Six Sigma Black Belt Project

Patient Non-Chargeable Supplies Order/Inventory/Stock Analysis

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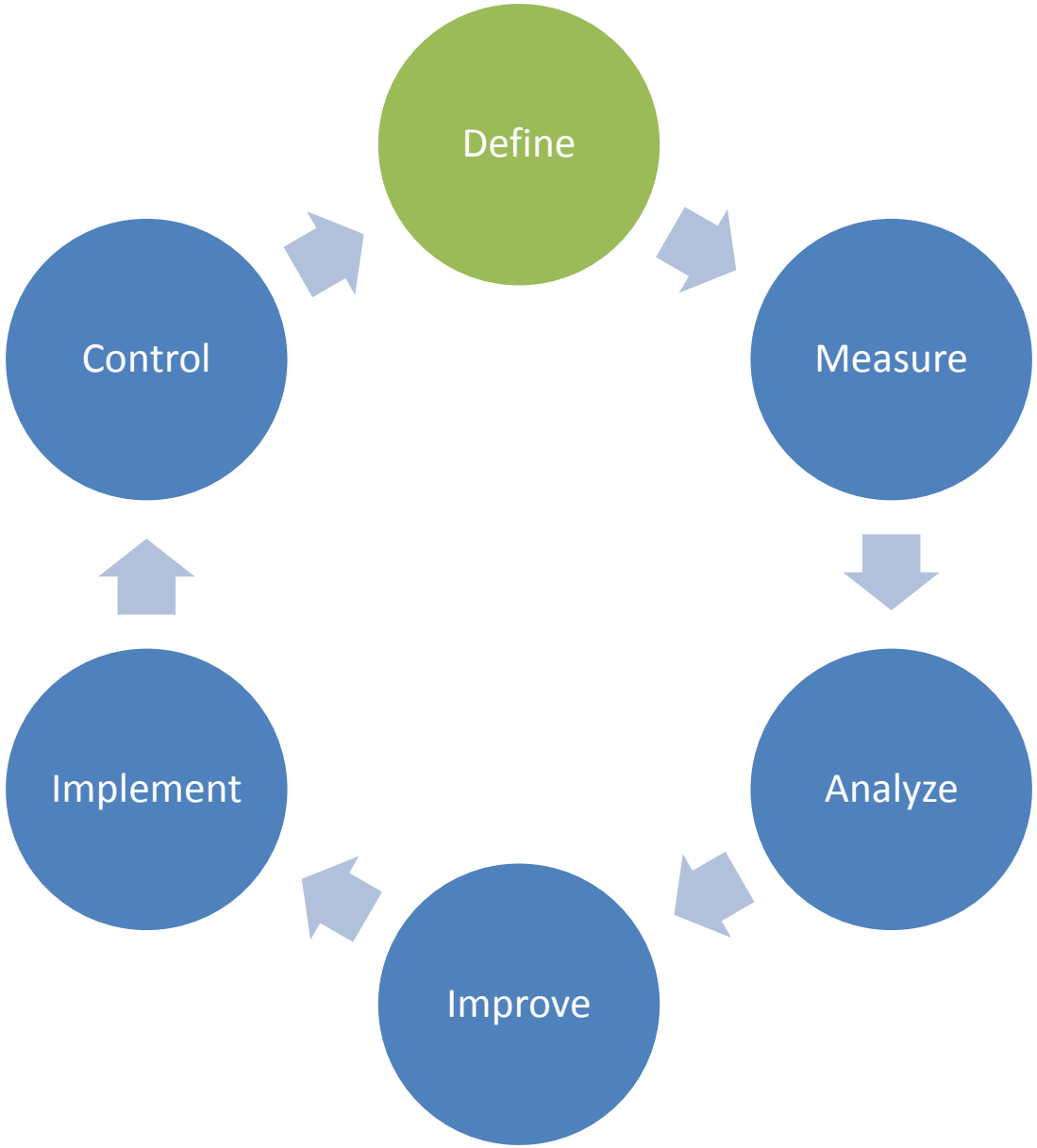
East Tennessee Children's Hospital

- Private, independent, not-for-profit pediatric medical center
- The only comprehensive regional pediatric center in East Tennessee
- 152 bed hospital with over 155,000 patient visits a year
- www.etch.com

Define



Project Charter

- **Project Name:** Patient Non-Chargeable Supplies Order/Inventory Analysis
- **Black Belt :** Isaac Mitchell, Lean Coordinator
- **Champion:** Rudy McKinley, Vice President for Operations
- **Master Black Belt:** Larry Aft, IIE Six Sigma Instructor
- **Start Date:** October 2013
- **Completion Date:** May 2014

Team Members

- Larry Murphy – Director of Materials Management
- Ed Wood – ED Assistant Nurse Manager
- Diana Burdick – 2nd Floor Nurse Manager
- Cindy Abraham – 3rd Floor Nurse Manager
- Margie McKelvey – Clinic Nurse Manager
- Debi Dobbs– OPS/IPS Nurse Manager
- Lori Smith – NICU Nurse Manager
- Bill Chesney – PICU Educator
- Gabrielle Knoll – Lean Intern
- Hayley Edwards – Lean Intern
- Leandra Church – Lean Intern
- Steven Burbank – Lean Intern

Charter Approval – 3/7/14

Six Sigma Project Charter

Project Name	*Patient Non-Chargeable Supplies Order/Inventory Analysis*		
Blackbelt	*Isaac Mitchell*	*Telephone Number*	*(865) 228-7429*
Champion	*Rudy McKinley*	*Master Black Belt*	*Larry Aft*
Start Date	*October 2013*	*Target Completion Date*	*May 2014*

Element	Description	Team Charter			
1. Process:	The process in which opportunity exists.	1) **Inventory:** Specific personnel (Secretary, Assistant Nurse Manager, Nurse, Tech) on each unit manually count supplies in each supply room. No defined inventory levels are set in each unit. 2) **Ordering:** List of supplies is used for manual order entry in Meditech information system. 3) **Delivery:** Supplies are delivered in bulk to each storage unit by Materials Management Receiving Clerks. 4) **Stocking:** Specific personnel (Secretary, Nurse, Tech) on each unit stock shelves.			
2. Project Description:	Describe the Project's Purpose and scope.	Reduce the time and cost associated with inventorying, ordering, and stocking patient non-chargeable supplies on the nursing unites. Eliminate cost associated with holding inventory levels.			
3. Objective:	What improvement is targeted and what will be the impact to the business?		BSL[1]	GOAL	units
	1. Time to inventory		17 minutes	1 minute	Minutes per room
	2. Cost to inventory		Confidential		$USD per hour
	3. Time to order supplies		19 minutes	10% reduction of BSL	Minutes per order
	4. Cost to order supplies		Confidential		$USD per hour
	5. Time to stock supplies		31 minutes	10% reduction of BSL	Minutes per department
	6. Cost to stock supplies		Confidential		$USD per hour
	7. Expired Supplies		33	50% reduction of BSL	Occurrences of Expired Supplies
	8. Inventory Level		$3,254,900	25% reduction of BSL	Total value of supplies in nine department annually

[1] Baseline

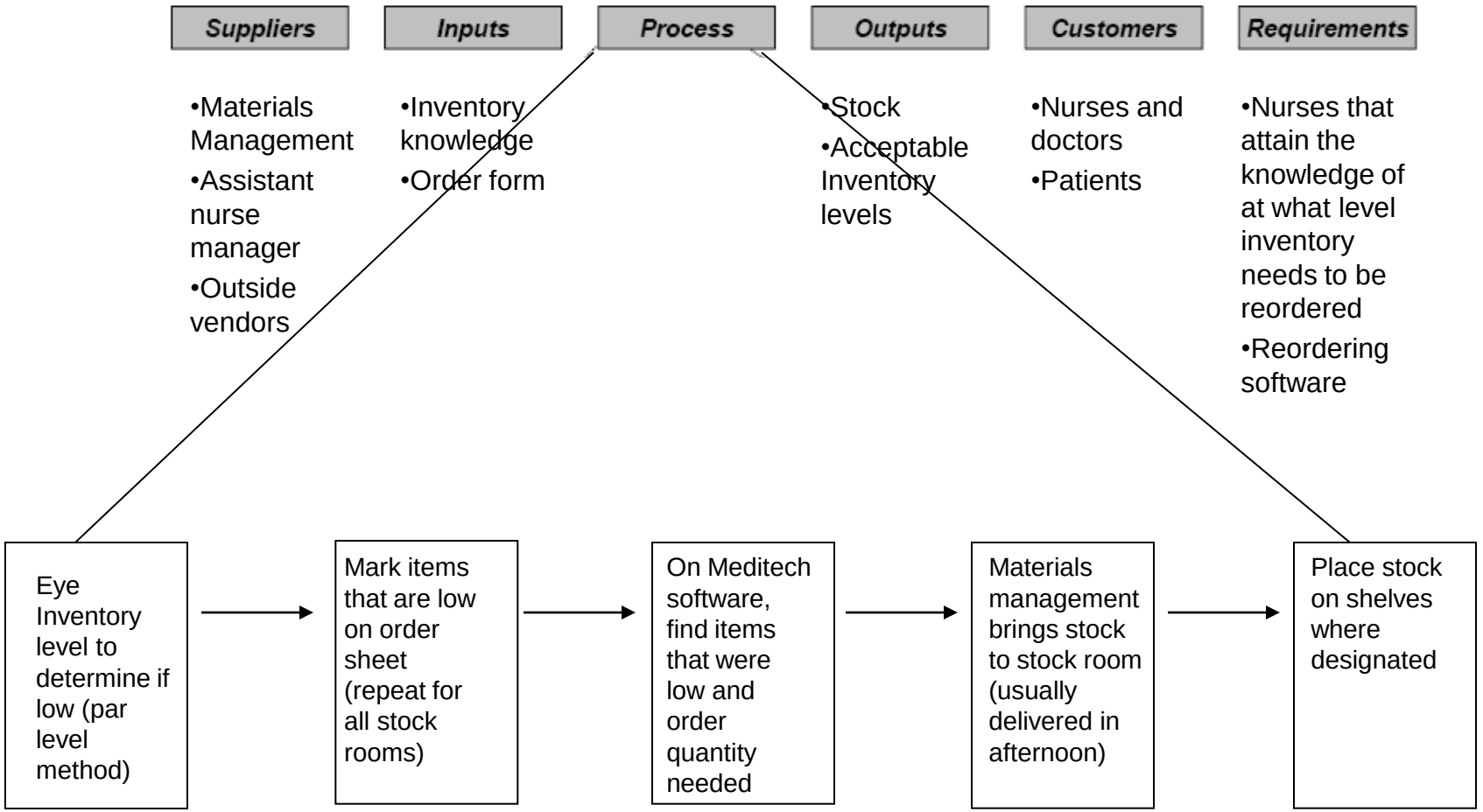
4. Business Results:	What is the improvement in business performance anticipated and when?	• Results will include a reduction in cost of inventorying, stocking and the cost associated with running out of stock that results in having to place expensive rush orders. The project will eliminate the labor cost of $59,000 associated with the inventorying, ordering and stocking of theses supplies annually. The project will also reduce the holding value of supplies by $813,000 annually. These results will be delivered in the first of nine departments by the end of the project on May 16, 2014.	
5. Team members:	Who are the full-time members and any expert consultants?	• Larry Murphy – Director of Materials Management • Ed Wood – ED Assistant Nurse Manager • Diana Burdick – 2nd Floor Nurse Manager • Cindy Abraham – 3rd Floor Nurse Manager • Margie McKelvey – Clinic Nurse Manager • Debi Dobbs– OPS/IPS Nurse Manager • Lori Smith – NICU Nurse Manager • Bill Chesney – PICU Educator • Gabrielle Knoll – Lean Intern • Hayley Edwards – Lean Intern • Leandra Church – Lean Intern • Steven Burbank – Lean Intern	
6. Project Scope:	Which part of the process will be investigated?	• Nursing Units: ED, 2nd Floor, 2nd Clinic, 3rd Floor, 3rd Clinic, OPS, IPS, NICU, PICU (2nd Floor will be the initial pilot unit) • Inventory Practice • Ordering Practice • Restocking Process • Inventory Levels	
7. Benefit to External Customers:	Who is the **final** customer, what benefits will they see and what are their most critical requirements?	• Patients and families are our ultimate customers. Patients will benefit by always having the supplies needed to take care of their needs. It is East Tennessee Children's Hospital's goal to provide lower cost while concurrently eliminating the opportunity for errors to improve quality of patient care.	
8. Schedule:	Give the key milestones/dates.	Project Start	• Tuesday, October 11, 2013
	D- Define	"D" Completion	• Monday, October 14, 2013
	M- Measurement	"M" Completion	• Friday, February 28, 2014
	A- Analysis	"A" Completion	• Friday, March 14, 2014
	I - Improvement	"I" Completion	• Friday, March 28, 2014
	I- Implement	"I" Completion	• Friday, April 11, 2014 (One Unit)
	C - Control	"C" Completion	• Friday, April 25, 2014
		Project Completion	• Friday, May 16, 2014

