next consecutive bin in the <u>DIRECTION</u> of the arrow.

Appendix 4 – Evaluation Sheet for Kanban Replenishment System

Evaluation Checklist ┼┼┼┼	
CARDS	
1. Any missing or lost cards	
2. Cards not well affixed or falling. (Any problem with the velcro?)	
3. Unsure where to place cards	
4. Incorrect Information on cards -wrong item number,product description etc	
5. Items on card does not match item on shelves (Misplaced Card)	
6.Any problems with the cards holder? Are they coming off?	
SHELVE ITEMS	
1. Running out of Items	
2. Bins have more items than what's written on the cards	
3.Any items you cannot locate?	
ORDERING	
1.Ordering takes longer than before (visual inspection)	
2.Any errors in Ordering?	
3.Any missing items on the ordering form?	
OTHER	

Appendix 5- General Standard Work for Kanban Implementation

General Standard Work
Implementing Supply Closet Kanban System

Purpose: The purpose of this general standard work is to document the process for implementing a Supply Closet Kanban System at the clinic sites.

Scope: The scope of this standard work shall include the standardization of the Kanban Supply Replenishment System for Primary Care supply closets.

Responsibilities:

Project lead – PFEP data input and analysis, site scoping prior to implementation, assure implementation supplies are ordered, prepare team for implementation, oversight of project implementation onsite, train the closet owner and users, and conduct post-implementation visit to get feedback.

Team members – follow process steps for implementation, develop and implement countermeasures for any special challenges not resolved with standard work.
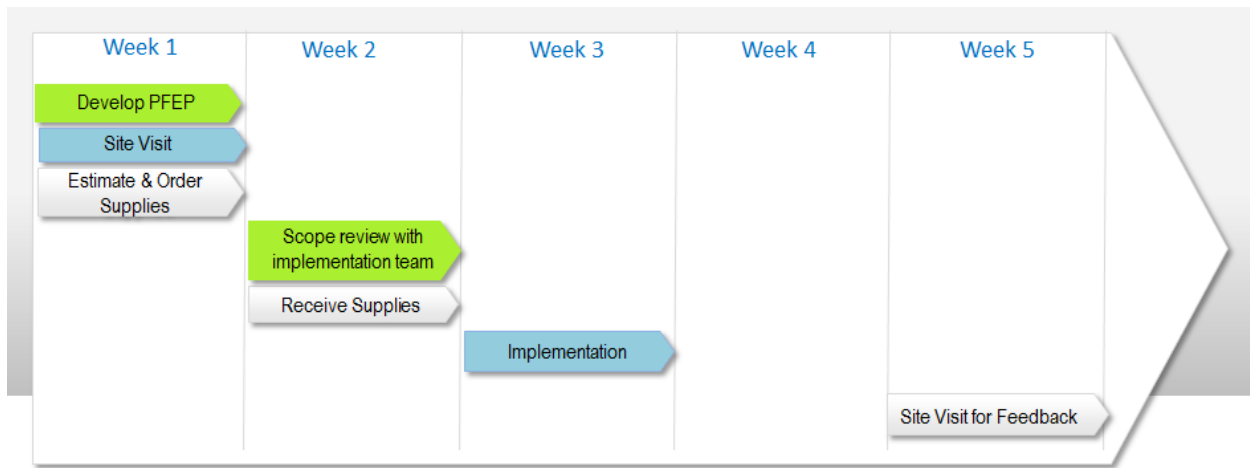
Closet owners – provide feedback for PFEP and 5s, schedule and participate in training, and generally support the implementation.

Reference Documents:
- PFEP template
- Kanban Card, Location Card, and Arrow templates
- Order Sheet templates
- General Standard Work for Supply Closet Kanban System
- Required supply list

Timeline for the Kanban Implementation

Week 1

PFEP (Plan for Every Part)

1. Request a purchasing report in an Excel spreadsheet that itemizes supplies purchased by the department for the past 2 years. These can be obtained by making a request to the Warehouse Manager for warehouse supplies and from the Purchasing Manager for supplies purchased through a purchase requisition.