Define | Measure | Analyze | Improve | Implement | Control

Process

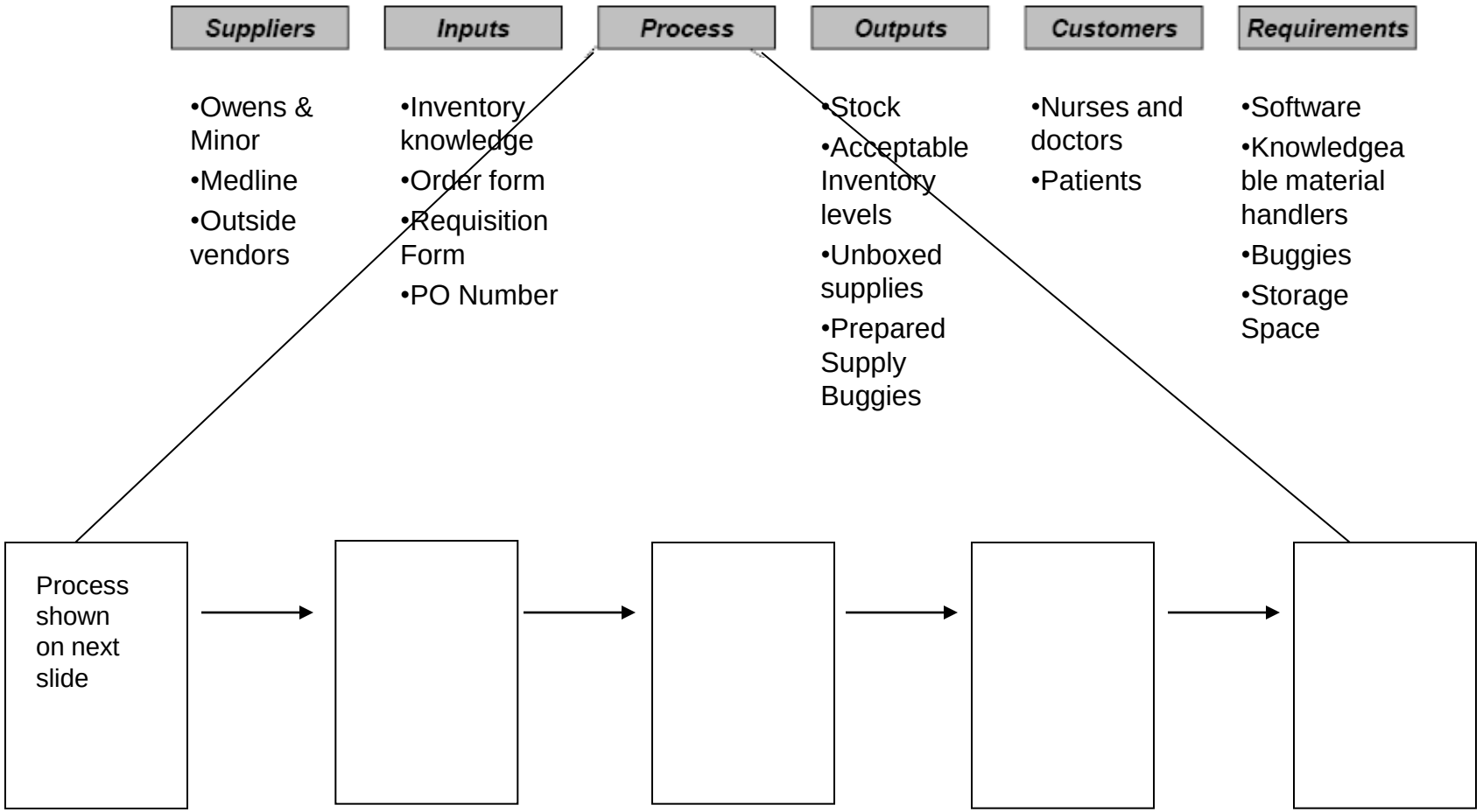
- **Inventory:** Specific personnel (Secretary, Assistant Nurse Manager, Nurse, Tech) on each unit manually counts supplies in each supply room. No defined inventory levels are set in each unit.
- **Ordering:** List of supplies is used for manual order entry in Meditech information system.
- **Delivery:** Supplies are delivered in bulk to each storage unit by Materials Management Receiving Clerks.
- **Stocking:** Specific personnel (Secretary, Nurse, Tech) on each unit stock shelves.

SIPOC Diagram ---- ETCH Inventory Process



Source: www.iSixSigma.com

SIPOC Diagram ---- Materials Management



Source: www.iSixSigma.com

Materials Management Process

Receive Order Templates from each Department

Rush Order? Special Order?

Manually pick-up rush orders from supplier(s)

Unpack rushed supplies and deliver to necessary departments

Special Order via Outside Vendors

Order necessary supplies via Meditech

Match new shipments with their PO# and Requisition Form (Daily Shipments + Special Orders that generally arrive MWF)

Unpack new shipments and prepare supply buggies for each department (morning)

Deliver loaded buggies to each department (afternoon)

Define | Measure | Analyze | Improve | Implement | Control

EAST TENNESSEE Children's Hospital

Project Description

- **Purpose:**
  - Reduce the time and cost associated with inventorying, ordering, and stocking patient non-chargeable supplies on the nursing units.
  - Eliminate cost associated with holding inventory levels.
- **Scope:**
  - Emergency Department, 2nd Floor Inpatient, 3rd Floor Inpatient, Clinic, NICU, PICU, Outpatient Surgery, and Inpatient Surgery

Impact to the Business

Metric	Baseline	Goal	Units
1. Time to inventory	17 minutes	1 minute	Minutes per room
2. Cost to inventory	Confidential		$USD per hour
3. Time to order supplies	19 minutes	10% reduction	Minutes per order
4. Cost to order supplies	Confidential		$USD per hour
5. Time to stock supplies	31 minutes	10% reduction	Minutes per department
6. Cost to stock supplies	Confidential		$USD per hour
7. Expired Supplies	33	50% reduction	Occurrences of Expired Supplies
8. Inventory Level	$3,254,900	25% reduction	Total value of supplies in nine department annually

Business Results

- Results will be delivered in the first department by the end of the project on May 16th, 2014.
  - The project will eliminate the labor cost of **$59,000** associated with the inventorying, ordering and stocking of theses supplies annually.
  - The project will also reduce the holding value of supplies by **$813,000** annually.

Benefit to Final Customer

- **Customer:** Patients and Families
- **Goal:**
  - Provide supplies needed to take care of our patients and families needs at all times.
  - Provide lower operating cost
  - Eliminate the opportunity for errors to improve quality of patient care.

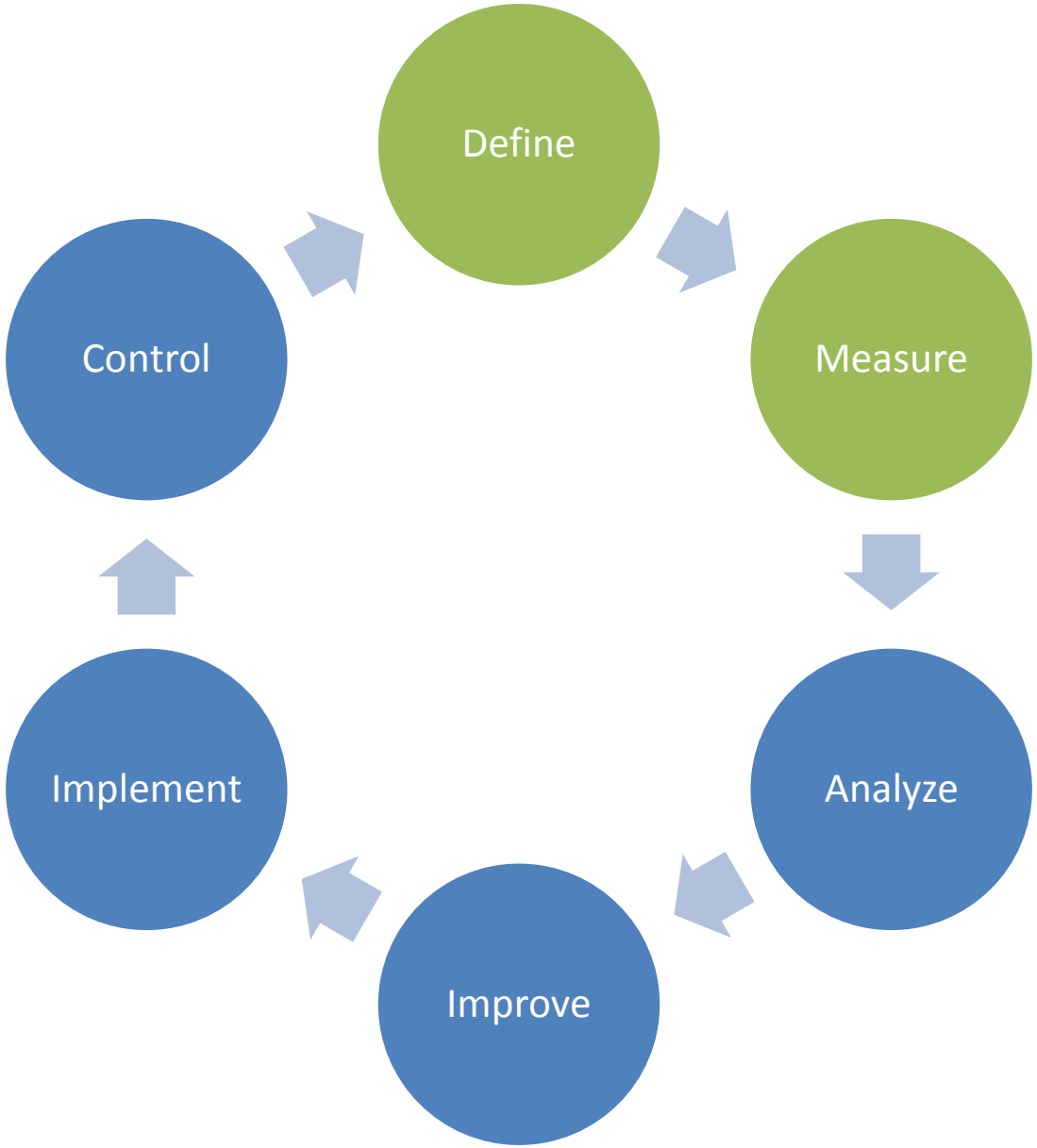
Schedule

- **Project Start:** 10/11/13
- **D – Define:** 10/14/13
- **M – Measure:** 2/28/14
- **A – Analysis:** 3/14/14
- **I – Improve:** 3/28/14
- **I – Implement:** 4/11/14
- **C – Control:** 4/25/14
- **Project Completion:** 5/16/14

Gantt Chart

Line	Task Name	Start Date	Finish Date	% Complete
1	Draft Project Charter	10/7/13	10/11/13	100%
1a	Charter Approval		3/7/14	100%
2	Define	10/11/13	10/14/13	100%
3	Measurement	10/14/13	2/28/14	100%
4	Analysis	2/28/14	3/14/14	100%
5	Improve	3/14/14	3/28/14	100%
6	Implement	3/28/14	4/11/14	100%
6a	Kaizen Event		3/28/14	100%
7	Control	4/11/14	4/25/14	25%
8	Project Completion	4/25/14	5/16/14	92%

Measure



Measurements

1) Task Responsibility by Job Class
2) Patient Non-Chargeable Supplies Fulfillment Process
3) Inventory Time and Cost
4) Ordering Time and Cost
5) Stocking Time and Cost
6) Expired Items Occurrences
7) 5S Compliance
8) Inventory Levels and Holding Cost

(1) Task Responsibility and Frequency Survey

Email survey sent to department managers on 10/18/13 to determine who is responsible for each task by unit.

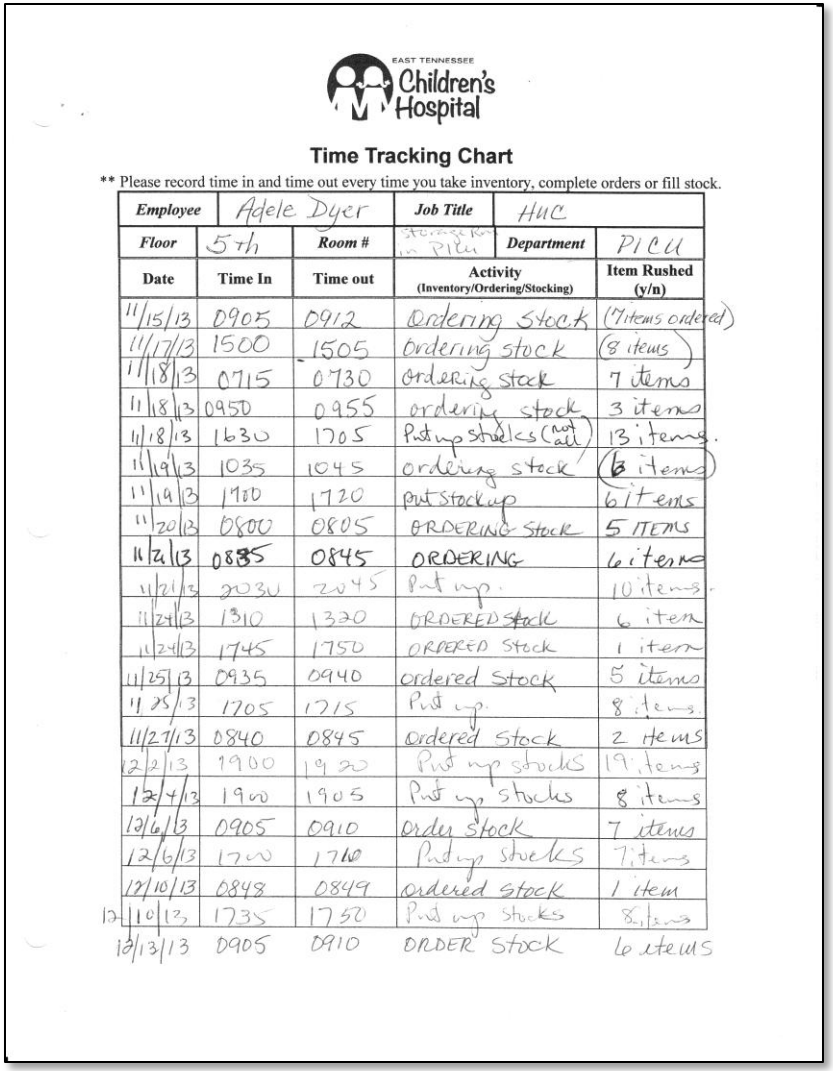
1. Who is responsible for taking inventory?
2. Who is responsible for stocking non-chargeable supplies in your unit?
3. How often do you take inventory?
4. What days and times do you typically take inventory?
5. What days and times do you typically order non-chargeable supplies?
6. What days and times do your typically stock non-chargeable supplies?

(2) Process Diagram

- Document using a process diagram how each department inventories, orders, and stocks supplies.
  - Is there is standard method?
  - What is best practice?
  - Are there different methods within a department?
  - What is the system?

(3 , 4 , 5) Data Collection Sheets

- Data Collection sheets were given to each target department to collect time spent ordering, inventory, and stock supplies.
- Two weeks of data was collect per department.



EAST TENNESSEE Children's Hospital

Time Tracking Chart

** Please record time in and time out every time you take inventory, complete orders or fill stock.

Employee	Adele Dyer		Job Title	HUC
Floor	5th	Room #	Storage Room in PICU	Department	PICU

Date	Time In	Time out	Activity (Inventory/Ordering/Stocking)	Item Rushed (y/n)
11/15/13	0905	0912	Ordering stock	(7 items ordered)
11/17/13	1500	1505	Ordering stock	(8 items)
11/18/13	0715	0730	Ordering stock	7 items
11/18/13	0950	0955	ordering stock	3 items
11/18/13	1630	1705	Putting stocks (not all)	13 items
11/19/13	1035	1045	ordering stock	(6 items)
11/19/13	1700	1720	put stock up	6 items
11/20/13	0800	0805	ORDERING STOCK	5 ITEMS
11/21/13	0835	0845	ORDERING	6 items
11/21/13	2030	2045	Put up.	10 items
11/24/13	1310	1320	ORDERED STOCK	6 item
11/24/13	1745	1750	ORDERED Stock	1 item
11/25/13	0935	0940	ordered Stock	5 items
11/25/13	1705	1715	Put up.	8 items
11/27/13	0840	0845	Ordered Stock	2 items
12/2/13	1900	1920	Put up stocks	19 items
12/4/13	1900	1905	Put up stocks	8 items
12/6/13	0905	0910	Order Stock	7 items
12/6/13	1700	1710	Putting stocks	7 items
12/10/13	0848	0849	ordered stock	1 item
12/10/13	1735	1750	Put up stocks	8 items
12/13/13	0905	0910	ORDER Stock	6 items

(6 & 7) Expired Items and 5S Occurrences

- Pharmacy audits each area for expired supplies and 5S effectiveness.

PHARMACY SERVICES INSPECTION # 1 **Department: 2E**

INSPECTED BY: Shenaiah Draper, CPhT Date/Time: 12/19/13 11:00

	FLOOR STOCK AND SUPPLIES	Yes	No
1	Are arrangements and neatness satisfactory; Is the designated Injection Prep area free of clutter?	X	
2	Are all reconstituted drugs properly dated, timed, and stored, and have all discontinued, expired or deteriorated drugs and/or IV fluids been removed and returned to Pharmacy?	X	
3	Is the amount of drugs stocked appropriate? Stock list, approved by Pharmacy and Nursing, with PAR levels and exp dates, is posted.	X	
4	Are there any patient's own prescriptions present not Identified by Pharmacy and approved for use?		X
5	Are internal drugs separated from external drugs?	X	
6	Are test agents, germicides, disinfectants, and other household substances separated from drugs?	X	
7	Is/are the floor stock cabinet(s) properly secured?	X	
8	Is/are the medication cart(s) locked if not in use?	X	
9	Are all other drugs secured if not in use?	X	
10	Are High Alert medications properly tagged and/or separated, and the list posted?	X	
11	Are Sound-alike/Look-alike medications separated and tagged, and the list posted?	X	
12	Are Central Supply kits present that contain medication in date?	X	
13	Are necessary drip charts accompanying Dopamine bags/vials, Dobutamine bags/vials, Nitroglycerine bags, and Epinephrine vials? (Remember NICU has specified Dopamine and Epinephrine charts)	X	

Mailed: (enter date)	1/3/2014
Returned: (enter date)	1/10/2014
Turn around:	7 days

Sample Audit Sheet

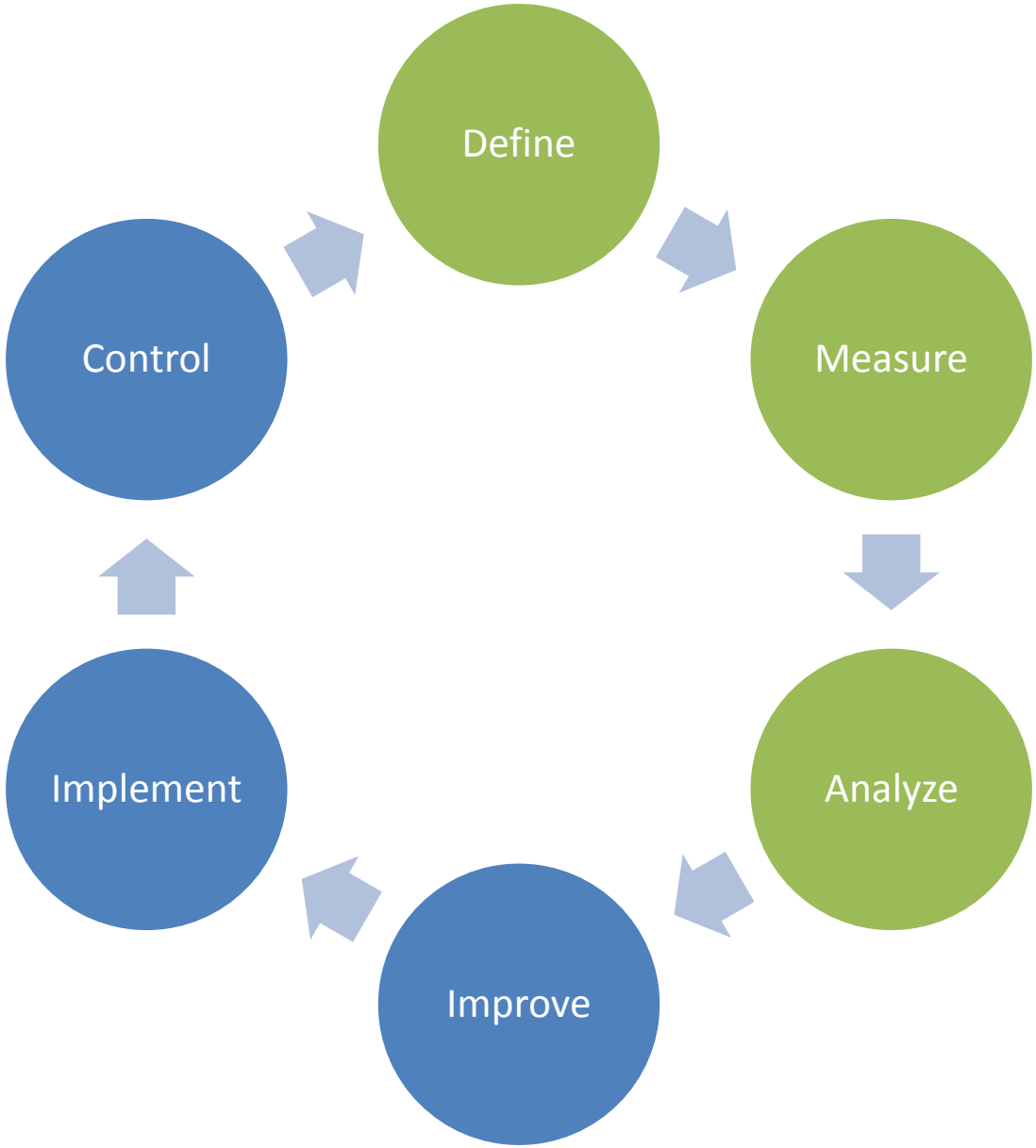
Define | Measure | Analyze | Improve | Implement | Control

8) Inventory Levels

- Review Meditech Information Systems Order History
  - How much inventory are we holding in each unit?
  - What is the value of that inventory?

Part Number	Item Name	Qty Type	Aug	Sep	Oct	Nov	Dec	Procurement
00158	Applicator Cotton Tip	BX		2		1		Outside - 1 wk
00289	Shur Klenz 20 ml	cs 100 ea.						Inside - 2 days
00482	Mask Isolation	cs/10 bx	2	2		2	6	Inside - 2 days
00821	Bag White Small #4	bndl/4 pkg/500 ea.	20	20	10			Inside - 2 days
00832	Prep Alcohol	BX	2	5	4	9	10	Inside - 2 days
00842	Benzoin Steri Strip	cs/4 bx/40 ea.						Inside - 2 days
00844	Swab Stick Betadine	bx/50 pk/1 ea.						CS - 1 day
00845	Pad Iodophor Prep	BX				1	2	Inside - 2 days
00871	Ball Cotton Prep	cs/8 bg/500 ea.					1	Inside - 2 days
00873	Basin Emesis 9"	EA		15	12		12	CS - 1 day
00876	Cup Graduate	PK	12		1		4	CS - 1 day
00877	Nurser Volufeed							
00884	Tape Measuring	bx/10 pk/100 ea.		1	12		1	Inside - 2 days
00885	Cup Medicine 1 OZ Disposable	SL	4	8	5		8	Inside - 2 days
00891	Remover Nail Polish Pad	cs 20/ bx 200 ea.	2					Inside - 2 days
00900	Pin Safety #3							
00948	Paper Scale	PK	1	1	1			Inside - 2 days
01084	Cannula Nasal Adult	CS/50 EA						Outside - 1 wk
01200	Gown Chemo	CS		1	2		1	Outside - 1 wk
01202	Kit Spill Chemo	cs/6 ea.						Outside - 1 wk
01225	Underpad Mini 3x3	Bag					2	CS - 1 day
01232	Tourniquet Latex Free	BX	1	2		2	4	Inside - 2 days
01269	TAPE BLENDERM 1/2X5 15250							
01270	TAPE BLENDERM 1"X5							
01271	Tape Durapore 1/2"	cs 10 bx/24 rl						Inside - 2 days
01272	Tape Durapore 1"	BX	6	5	1	4	8	Inside - 2 days
01273	Tape Durapore 2"	BX		2			3	Inside - 2 days
01274	Tape Micropore 1/2"	cs 10 bx/6 rl						Inside - 2 days
01275	Tape Micropore 1"	BX			1			Inside - 2 days
01276	Tape Micropore 2"	cs/10 bx/6 rl						Inside - 2 days
01277	Tape Microfoam 2"	BX	1			1	2	Inside - 2 days
01278	Tape Transpore 1"	bx/12 rl						Inside - 2 days
01279	Tape Transpore 2"	bx/6 rl						Inside - 2 days
01280	Tape Cloth Adhesive 1/2"							
01376	Cup Foam 12 oz White	PKG	24	88	50	40	80	Inside - 2 days