2. Consolidate the data by summing up the quantities for each item. Input information and results into the PFEP under "Item #," "Description," "Total Purchased," "Unit of Measure (as purchased)."

3. Determine the number of business days the department operated during the data period and input the data into cell I3 of the PFEP ("Business Days").

4. Identify the frequency of when supplies are ordered by the department and determine the number of working days between these order points. Input this data for each supply item into the PFEP template under "Frequency of Ordering (days)."

5. Identify the number of days from the date that supplies are ordered by the department and the date they receive them. Input this data for each supply item into the PFEP template under "Lead Time to Delivery (days)."

6. Determine the minimum order quantity from the supplier and input the data under "Minimum Order Quantity." The spreadsheet should now calculate the "Order QTY" and "Trigger QTY." Check the spreadsheet to make sure all items have calculated and are numeric results.

7. Identify and add to the PFEP:

a. Is the item used in the exam rooms (X for yes)?
b. "Purchase Type (Warehouse or Purchase Requisition)"
c. "Unit of Measure (as Purchased" - roll, case, bottles, pack, etc.
d. Add any comments that may be pertinent to the implementation.

8. Determine if there are any items that the consumption rate may be influenced by seasonal variation or other abnormal conditions.

Site Visit

Visit the site to scope out closet work that will need to be done. This will include:
1. Determine the scope of the project and note any special problems or constraints that will impact the implementation process and help the team prepare. Take pictures of the closets to share with the implementation team.

2. Estimate the supplies needed and issue purchase orders.

3. Determine if any modifications to storage areas will be required. Notify Practice Manager and have work order issued to facilities maintenance.

4. Meet with the Practice Manager and closet owners to discuss the implementation impact and standard work for the department.

Week 2

- Receive the supplies.

- Meet with the implementation team to review PFEP. Update the PFEP prior to the meeting and make sure it is accurate as possible.

- Discuss the scope of the closet work at the particular department they will be working and develop ideas for counter measures for any special problems or constraints.

Week 3

Implementation
8. Reorganize each closet (5S):
   a. Remove any unnecessary items from the closets that don't belong.
   b. Referring to the PFEP, determine if there are any items that may be potentially overstocked. Discuss with closet owner and determine (within the context of the kanban system) which items have been overstocked. All extra supplies that are still in their original condition and package should be boxed up and sent back to the warehouse with an itemized list of the returned items (the standard warehouse order sheet can be used as the list). See Practice Manager for disposition of the rest.
   c. Reorganize the supplies and group them together based on the following criteria:

     i. Group by type of item (tapes together, bandaids together, gauzes together, etc.).

     ii. Exam room topoff and kanban items stored within easy reach and closest to the supply closet entrance.

     iii. Items used frequently should also be close to the entrance and easy to reach.

     iv. Large items should be stored closest to the floor.

     v. Ortho supplies should be stored together.

  d. Allow a little space between supplies.

  e. Utilize shoe holders (wall or door mounted) to move some supplies from the shelves to create more shelf space.

  f. Make labels and place them onto the front of the shelves at the center of each item location. Each label will have the item number and description. **Important:** Check accuracy of the label information and that each item is correctly labeled.

9. Determine kanban methods and complete PFEP:

  a. With the closet owner, determine if there are any items missing on the PFEP.

  b. Determine the items that will be managed as a Kanban and those that won't. Remove the non-kanban items from the closet if possible.

  c. Review the calculated trigger and order quantities with the closet owner and come to an agreement on starting quantities for both.

  d. Identify the type of kanban that will be used for each of the items based on the following order of preference:

     i. **2-Bin** – equal quantities in each bin and each bin has its own kanban card.