Analysis



(1) Task Responsibility Matrix Results

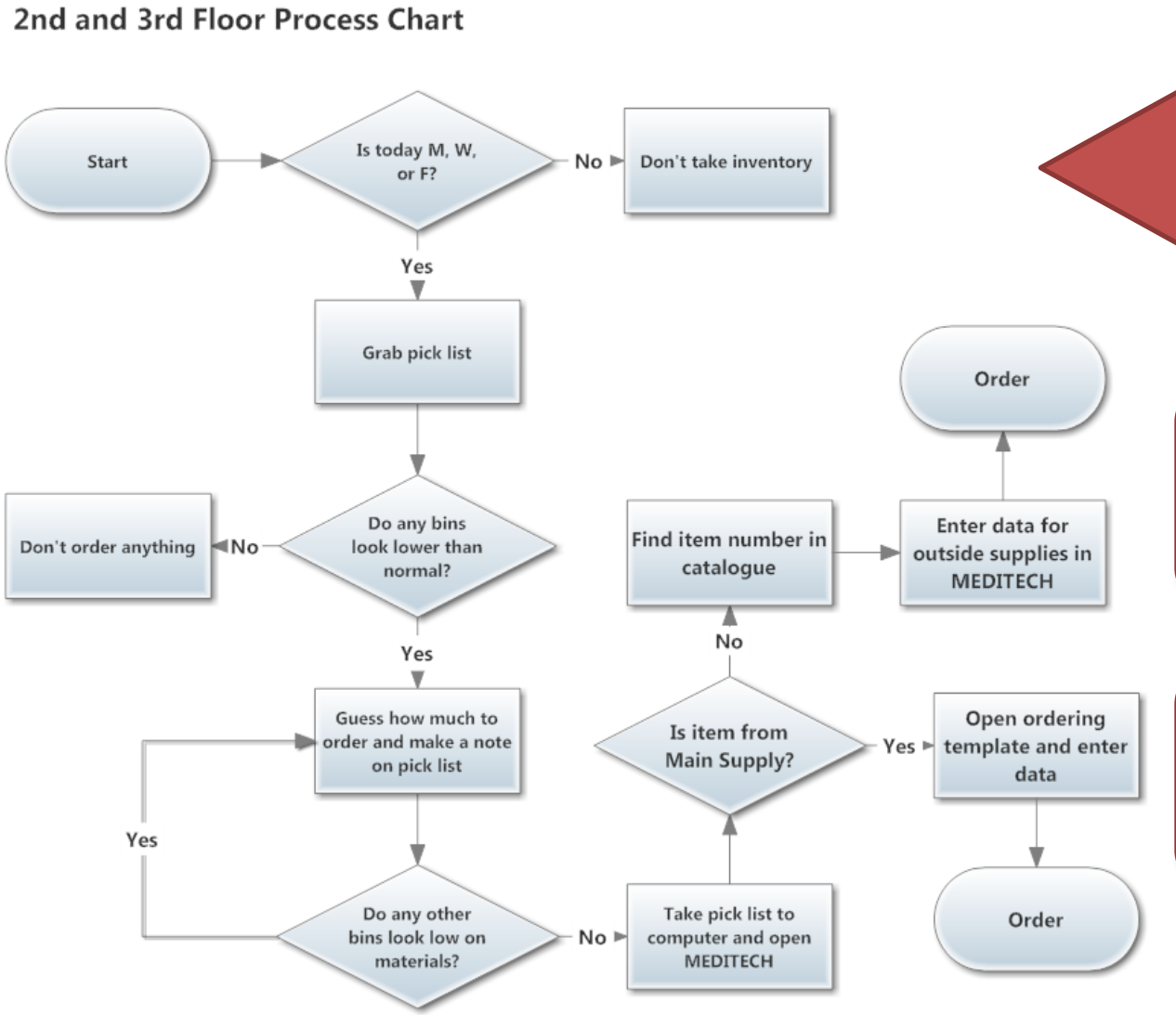
		Department								
Line	Question	ED	2nd Floor	2nd Clinic	3rd Floor	3rd Clinic	OPS	IPS	NICU	PICU
1a	Who is responsible for taking inventory of non-chargeable supplies in your unit?	ED Wood, Assistant Nurse Manager Christy Hershman, ER Tech Tim McDowell, ER Tech	Debi Hill, Assistant Nurse Manager PCAs	PCA	Charge Nurse and/or Assistant Nurse Manager	Susan Beckham, PCA	Nancy Borden , HUC	Kathy Stevens, RN	Debra Nelson, Equipment Specialist	HUC
1b	Contact Info for above	wwood@etch.com, 541-8329 chershman@etch.com, 541-8175 sjmcdowell@etch.com. 541-8175	Debi Hill, Assistant Nurse Manager, DPBurdick@etch.com, 541-8654	Margie McKelvey, Nurse Manager, MMMcKelvey@etch.com, 541-8235	Cindy Abraham, Nurse Manager, cmabraham@etch.com, 541-8487	sbeckham@etch.com, 541-8830	NBBordan@etch.com, 541-8402	KCStevens@etch.com , 541-8580	DJNelson@etch.com, 541-8200	Bill Chesney, Nurse Educator, Bchesney@etch.com, 541-8443
2	Who is responsible for stocking non-chargeable supplies in your unit?	ER Techs	The ANM checks, orders stock, and assigns a PCA(to put the stock up) if she is not here.	PCA	Team effort but the brunt of the responsibility falls to PCAs	PCAs	HUC	RNs, PCAs	NICU Equipment Specialist	HUC
3	How often do you take inventory?	Daily	Monday, Wednesday, and Friday by 9AM	2 x week	Every Monday, Wednesday, and Friday	Once a week, sometimes twice –depending on clinics that week	Every Monday, Wednesday, and Friday	Weekly	Everyday	Daily
4	What days and times do you typically take inventory?	No Response	Monday, Wednesday, and Friday by 9AM	No Response	As above before noon	Mainly Friday AM or afternoon; backup day is Mondays	No Response	Variable: I work 3 days in a row and usually do it on the 2nd day	7AM to 3 PM	No Response
5	What days and times do you typically order non-chargeable supplies?	No Answer	Monday, Wednesday, and Friday by 9AM	No Response	Same day after delivery from purchasing.	Mainly Friday AM or afternoon; backup day is Mondays	No Response	Variable: I work 3 days in a row and usually do it on the 2nd day	7AM to 3 PM	No Response
6	What days and times do your typically stock non-chargeable supplies?	No Response	Putting stock away varies throughout the day as patient care comes first and stock last	No Response		Monday AM or afternoon	No Response	I order during my work shift ..will stock at night when not busy...could be anywhere from 10p to 4am	7AM to 3 PM	No Response

(1) Average Wages by Staff Type

- Assistant Nurse Manager **Confidential**
- Nurse **Confidential**
- PCA **Confidential**
- ER Tech **Confidential**
- HUC **Confidential**
- CSSP Technician **Confidential**
- CSSP Technician – Certified **Confidential**
- Receiving Clerk **Confidential**
- Additional 30% for benefits

CONFIDENTIAL

(2) Current State Process Diagram



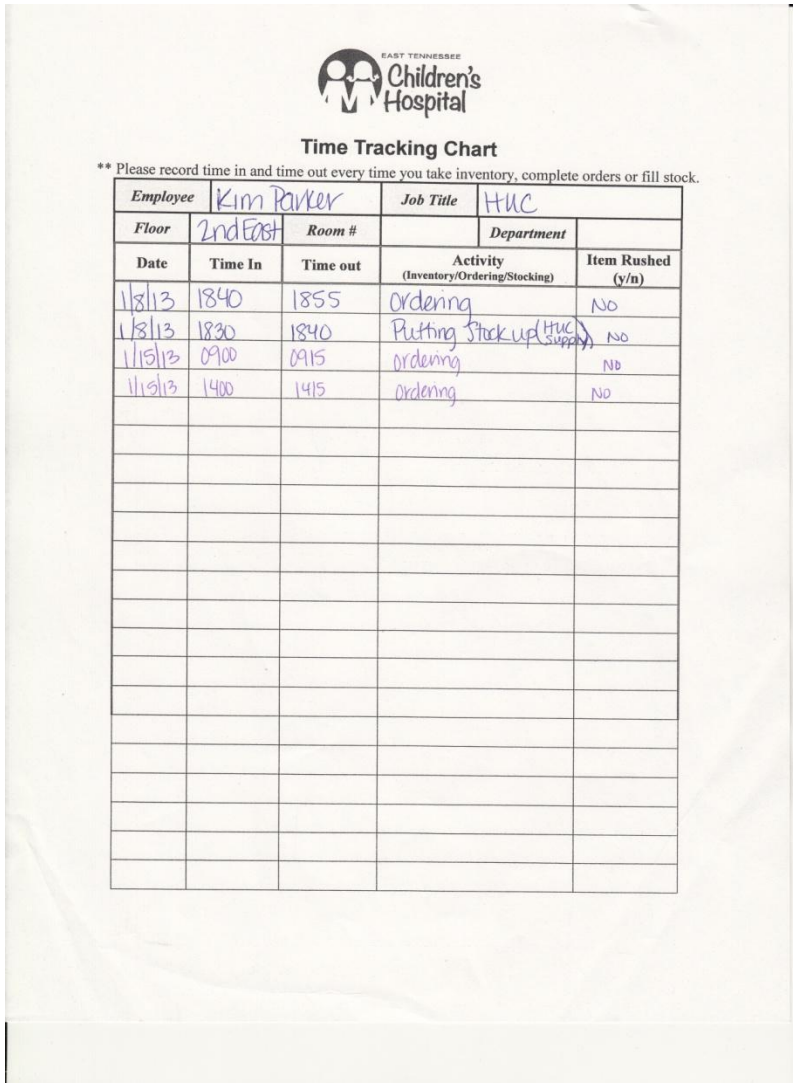
4 Decision Points

14 Step Process

4 Different Methods

Define | Measure | Analyze | Improve | Implement | Control

(3 , 4 , 5) Data Collection Tally (2nd Floor)

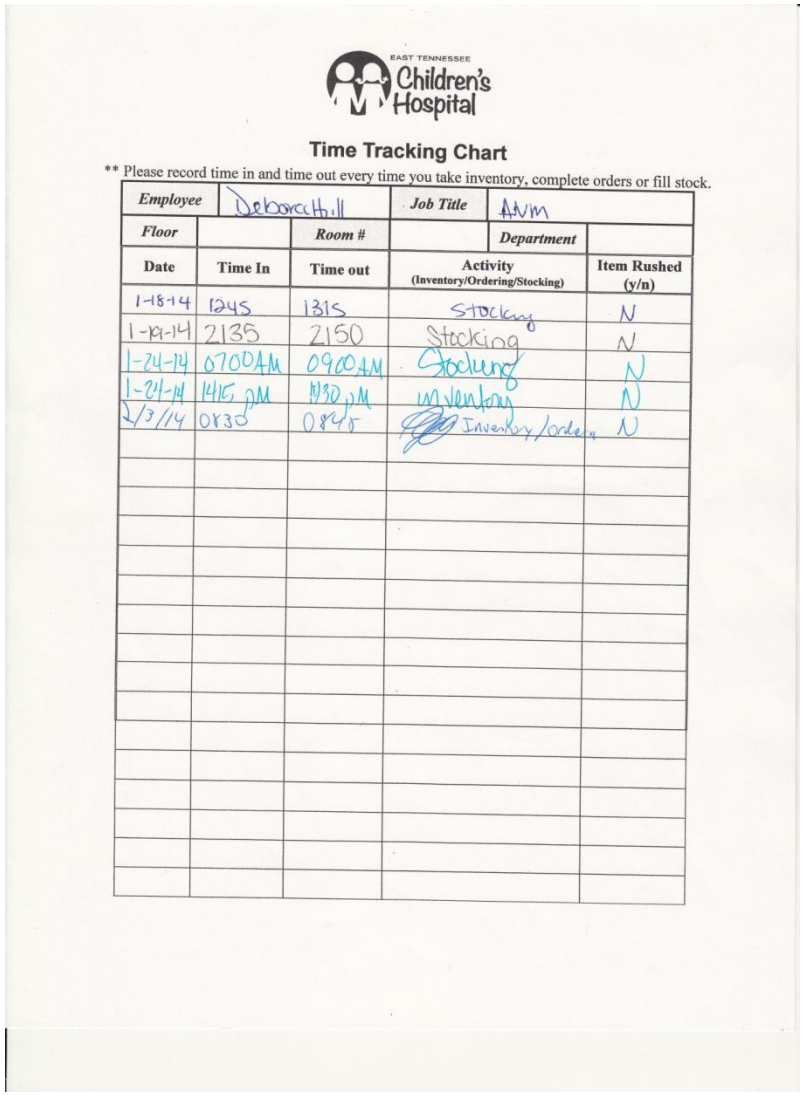


EAST TENNESSEE Children's Hospital

Time Tracking Chart

** Please record time in and time out every time you take inventory, complete orders or fill stock.

Employee	Kim Parker		Job Title	HUC	
Floor	2nd East	Room #		Department	
Date	Time In	Time out	Activity (Inventory/Ordering/Stocking)		Item Rushed (y/n)
1/8/13	1840	1855	Ordering		NO
1/8/13	1830	1840	Putting Stock up (HUC supply)		NO
1/15/13	0900	0915	Ordering		NO
1/15/13	1400	1415	Ordering		NO



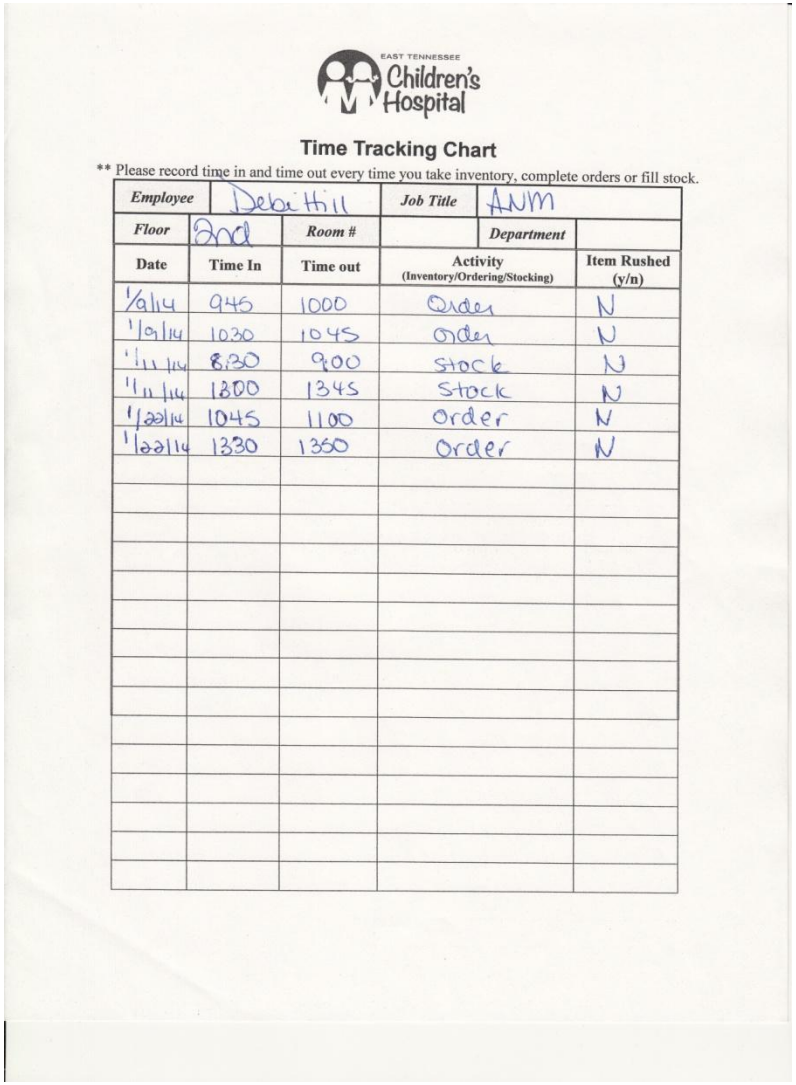
EAST TENNESSEE Children's Hospital

Time Tracking Chart

** Please record time in and time out every time you take inventory, complete orders or fill stock.

Employee	Deborah Hill		Job Title	ATM	
Floor		Room #		Department	
Date	Time In	Time out	Activity (Inventory/Ordering/Stocking)		Item Rushed (y/n)
1-18-14	1245	1315	Stocking		N
1-19-14	2135	2150	Stocking		N
1-24-14	0700AM	0900AM	Stocking		N
1-21-14	1415 PM	1430 PM	Inventory		N
1/3/14	0830	0845	Inventory/Ordering		N

(3 , 4 , 5) Data Collection Tally (2nd Floor)

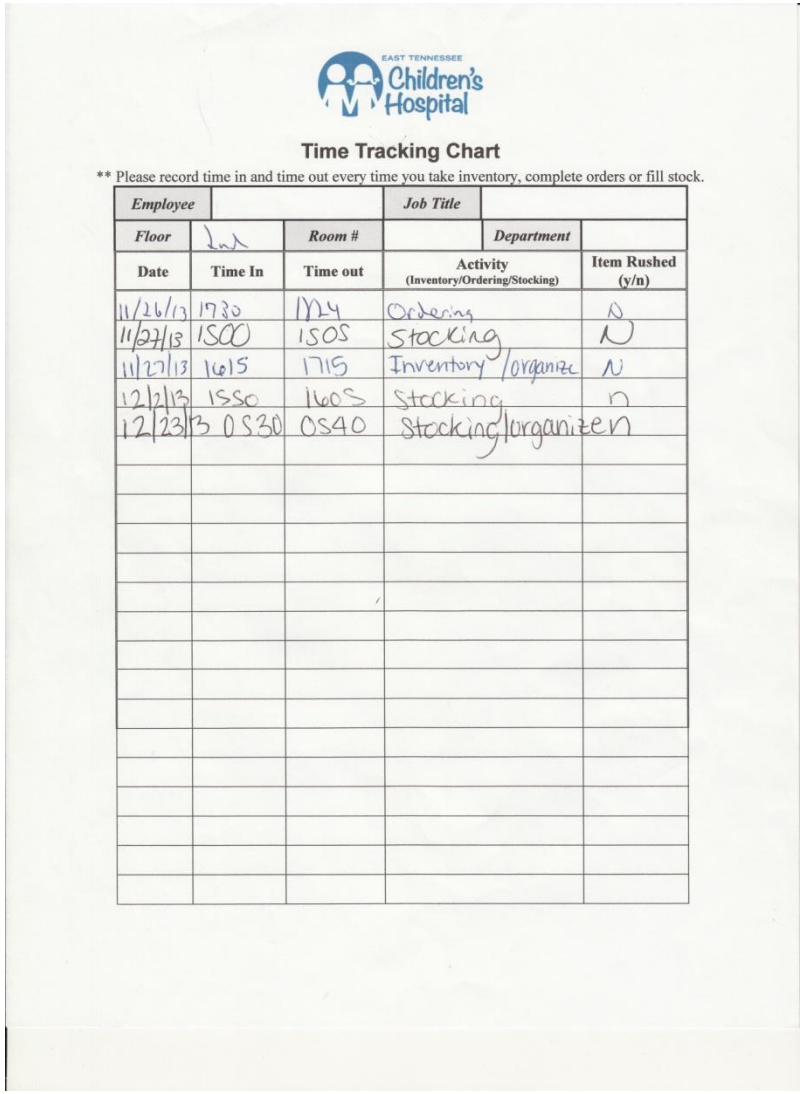


EAST TENNESSEE Children's Hospital

Time Tracking Chart

** Please record time in and time out every time you take inventory, complete orders or fill stock.

Employee	Debi Hill		Job Title	ANM	
Floor	2nd	Room #		Department	
Date	Time In	Time out	Activity (Inventory/Ordering/Stocking)		Item Rushed (y/n)
1/9/14	945	1000	Order		N
1/9/14	1030	1045	Order		N
1/11/14	8:30	900	stock		N
1/11/14	1300	1345	Stock		N
1/22/14	1045	1100	Order		N
1/22/14	1330	1350	Order		N



EAST TENNESSEE Children's Hospital

Time Tracking Chart

** Please record time in and time out every time you take inventory, complete orders or fill stock.

Employee			Job Title		
Floor	2nd	Room #		Department	
Date	Time In	Time out	Activity (Inventory/Ordering/Stocking)		Item Rushed (y/n)
11/26/13	1730	M24	Ordering		N
11/27/13	1500	1505	Stocking		N
11/27/13	1615	1715	Inventory/organize		N
12/2/13	1550	1605	Stocking		n
12/23/13	0530	0540	Stocking/organizen		

(3 , 4 , 5) Data Collection Tally (2nd Floor)

EAST TENNESSEE Children's Hospital

Time Tracking Chart

** Please record time in and time out every time you take inventory, complete orders or fill stock.

Employee	Deborah Hill		Job Title	ANM	
Floor	2nd	Room #		Department	
Date	Time In	Time out	Activity (Inventory/Ordering/Stocking)		Item Rushed (y/n)
1/13/14	1000	1044	Order		N

EAST TENNESSEE Children's Hospital

Time Tracking Chart

** Please record time in and time out every time you take inventory, complete orders or fill stock.

Employee	Justin Abbott		Job Title	RN ANA	
Floor	2nd	Room #		Department	Nursing
Date	Time In	Time out	Activity (Inventory/Ordering/Stocking)		Item Rushed (y/n)
1/19	1730	1800	ordering		N
1/24	1435	1445	ordering		N

(3 , 4, 5) Recommendations for Future Observations

- When observing the data provided by the floors, a trend was seen to only provide data for ordering and stocking.
- This showed that most employees consider inventory and ordering as the same task.
- Going forward in data collection we may need to combine inventory and ordering as one task get more accurate numbers.

(3 , 4, 5) X-mR Charts

- Shewhart Control Chart
  - Single observations per time period
  - Risk factors do not change over time periods
  - Observations are measured in an interval scale
  - Observations are independent of each other

Walter Shewhart

(3 , 4, 5) X-mR Charts

- **Mean** = Sum of total time / n
- **UCL** = Average of observations + E-value*Average of moving range
- **LCL** = Average of observations - E-value*Average of moving range

Number of time periods	E values	Number of time periods	E values
		11	0.945
2	2.660	12	0.921
3	1.772	13	0.899
4	1.457	14	0.881
5	1.290	15	0.864
6	1.184	16	0.849
7	1.109	17	0.836
8	1.054	18	0.824
9	1.010	19	0.813
10	0.975	20	0.803

Based on Wheeler DJ. Advanced topics in statisical process control, 1995 SPC Press Inc, Knoxville TN 37919

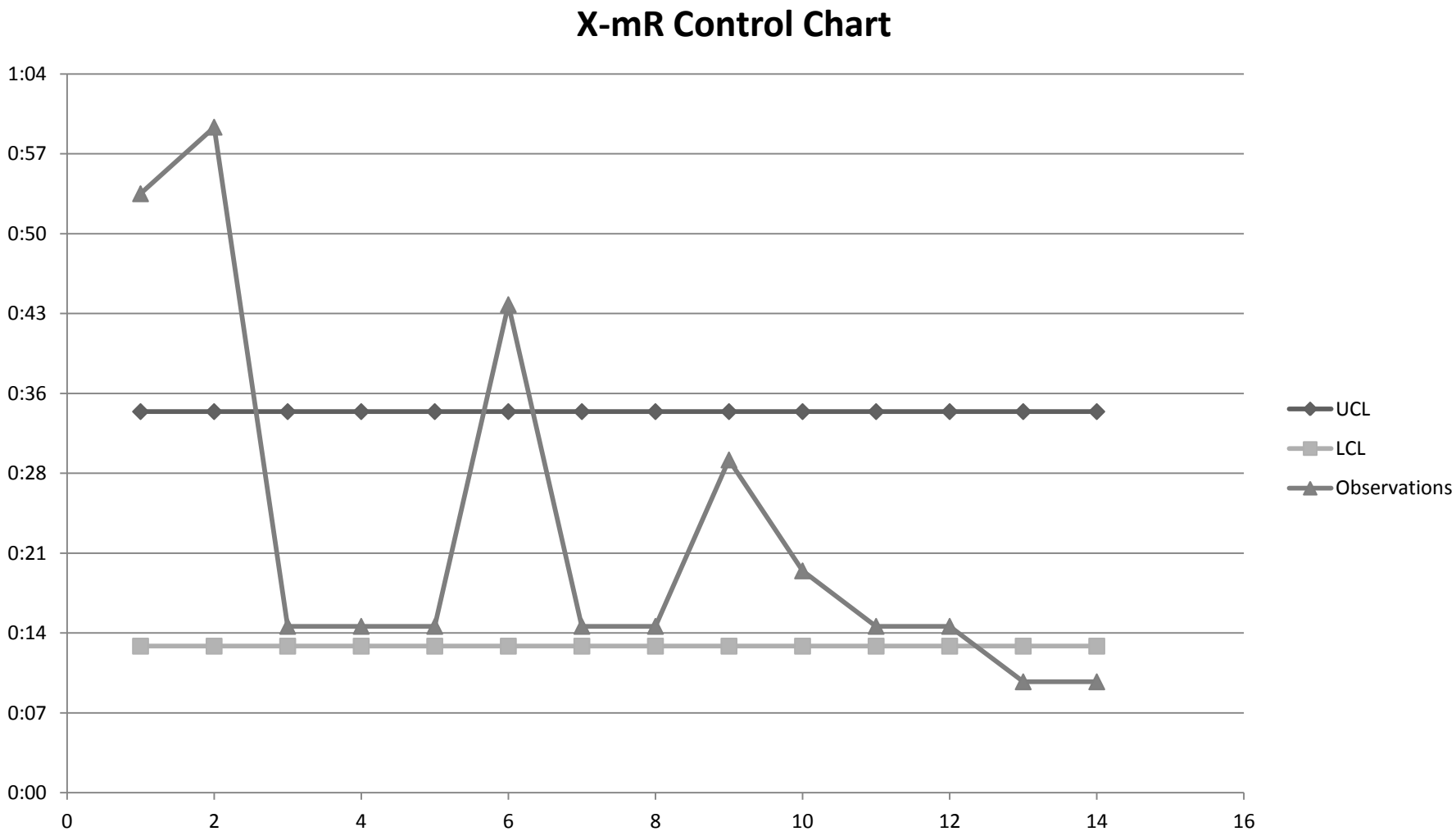
(3 & 4) Pre Inventory and Ordering Times

Employee	Debi Hill, Kim Parker, Justin Abbott	Department	2nd Floor

ORDERING/INVENTORYING

Date	Time in	Time out	Total Time	mR (moving range)	UCL	LCL
11/26/2013	17:30	18:24	0:54		0:34	0.009
11/27/2013	16:15	17:15	1:00	0:06	0:34	0.009
1/8/2014	18:40	18:55	0:15	0:45	0:34	0.009
1/9/2014	9:45	10:00	0:15	0:00	0:34	0.009
1/9/2014	10:30	10:45	0:15	0:00	0:34	0.009
1/13/2014	10:00	10:44	0:44	0:16	0:34	0.009
1/15/2014	9:00	9:15	0:15	0:29	0:34	0.009
1/15/2014	14:00	14:15	0:15	0:00	0:34	0.009
1/19/2014	17:30	18:00	0:30	0:15	0:34	0.009
1/22/2014	13:30	13:50	0:20	0:10	0:34	0.009
1/22/2014	10:45	11:00	0:15	0:05	0:34	0.009
1/24/2014	14:15	14:30	0:15	0:00	0:34	0.009
1/24/2014	14:35	14:45	0:10	0:20	0:34	0.009
2/3/2014	8:30	8:40	0:10	0:10	0:34	0.009
		Means:	0:23	0:12		
		E Value:	0.881			