       1. **As Packaged**

       2. **Small, Medium,** or **Large**

       3. **1-Bin** – preferred if the supply item is used infrequently and stocked in the exam rooms.

     ii. **Min/Max** – used when trigger and order quantities are not necessarily equal or the item cannot be easily binned due to size of item or shelf space constraints.

       1. **Shelf Mount**

       2. **Insert**

       3. **Insert w/cardholder**

       4. **Location Card**

  e. Complete the PFEP with the new information:

     i. Add supply items that are missing from PFEP and will be part of the kanban system.

     ii. Remove items from PFEP if they will not be part of the kanban system.

     iii. Input remaining data:

       1. "Unit of Measure (as stored in closet)"

       2. "Closet Name"

       3. "Location on Shelf"

       4. "Kanban Method"

10. Create kanban cards, location cards, and arrows.

a. Using the kanban card templates (horizontal and vertical), fill in the required information from the updated PFEP based on the following guidelines:
   i. Create separate files for Warehouse horizontal, Warehouse vertical, Purchasing horizontal, Purchasing vertical (4 files). This will help the department later when they will be creating their own cards.
   ii. Fill in the information for each item inside the right text box keeping all in alignment with the category titles in the left textbox (left textbox alignment can be modified to accommodate the information entered on the right). See example below:
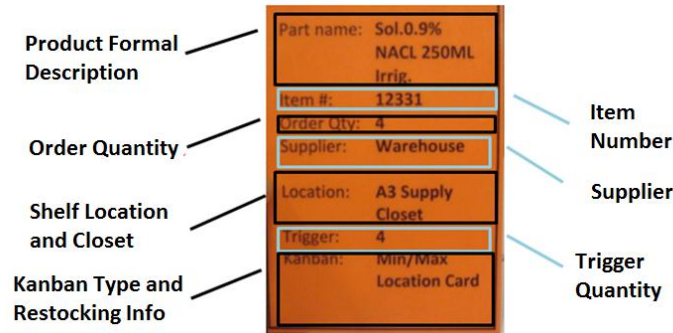
   iii. Location should indicate shelf location first and then closet name.
   iv. Kanban type and restocking information is based on the criteria defined in step 2.4. **Note: All 2-Bin kanban versions require 2 identical cards.**
b. Print kanban cards: orange paper for warehouse ordered items and yellow for purchase requisition ordered items.
c. Create location cards using the location card templates for those items that require them (primarily bottles). Choose the appropriate template based on the size and shape of the supply item.
d. Create arrows using the arrow template.
e. Laminate all kanban cards, location cards, and arrows (the entire 8 ½" x 11" page can be laminated at once) and then trim to size.

11. Set up supply closet items as kanbans.
a. Assemble all kanban supplies required for kanban setup.
b. Set up supply closet items per criteria in 2.4. The direction of the "pull" (in what order the supply items will be taken when needed) is based on these preferences:
   i. Top to bottom or front to back (most preferred)
   ii. Left to right (requires directional arrow)
   iii. Right to left (least preferred and also requires a directional arrow)

Arrow should be placed next to the place where the supply item should be pulled first and indicate the direction the item should be pulled next.

c. Place or affix cards based on the following guidelines:
  i. **2-Bin or 1-Bin, As Packaged** – Affix clear plastic sleeve onto package and insert kanban card. The cards can be either horizontal or vertical version depending on the package size and shape.

  ii. **2-Bin or 1-Bin, Small clear plastic bins** – Kanban card will be placed inside the bin under the supply item. The card version should be vertical.
  iii. **2-Bin or 1-Bin, Medium and Large clear plastic bins** – Affix the card to front of the bin using Velcro strips (fuzzy side of Velcro should always be on the bin). The card version should be horizontal.