(3 & 4) Pre Inventory and Ordering Times Chart



Define | Measure | Analyze | Improve | Implement | Control

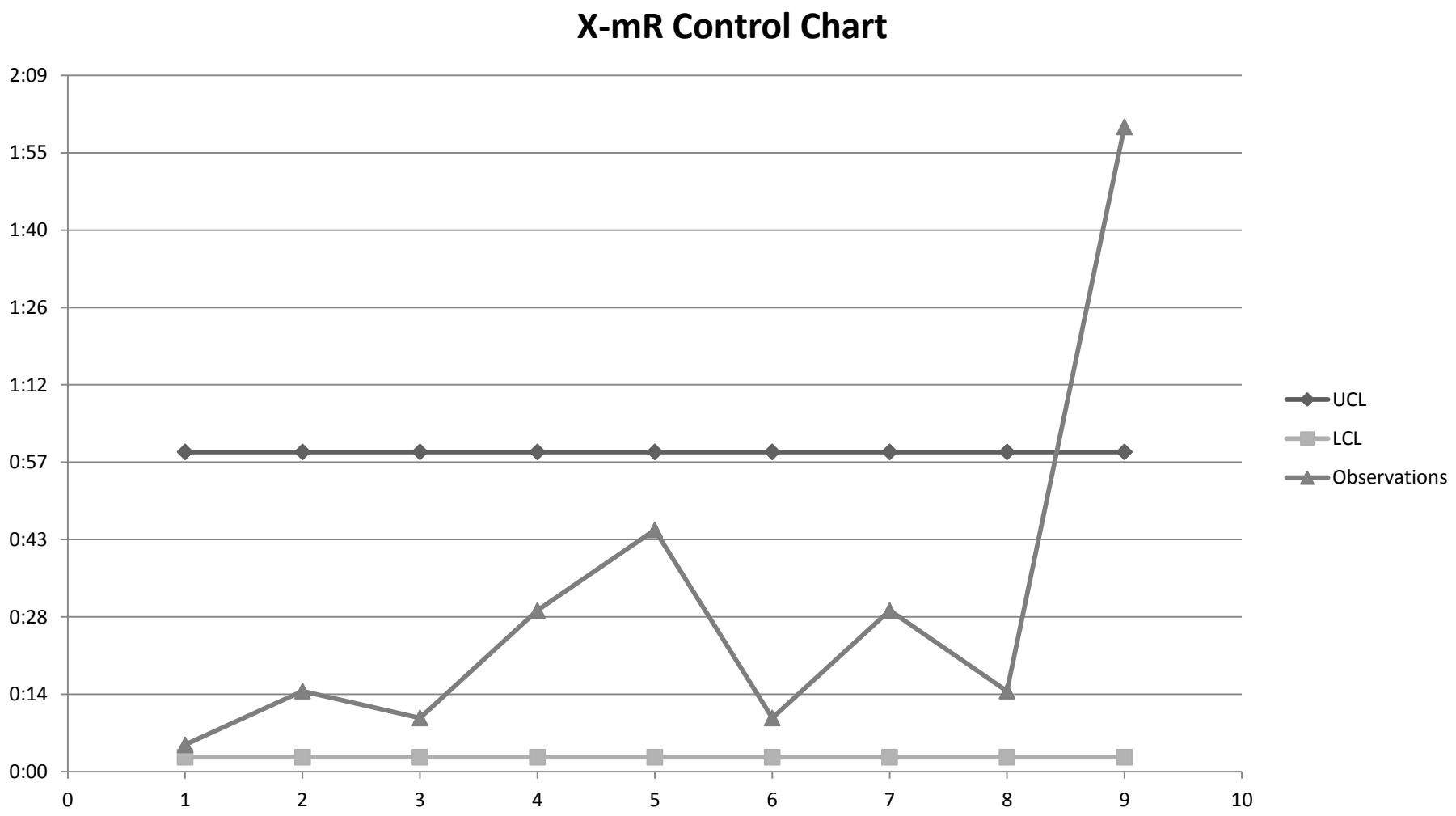
(5) Pre Stocking Times

Employee	Debi Hill, Kim Parker, Justin Abbott	Department	2nd Floor

STOCKING

Date	Time in	Time out	Total Time	mR (moving range)	UCL	LCL
11/27/2013	15:00	15:05	0:05		0:59	0:02
12/2/2013	15:50	16:05	0:15	0:10	0:59	0:02
12/23/2013	5:30	5:40	0:10	0:05	0:59	0:02
1/11/2014	8:30	9:00	0:30	0:20	0:59	0:02
1/11/2014	13:00	13:45	0:45	0:15	0:59	0:02
1/18/2014	18:30	18:40	0:10	0:35	0:59	0:02
1/18/2014	12:45	13:15	0:30	0:20	0:59	0:02
1/19/2014	21:35	21:50	0:15	0:15	0:59	0:02
1/21/2014	7:00	9:00	2:00	1:45	0:59	0:02
		Means:	0:31	0:28		
		E Value:	1.01			

(5) Pre Stocking Times Chart



(3 , 4, 5) Pre Data Interpretation

- In order for data to be considered in control, 95% of the data should fall within UCL and LCL parameters. The plotted observation points shows the range of variability within the data.
- When analyzing the following X-mR charts, it shows a high level of variability within the data and a higher than normal range of observation points outside the contol limits. This may indicate the data is not in control and observed process is not operating consistently.
- When considering the final averages in task times, these outliers can be neglected in order to get more accurate numbers. Suggestions for further data collection include finding and eliminating causes of observed times outside of the control limits in order to obtain greater accuracy.

(6) Pre Data Expired Supplies

- **Question 2:** Are all reconstituted drugs properly dated, timed, and stored, and have all discontinued, expired or deteriorated drugs and/or IV fluids been removed and returned to Pharmacy?

	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Sum
2E	1			1					1	1			**4**
2W	1							1	1		1	1	**5**
3E	1			1					1				**3**
3W				1	1				1	1	1		**5**
4E	1										1		**2**
4W													**0**
NICU 1			1			1		1	1	1			**5**
NICU 2						1							**1**
PICU													**0**
ER FT													**0**
ER Cen				1					1	1			**3**
ER UR				1						1		1	**3**
2nd Clinc				1									**1**
3rd Clinic	1												**1**

33 Occurrences

(7) Pre Data 5S Effectiveness

- **Question 1:** Are arrangements and neatness satisfactory; Is the designated Injection Prep area free of clutter?

	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Sum
2E													**0**
2W	1				1							1	**3**
3E		1					1	1				1	**4**
3W	1			1						1		1	**4**
4E											1	1	**2**
4W												1	**1**
NICU 1													**0**
NICU 2			1									1	**2**
PICU													**0**
ER FT	1							1					**2**
ER Cen	1	1	1					1	1	1			**6**
ER UR									1	1			**2**
2nd Clinc													**0**
3rd Clinic													**0**

26 Occurrences

(8) Inventory Levels - 2nd Floor East

- Current inventory levels were taken for 164 stocked Items
- Current Value = Current Inventory Levels x Unit Cost
- Sum of current value of all items = $11,740

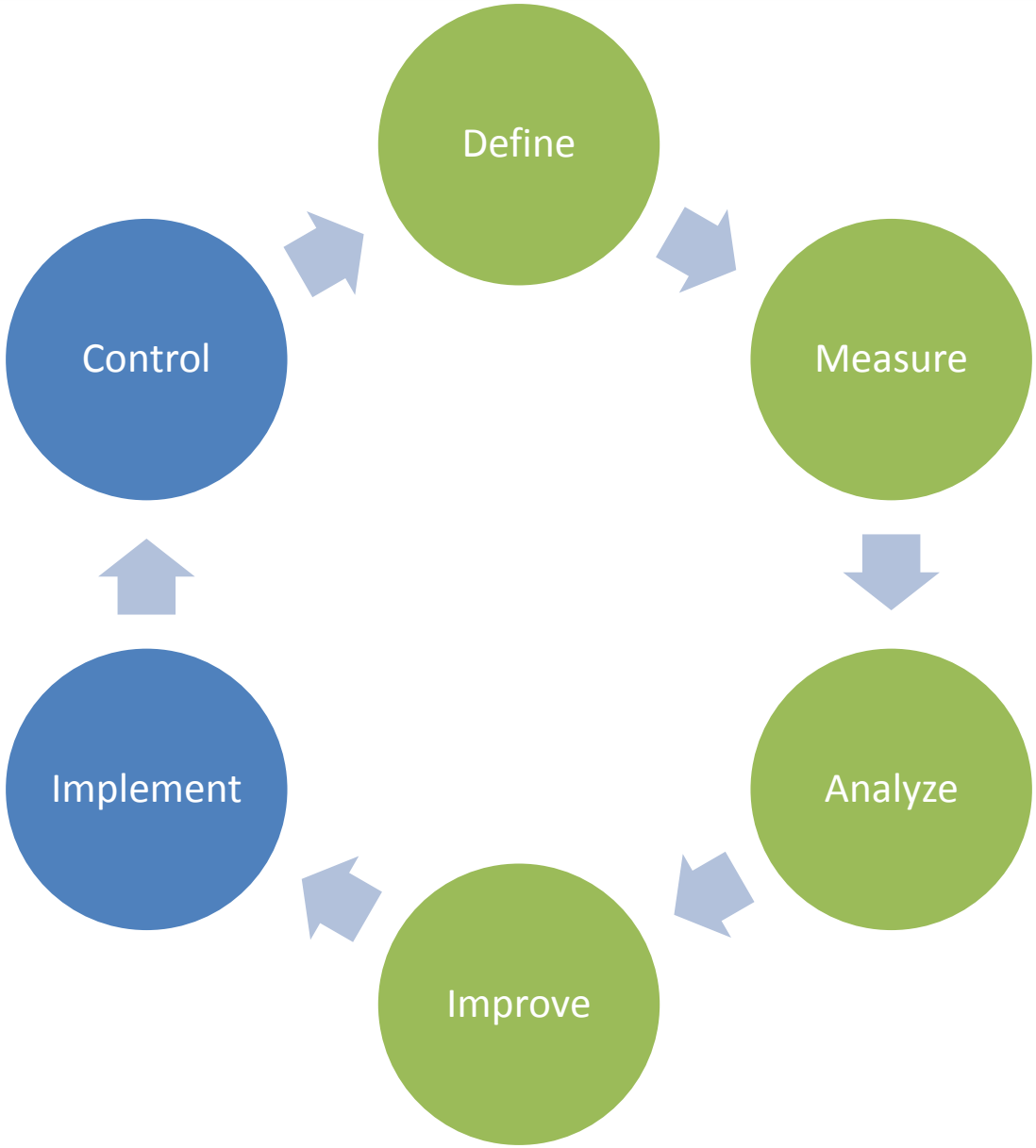
Item Name		Part Number	Procurement	Location	TYPE	Current (1/16/14) Inv		Pkg cost	Units per pkg	Unit Cost	Current Value
Glove Chemo Plus Small	BX/50 PR	13294	Inside	Med Room	BX	23	bx	Confidential	1	63.90	Confidential
Bag Quick Clean Sterilization	BG/100 EA.	16604	Outside	Storage Rm	BX	20	bx			46.12	
Glove Chemo Plus Medium	BX/50 PR	13295	Outside	Med Room	BX	14	bx		1	67.45	
Gown Isolation	CS/10 PK	01415	Inside	Storage Rm	PKGS	42	pkgs		10	8.71	
Glove Exam Nitrile Small	CS/10 BX 200 EA.	03177	Inside	Storage Rm	EA.	37	bx		10	9.60	
Solidifier 1500 cc	cs/96 ea.	02483	Outside	Storage Rm	CASE	300	ea.		96	0.99	
Tape Microfoam 1"	BX/12 EA.	02923	Inside	Med Room	BX	14.5	bx		1	12.64	
Filter Straw Micron	cs/100 ea.	04976	Inside	Storage Rm	BOX	5.78	bags		1	32.27	
Sticker Friday	RL	14753	Outside	Med Room	ROLLS	5	roll		1	50.79	
Mask Procedure W/Shield	BX/50 EA.	13249	Outside	Storage Rm	BX	3	bx		1	75.65	
Syringe Oral 10ML Vygon	cs/100 ea.	13606	Inside	Storage Rm	BX	5	bx		1	42.75	
Syringe Oral 2.5 ml Vygon	CS/50 EA	13626	Inside	Storage Rm	BX	5	bx		1	34.00	
Sticker Sunday	RL	14748	Outside	Med Room	ROLLS	4	roll		1	50.79	

(8) Inventory Levels - 2nd Floor West

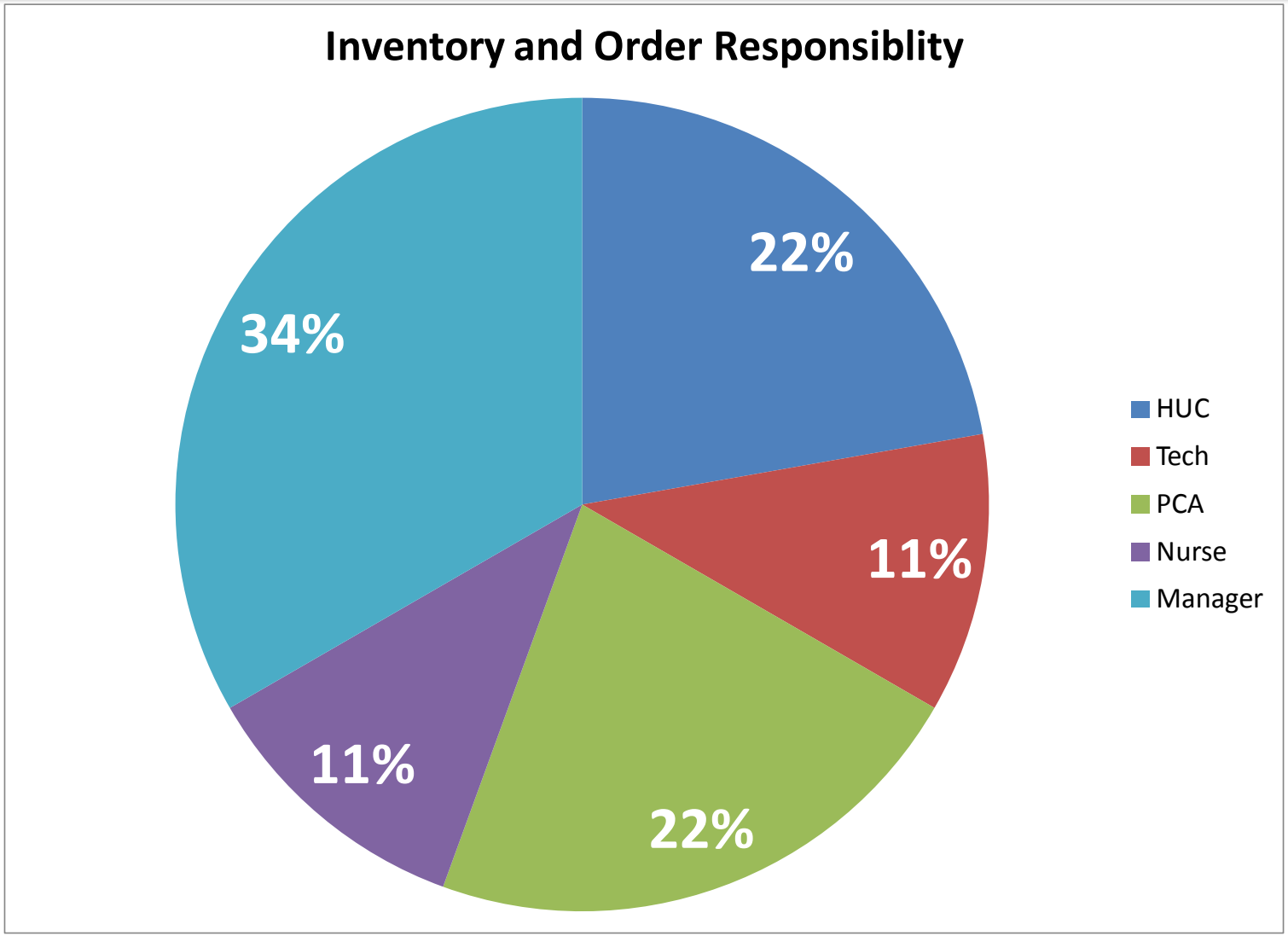
- Current inventory levels were taken for 101 stocked Items
- Current Value = Current Inventory Levels x Unit Cost
- Sum of current value all items = $4,750

Item Name	Packaging	Part Number	Procurement	Loc	Type	Current Inv	Pkg cost	Units per pkg	Unit Cost	Current Value
ADDIPAK NORMAL SALINE	CS/10 BX/100 EA.	01501	Inside - 2 days	MR	BX	2	Confidential	10	7.38	Confidential
APPLICATOR COTTON TIP	CS/10 BX/100 PK/2 EA.	00158	Inside - 2 days	MR	BX	1		10	2.14	
ASPIRATOR NASAL BBG	CS/50 EA	02620	Outside - 8 days	MR	CS	0.5		50	1.77	
Bacitracin		RX	Inside - 2 days	MR	RX	1				
Bag Clear Qt Resealable	CS/2 BX/500 EA.	11735	Outside - 8 days	MR	CS	0		2	6.95	
Bag eme-bag, sic-sac bag	CS/144 ea.	15384	Outside - 8 days	MR	CS	0		1	73.40	
BAG QUICK CLEAN MICRO STEAM	BG/100 EA.	16604	Outside - 8 days	MR	BG	0				
BAG WHITE SMALL #4	bndl/4 pkg/500 ea.	00821	Inside - 2 days	MR	EA	1		4	2.67	
Ball Cotton Prep	cs/8 bg/500 ea.	00871	Inside - 2 days	MR	BAG	1		8	0.98	
BANDAGE COFLEX MULTI		10405	Outside - 8 days	MR	CS	1				
BANDAID SNOOPY 3/4"	CS/12 BX/100 EA.	01708	Inside - 2 days	MR	BX	2		12	4.58	
BANDAID SPOT	CS/24 BX/100 EA.	01683	Inside - 2 days	MR	BX	4		24	1.83	
BASIN EMESIS 9" DISPOSABLE	cs/250 ea.	00873	Inside - 2 days	MR	EA	25		250	0.08	

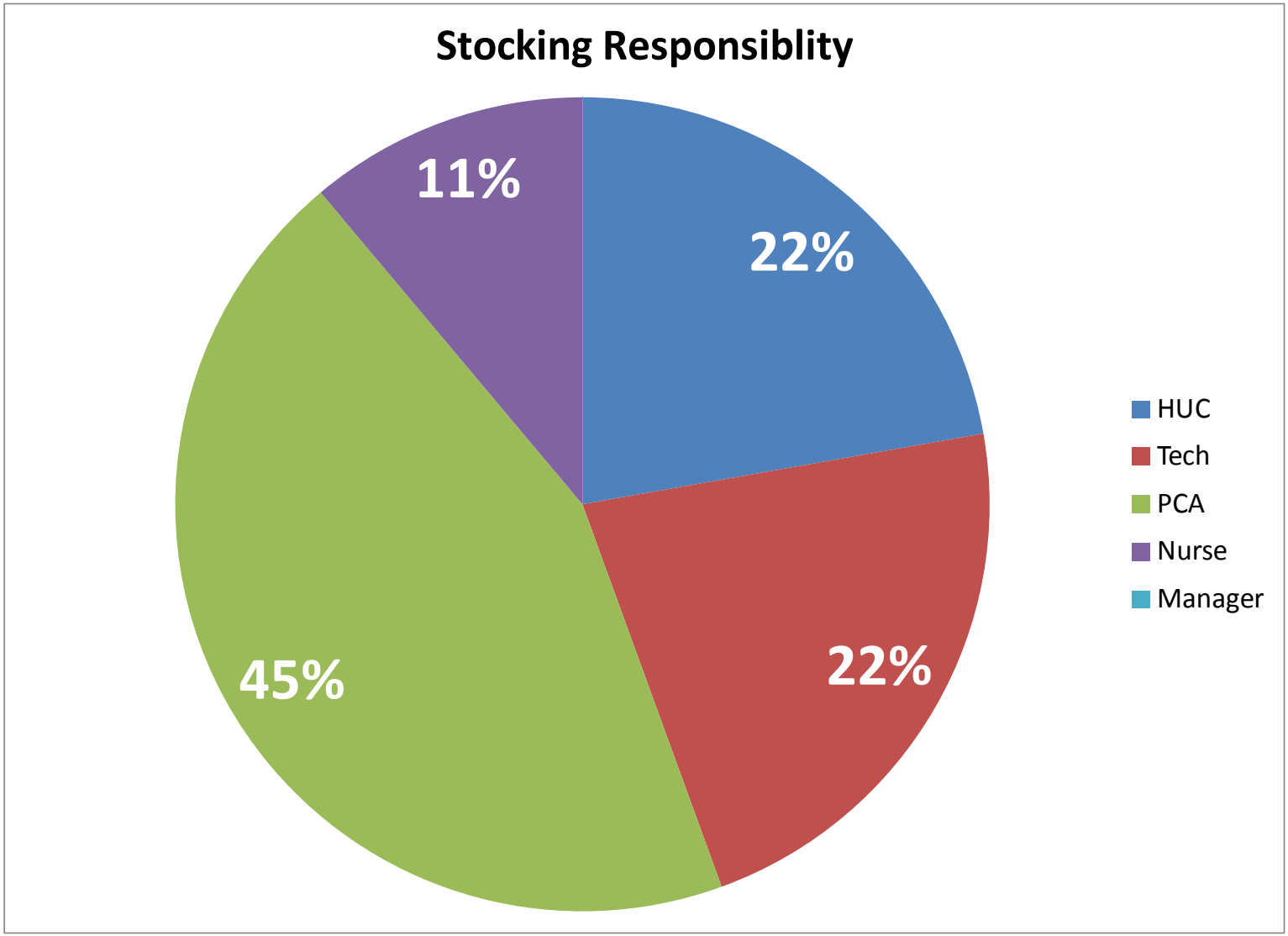
Improve



(1) FTE Labor Analysis



(1) FTE Labor Analysis



Define | Measure | Analyze | Improve | Implement | Control

(1) FTE Labor Analysis

- Labor saving estimates by task if we move from high pay mixed responsibility model time to single responsibility Receiving Clerk model.

Inventory		Order		Stocking	
17	minutes average order/inventory	19	minutes average order/inventory	31	minutes average order/inventory
0.28	in hours	0.32	in hours	0.52	in hours
1.98	hours 7 occurrence a week	2.22	hours 7 occurrence a week	3.62	hours 7 occurrence a week
103.13	hours 52 weeks a year	115.27	hours 52 weeks a year	188.07	hours 52 weeks a year
928.2	hours 9 units in study	1037.4	hours 9 units in study	1692.6	hours 9 units in study
Confidential		Confidential		Confidential	
$9,226	Savings with 100% Receiving Clerk	$10,311	Savings with 100% Receiving Clerk	$4,217	Savings with 100% Receiving Clerk

$23,754 Yearly Labor Savings With No Process Change

Define | Measure | Analyze | Improve | Implement | Control

(1) FTE Labor Analysis

Receiving Clerk(Purchasing Tech) responsibility vs. mixed responsibility

Advantages

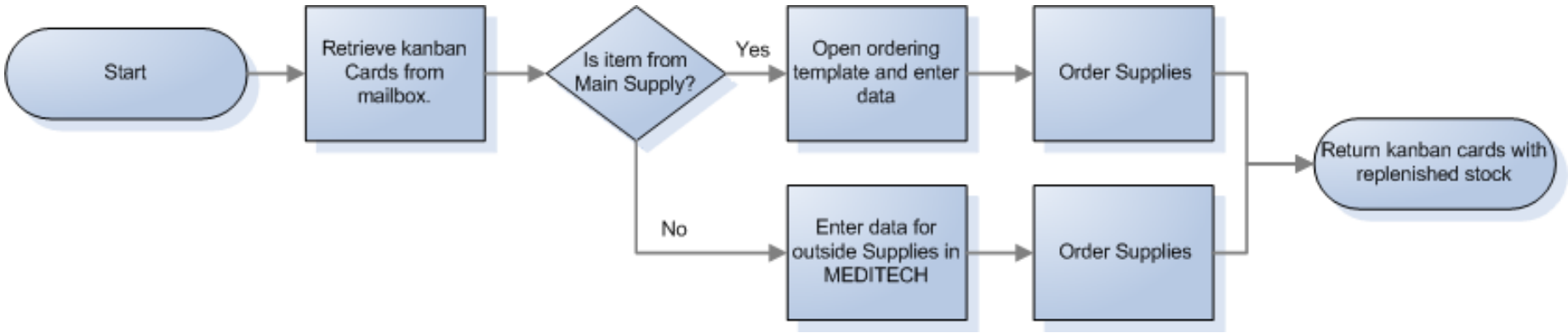
- Lower overall cost vs. mixed model at $23,754 a year savings
- Group ownership of the process
- Standard process for ordering, inventory, and stocking supplies across hospital units
- Less overall chance of error

Disadvantages

- Slightly higher pay at Confidential Confidential over PCA at
- Less product knowledge
- Less profound knowledge on census

(2) Future State Process Diagram

- Develop one best method for ordering



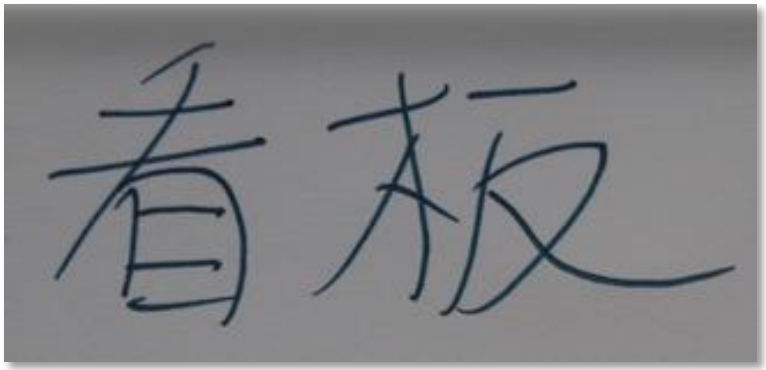
Only 1 Decision Point

6 Process Step Reduction!

1 Best Method!

Kanban System

- Kanban (pronounced “Kahn-Bahn”) is a Japanese term for signal.
- Is it used to manage inventory and reduce the chance of running out of supplies.
- It also creates FIFO (First In, First Out) for inventory to help prevent expired supplies.



Kanban System Types ROI

1. Traditional Kanban
2. Electronic Kanban (E-Kanban) with Stock Box System
3. Electronic Kanban (E-Kanban) with OptiFlex System

First Year ROI

Line	Traditional Kanban	Notes	Stockbox (e-kanban)	Notes	Opti-Flex (barcode)	Notes
Predicted First Year Savings from **Inventorying**	$ Confidential	Assuming it takes a receiving clerk 3 mins to pick up kanban cards.	$ Confidential	Assuming it takes the same time to retreive e-kanban cards as traditional kanban cards	$ Confidential	Opti-flex continuously tracks per item/"bundle" useage therefore eliminating inventorying cost
Predicted First Year Savings from **Ordering**	$	Assuming it takes a receiving clerk 12 mins to order new supplies	$	Automatic ordering eliminates all ordering costs. Savings taken directly from PP labor analysis	$	Opti-flex can be set up to automatically re-order therefore eliminating order costs.
Predicted First Year Savings from **Stocking**	$	Assuming it takes a receiving clerk 28 minutes to re-stock supplies	$	Stocking time shouldn't change	$	Stocking Time shouldn't change.
Total First Year **Labor** Savings	$ 42,908		$ 52,493		$ 54,890	
Total First Year Savings from **Holding** (Inventory)	$ 809,127	Value taken directly from 6-month data excel chart for all 9 departments	$ 809,127	Assumed to be same as traditional	$ 809,127	Assumed to be same as traditional
Total First Year Savings	$ 852,035		$ 861,620		$ 864,017	
Estimated Total Cost for Initial Implementation	$ 4,500	$500 estimated cost for Bins, dividers, tape, supplies for each department	$ 191,316	Assuming we order 12 stockboxes	$ 77,893	Assuming we need 8 sets of cybernet scanning interfaces. Also assumes a receiving clerk(s) spends 20 hours editing Opti-Flex database.
ROI = (Total Savings/Total Cost)	189		5		11	
ROI Time	2	days	83	days	34	days

Define | Measure | Analyze | Improve | Implement | Control

EAST TENNESSEE Children's Hospital

First Year ROI Conclusion

Traditional Kanban

- ROI = 189
- By implementing a two-bin kanban system, ETCH is able to realize significant savings due to reduction in its inventorying and ordering costs. Given the relatively cheap implementation cost, this method results in a high ROI that appears to be the best option.

Stockbox

- ROI = 5
- While the stockbox e-kanban manages to eliminate costs associated with ordering and most of inventorying, it's ROI is quite low due to the high cost (~$16,000 ea) of purchasing the physical stockboxes for each area. Therefore, it is more practical to use the traditional kanban system.

Opti-Flex

- ROI = 11
- Should ETCH decide to track patient Non-Chargeables with the Optiflex system, all inventorying and ordering costs would essentially be eliminated due to the automatic per-useage item tracking. While this option provides the best labor savings, it's ROI is still lower than that of the traditional kanban due to the infrastructure expenditures that would be needed on floors that do not currently have the optiflex hardware.