  iv. **Min/Max, Shelf Mount** – Affix a shelf mounted card holder to the shelf at the proper trigger location using a strip of Velcro (fuzzy side of Velcro should always be on the shelf). Place card into the card holder. The card version should be vertical. If the supply closet item requires location cards (one each for both the trigger and order quantities) affix the location cards to the shelf with double-sided tape before and after the shelf mounted card holder. This will help constrain the number of items and their placement on the shelf.
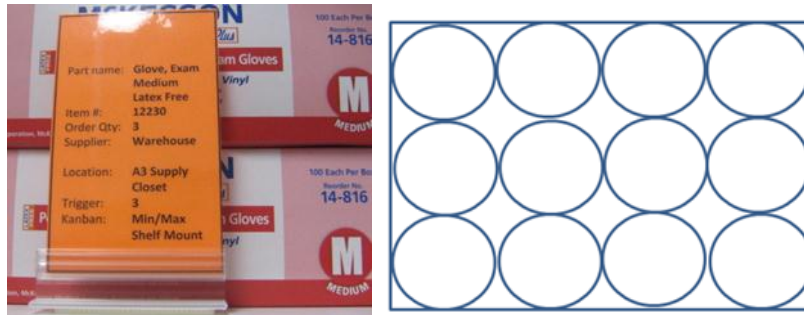
    v. **Min/Max, Insert w/cardholder** – Place the bottom of the kanban card into insert card holder and insert between supply closet items at the trigger point. The card version can be either horizontal or vertical depending on package size and shape.

    vi. **Min/Max, Insert** – In the case of supplies kept in slots, pockets, holders (including crutches and walkers), etc., the kanban card can be inserted behind the supply closet item at the trigger point. The card must become visible when the supply is pulled. The card version should be vertical.

  d. After all kanbans are set up, inspect for errors and compare the kanban card information with the label information to make sure they are the same item.

12. Develop order sheets for each closet.
  a. Create a new tab in the spreadsheet that is a copy of the current PFEP tab and sort the items by the "Closet Name" as the primary and the "Item Number" as the secondary. Transfer the information to the order sheet templates based on the following criteria:
    i. There should be 1 warehouse order sheet for each closet and 1 purchase requisition sheet for each closet (if applicable).
    ii. The order sheet should only have the items for the particular supply closet it will be located.
  b. Obtain the account and ordering information from the closet owner and fill out the rest of the order sheets.
  c. Print out the order sheets and place 1 copy of each in the supply closets.

Charge Acc #: 40 025-2100					Warehouse Use: Req#				
Deliver to: SPE.INT.MED					Fax #: 508-407-7765				
Requisitioned By:			EXT:		Date:				

Order (X)	Quantity	Units of Measure	Item Number	Item Description	Order (X)	Quantity	Units of Measure	Item Number	Item Description
	1	BX	12170	APPLICATOR, COTTON TIP 6" NS		1	BX	12375	TAPE, POROUS 2"X10yds
	1	BX	12171	APPLICATOR, COTTON TIP 6" STERILE		1	BX	12380	TAPE, CLOTH 1\2"X10YDS. "LF"
	2	BX	12184	BANDAID, SHEER PATCH 1.5 X 1.5		1	BX	12381	TAPE, CLOTH 1"X10YDS. "LF"
	2	BX	12186	BANDAID, 1"		1	BX	12384	TAPE, PAPER 1"X10YDS. "LF"
	2	BX	12187	BANDAID, 2"		1	BX	12385	TAPE, PAPER 2"X10YDS. "LF"
	5	EA	12188	BOWL, EMESIS DISPOSABLE		1	BX	12391	TONGUE DEPRESSOR, 6" NON-STER.
	3	EA	12196	BOWL, 1 QUART STERILE DISPOSABLE		1	BX	12393	TOWEL, OVAL FENESTR. 18X26" STER.
	1	EA	12208	DRESSING, TELFA 2X3" STERILE (WRAPPER CONTAINS LATEX)		1	BX	12394	TOWEL, PLAIN 18X26" STER.
	1	EA	12209	DRESSING, TELFA 3X4" STERILE (WRAPPER CONTAINS LATEX)		1	CS	12395	TOWEL, PROFESSIONAL
	1	EA	12211	DRESSING, VASEL. 3"X9" ST		1	CS	12396	UNDERPADS (CHUCKS) 28x30
	1	TB	12214	SPECULUM, EAR 2.75 DISP.		1	BG	12398	TUBE, THROAT CULTURE
	1	TB	12215	SPECULUM, EAR 4.25 DISP.		1	BX	12403	SPECULUM, VAG. COOPER SMALL FOR PAP LIGHT
	3	BX	12229	GLOVE, EXAM SMALL "LATEX FREE"		3	EA	12405	WATER, DISTILLED GALLON
	6	BX	12230	GLOVE, EXAM MEDIUM "LATEX FREE"		1	CS	12407	PEAK FLOW, MOUTH PIECE
	3	BX	12231	GLOVE, EXAM LARGE "LATEX FREE"		2	EA	12477	KIT, CLEAN-UP SPILL
	2	BX	12238	HEMOCULT SLIDE		10	EA	12492	SANITARY NAPKINS (MAXI THINS)
	1	BX	12239	HEMOCULT DEVELOPER		15	BX	12509	KLEEN TISSUE, FACIAL
	1	PK	12254	GAUZE, KLING CONFORM 2"X5 YDS		1	BX	18659	SWAB, OB/GYN 8" NONSTERILE
	1	PK	12255	GAUZE, KLING CONFORM 3"X5 YDS		1	BG	18886	BANDAGE, GAUZE STRETCH CONFORM WHITE "LF" 3"X5YDS. STER.
	1	PK	12256	GAUZE, KLING CONFORM 4" x 5 yds		1	BG	18887	BANDAGE, GAUZE STRETCH CONFORM WHITE "LF" 4"X5YDS. STER.
	2	BX	12263	MASK, SURGICAL FACE		10	EA	22273	BD PROBE TEC FEMALE COLLECTION KIT
	1	EA	12266	MASK, FACE SHIELD FULL		5	EA	22274	BD PROBE TEC MALE COLLECTION KIT

13. Print and laminate a copy of the general standard work for the kanban system. Put in a loose leaf notebook along with 1 copy of the PFEP. Place the copy in one of the supply closets per closet owner.
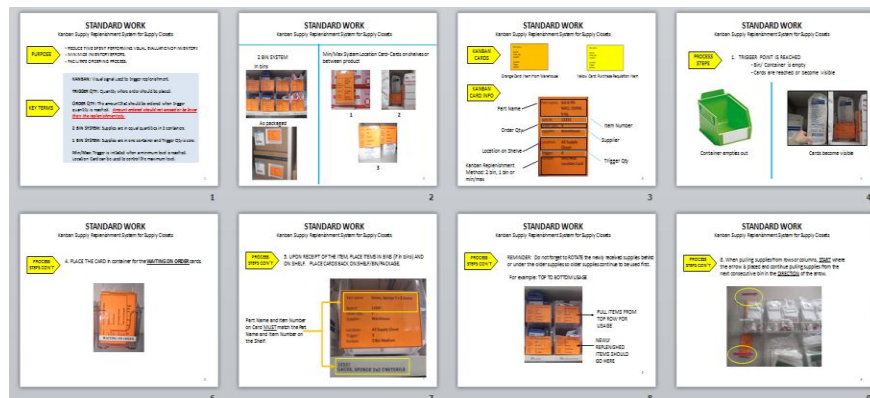
14. Mount a clear bin for the cards in each closet that has an order form and label it "Waiting on Order."

8. Copy all site specific documentation to the SharePoint site into the "Supply Closet" folder in the department's site specific documents folder.

9. Train the closet owner(s) and users on the standard work. Guidelines are:
   a. Discuss what a kanban is and how it works.
   b. Discuss what the expected outcomes are from doing a kanban system in their supply closets.
   c. Review definitions of some of the common terms in the standard work.
   d. Review the general standard work.
   e. Review with the closet owner the supporting documentation and how to revise it in SharePoint.

10. Calibrate the system to what has already been ordered and begin using system.

Week 5

Site Visit
1. Visit site and meet with closet owners and users to:
   a. Solicit feedback
   b. Observe closet status
   c. Give feedback
   d. Coach
   e. Conduct any additional training

2. Develop, review, and communicate any lessons learned to CIB for potential changes in standard work.

Appendix 6 - Results for Spencer Internal Medicine (3/15/2012-4/2/2012)

Evaluation Checklist ~~HHT~~

CARDS	
1. Any missing or lost cards	No missing cards I I
2. Cards not well affixed or falling. (Any problem with the velcro?)	Some cards tough to remove I I
3. Unsure where to place cards	I I
4. Incorrect information on cards -wrong item number, product description etc	I I So far so good
5. Items on card does not match item on shelves (Misplaced Card)	I I
6. Any problems with the cards holder? Are they coming off?	I I

SHELVE ITEMS	
1. Running out of Items	I I
2. Bins have more items than what's written on the cards	I I Currently yes, not permanent
3. Any items you cannot locate?	I I NO

ORDERING	
1. Ordering takes longer than before (visual inspection)	I I
2. Any errors in Ordering?	I I
3. Any missing items on the ordering form?	I I

OTHER
Medical assistant did not check the boxes correctly. She put a tcik mark for things that were working well

Evaluation Checklist ~~HHT~~

CARDS	
1. Any missing or lost cards	
2. Cards not well affixed or falling. (Any problem with the velcro?)	
3. Unsure where to place cards	
4. Incorrect information on cards -wrong item number, product description etc	
5. Items on card does not match item on shelves (Misplaced Card)	
6. Any problems with the cards holder? Are they coming off?	

SHELVE ITEMS	
1. Running out of Items	I
2. Bins have more items than what's written on the cards	I
3. Any items you cannot locate?	

ORDERING	
1. Ordering takes longer than before (visual inspection)	
2. Any errors in Ordering?	I
3. Any missing items on the ordering form?	

OTHER

Appendix 7- Results for Spencer Pediatry (4/4/2012)

Evaluation Checklist   ╫╫   —4/4/12

CARDS	
1. Any missing or lost cards	
2. Cards not well affixed or falling. (Any problem with the velcro?)	
3. Unsure where to place cards	
4. Incorrect Information on cards -wrong item number,product description etc	//
5. Items on card does not match item on shelves (Misplaced Card)	
6.Any problems with the cards holder? Are they coming off?	
SHELVE ITEMS	
1. Running out of Items	
2. Bins have more items than what's written on the cards	
3.Any items you cannot locate?	
ORDERING	
1.Ordering takes longer than before (visual inspection)	
2.Any errors in Ordering?	
3.Any missing items on the ordering form?	
OTHER	
Tape clears 1" x 10" #12378 s/b 2" x 10' Vasel Dressing 3" x 9" #12211 s/b 2" x 2"	

Appendix 8- Results for Spencer Pediatry (4/11/2012)

Evaluation Checklist   ╫╫╫-

CARDS	
1. Any missing or lost cards	
2. Cards not well affixed or falling. (Any problem with the velcro?)	
3. Unsure where to place cards	
4. Incorrect Information on cards -wrong item number,product description etc	
5. Items on card does not match item on shelves (Misplaced Card)	
6.Any problems with the cards holder? Are they coming off?	
SHELVE ITEMS	
1. Running out of Items	\
2. Bins have more items than what's written on the cards	
3.Any items you cannot locate?	
ORDERING	
1.Ordering takes longer than before (visual inspection)	
2.Any errors in Ordering?	\
3.Any missing items on the ordering form?	
OTHER	

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