Annual Year ROI

	Traditional Kanban	Notes	Stockbox (e-kanban)	Notes	Opti-Flex (barcode)	Notes
Predicted Annual Savings from **Inventorying**	$ Confidential	Assuming it takes a receiving clerk 3 mins to pick up kanban cards.	$ Confidential	Assuming it takes the same time to retreive e-kanban cards as traditional kanban cards	$ Confidential	Opti-flex continuously tracks per item/"bundle" useage therefore eliminating inventorying cost
Predicted Annual Savings from **Ordering**	$	Assuming it takes a receiving clerk 12 mins to order new supplies	$	Automatic ordering eliminates all ordering costs. Savings taken directly from PP labor analysis	$	Opti-flex can be set up to automatically re-order therefore eliminating order costs.
Predicted Annual Savings from **Stocking**	$	Assuming it takes a receiving clerk 28 minutes to re-stock supplies	$	Stocking time shouldn't change	$	Stocking Time shouldn't change.
Total Annual Savings (Labor)	$ 42,908	Same as First Year	$ 52,493	Same as First Year	$ 54,890	Same as First Year
Estimated Annual Cost	$ 100	Simple two-bin maintenance supplies (tape, foamboard, etc.)	$ 24,660	Assuming $2,055 annual software & licensing costs for 12 units.	$ 17,855	Assuming $2,232 annual software & database maintenance costs for the whole hospital.
ROI = (Total Savings/Total Cost)	**429**		**2**		**3**	
ROI Time	**1**	**days**	**175**	**days**	**121**	**days**

Define | Measure | Analyze | Improve | Implement | Control

Annual ROI Conclusion

Traditional Kanban

- ROI = 429
- After the initial implementation of the traditional two-bin kanban system, there are essentially no additional future costs associated with this method except for simple maintenance & replacement of aging kanban cards/dividers/bins. This method again appears to be the best option based on annual ROI.

Stockbox

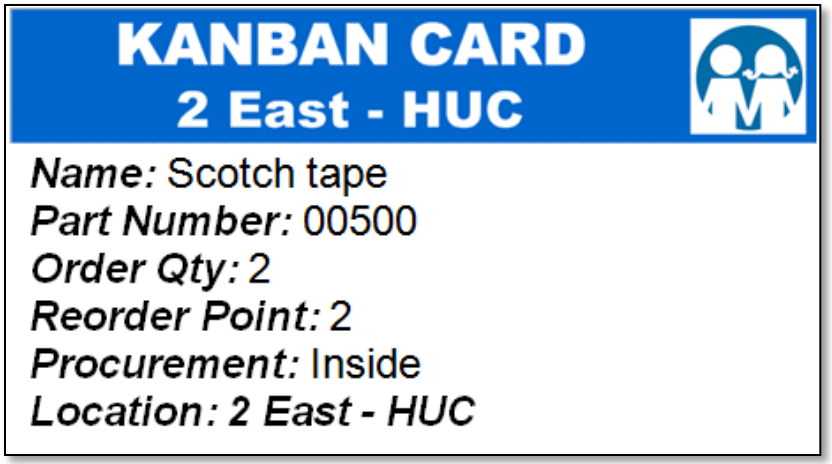
- ROI = 2
- While the stockbox e-kanban manages to eliminate costs associated with ordering and most of inventorying, it's ROI is lower than that of the traditional kanban due to the high annual maintenance and licensing costs.

Opti-Flex

- ROI = 3
- Should ETCH decide to track patient Non-Chargeables with the Optiflex system, all inventorying and ordering costs would be eliminated due to the automatic per-useage item tracking. This ROI calculation does not include any additional savings regarding the efficiency of expired items or useage, which could significantly raise this figure.

(2 - 8) Tradition Kanban System

- The Kanban card is used as a signal to order more supplies.
  - It tells you what to order, the quantity and where to store the supplies.



Traditional Kanban Instructions

1) When supplies in a bin hits the reorder point, pull the Kanban card.

A.

Full Bin: Pull from the side that is not covered with foam board

B.

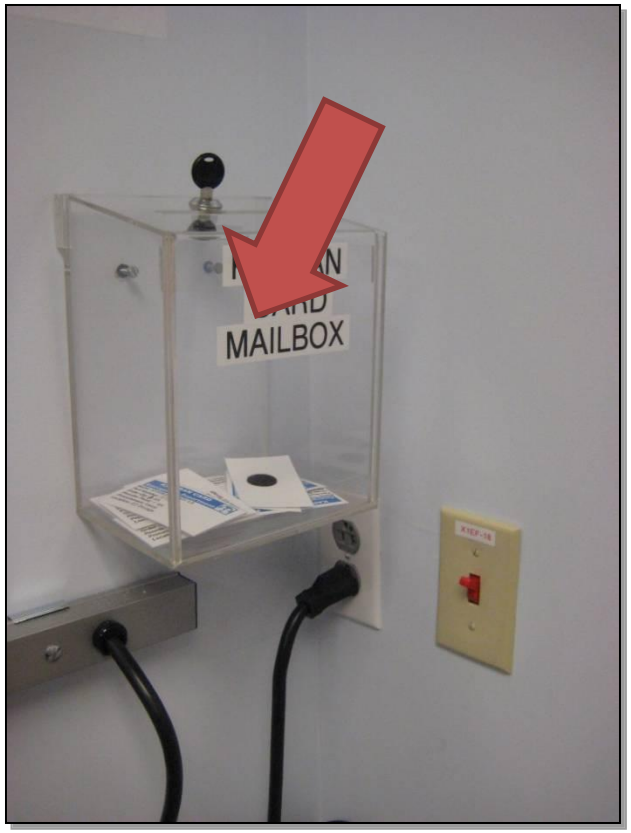
Reorder Point: When one side is empty and you reach the side covered with foam board lower the cover, remove the Kanban card and use the remaining supplies.

Kanban Instructions

2) Place removed Kanban card in the mailbox mounted on the wall in the Respiratory supply closet.

3) Cards are collected from the mailbox on ordering day.

4) The cards tell the person ordering exactly what to order.



Kanban Instructions

5) Once supplies are received, bins will be refilled to the correct level and the Velcro Kanban card will be reattached to the bin.

Kanban Pro / Con

What Makes this Work

- Every single employee using the system.
- It's Easy!

What Makes this Fail

- Employees not taking ownership.
- Not placing Kanban cards in the mailbox.
- Losing cards
  - If you notice a card on the floor find it's home!

Kanban Inventory Level Calculations

- **Average Monthly Usage** = Sum of Months / Number of Months
  - Six month order report unitized to determine patient demand
- **Max Daily Usage** = Historical maximum usage of part number in one day period
- **Normal Daily Usage** = Average Monthly Usage ÷ 30 Days

Kanban Inventory Level Calculations

- **Lead Time** = How long it takes to ship part number from supplier
  - Inside Procurement = 3 days
  - Outside Procurement = 8 days
- **Safety Stock** = (Max Daily Usage – Normal Daily Usage) x Lead Time
- **Reorder Point** = (Normal Daily Usage x Lead Time) + Safety Stock
- **Par Level =** Reorder Point x 2
  - * For Two Bin Kanban System

Kanban Sample Calculations

Item Name	Procurement	May	Aug	Sep	Oct	Nov	Dec	Sum Total	Order Count	Max	AVERAGE	Max DU	Normal DU	LT	SS	Reorder Point	Par Level
Glove Exam Nitrile Small	Inside	40	21	14	10	16	32	133	6	40	22.17	1.33	0.74	3	1.78	4	8

- **Average Monthly Usage =** (40+21+14+10+16+32) ÷ 6 months = 22.17 units per month
- **Max Daily Usage =** 40units per month ÷ 30 days = 1.33
- **Normal Daily Usage =** 22.17units per month ÷ 30 days = 0.74

Kanban Sample Calculations

Item Name	Procurement	May	Aug	Sep	Oct	Nov	Dec	Sum Total	Order Count	Max	AVERAGE	Max DU	Normal DU	LT	SS	Reorder Point	Par Level
Glove Exam Nitrile Small	Inside	40	21	14	10	16	32	133	6	40	22.17	1.33	0.74	3	1.78	4	8

- **Lead Time** = Inside = 3 Days
- **Safety Stock** = (1.33 - .74) x 3 = 1.78 units
- **Reorder Point** = (0.74 x 3) + 1.78 days = 4 units
- **Par Level** = 4 units x 2 = 8 units

Kanban Inventory Level Calculations

Item Name		Part Number	Type	Procurement	TYPE	May	Aug	Sep	Oct	Nov	Dec	Sum Total	Order Count	Max	AVERAGE	Max DU	Normal DU	LT	SS	Calc Reorder Point	Reorder Pnt	Reorder Type	Est Par	Kanba Par
Glove Chemo Plus Small	BX/50 PR	13294	BX	Inside - 2 days	BX							0	0	0	0.00	0.00	0.00	3	0.00	0.00	1	BX	0.00	2
Bag Quick Clean Sterilization	BG/100 EA.	16604	bx	Outside - 1 wk	BX			1				1	1	1	0.17	0.03	0.01	8	0.22	0.27	0.5	BX	0.53	1.5
Glove Chemo Plus Medium	BX/50 PR	13295	BX	Outside - 1 wk	BX		16					0	1	0	2.67	0.00	0.09	8	-0.71	0.00	1	BX	0.00	2
Gown Isolation	CS/10 PK	01415	CASE	Inside - 2 days	PKGS	3	1	1	1		3	9	5	3	1.50	0.10	0.05	3	0.15	0.30	4	PKGS	0.60	1
Glove Exam Nitrile Small	CS/10 BX 200 EA.	03177	EA.	Inside - 2 days	EA.	40	21	14	10	16	32	133	6	40	22.17	1.33	0.74	3	1.78	4.00	6	BX	8.00	12
Solidifier 1500 cc	cs/96 ea.	02483	CASE	Outside - 1 wk	CASE						1	1	1	1	0.17	0.03	0.01	8	0.22	0.27	0.25	CS	0.53	1
Tape Microfoam 1"	BX/12 EA.	02923	BX	Inside - 2 days	BX	2				1	2	5	3	2	0.83	0.07	0.03	3	0.12	0.20	1	BX	0.40	2
Filter Straw Micron	cs/100 ea.	04976	BOX	Inside - 2 days	BOX	1		1			3	5	3	3	0.83	0.10	0.03	3	0.22	0.30	1	BX	0.60	1
Sticker Friday	RL	14753	Rolls	Outside - 1 wk	ROLLS			2				2	1	2	0.33	0.07	0.01	8	0.44	0.53	1	ROLL	1.07	2
Mask Procedure W/Shield	BX/50 EA.	13249	BX	Outside - 1 wk	BX			4				4	1	4	0.67	0.13	0.02	8	0.89	1.07	1	BX	2.13	2
Syringe Oral 10ML Vygon	cs/100 ea.	13606	BX	Inside - 2 days	BX	2	3	2	1	2	5	15	6	5	2.50	0.17	0.08	3	0.25	0.50	1	BX	1.00	2
Syringe Oral 2.5 ml Vygon	CS/50 EA	13626	BX	Inside - 2 days	BX	1	1	2				4	3	2	0.67	0.07	0.02	3	0.13	0.20	1	BX	0.40	1.5
Sticker Sunday	RL	14748	Rolls	Outside - 1 wk	ROLLS			2				2	1	2	0.33	0.07	0.01	8	0.44	0.53	1	f	1.07	2
Sticker Monday	RL	14749	Rolls		ROLLS			2				2	1	2	0.33	0.07	0.01	8	0.44	0.53	1	ROLL	1.07	2
Sticker Wednesday	RL	14751	Rolls	Outside - 1 wk	ROLLS			1				1	1	1	0.17	0.03	0.01	8	0.22	0.27	1	ROLL	0.53	2
Sticker Thursday	RL	14752	Rolls	Outside - 1 wk	ROLLS		1	2				3	2	2	0.50	0.07	0.02	8	0.40	0.53	1	ROLL	1.07	2
Syringe Oral 5ml Vygon	cs/100 ea.	13605	BX	Inside - 2 days	BX	3	2	2	1	1	2	11	6	3	1.83	0.10	0.06	3	0.12	0.30	1	BX	0.60	1.5
Mask Isolation - Ped	CS/10 BX/75 EA.	10947	BX	Inside - 2 days	BX	18	8					26	2	18	4.33	0.60	0.14	3	1.37	1.80	1	BX	3.60	3
Glove Surgical Protexis SZ 6	CS/4 BX/50 PR	09223	BX	Inside - 2 days	BX		1	1				2	2	1	0.33	0.03	0.01	3	0.07	0.10	0.25	BX	0.20	1
Bulb Welch Allyn 4900U	PK/6 EA.	06253	PKGS	Outside - 1 wk				24				24	1	24	4.00	0.80	0.13	8	5.33	6.40	6	PKGS	12.80	12
Glove Exam Nitrile LG	CS/10 BX/200 EA.	03821	EA.	Inside - 2 days	EA.	40	10	12	10	16	16	104	6	40	17.33	1.33	0.58	3	2.27	4.00	6	EA.	8.00	12
Syringe 12CC L/L	BX/6 BX/100 EA.	02155	BX	Inside - 2 days	BX	7	3	6	2	3	6	27	6	7	4.50	0.23	0.15	3	0.25	0.70	1	BX	1.40	2
Syringe Prefilled Saline 10ML	CS/8 BX/100 EA.	13062	BX	Inside - 2 days	BX	28	17	22	8	25	20	120	6	28	20.00	0.93	0.67	3	0.80	2.80	2	BX	5.60	6
Tape Durapore 1"	S/10 BX/12 R;	01272	BX	Inside - 2 days	BX	5	6	5	1	4	8	29	6	8	4.83	0.27	0.16	3	0.32	0.80	1	BX	1.60	2
Sticker Tuesday	RL	14750	Rolls	Outside - 1 wk	ROLLS			2				2	1	2	0.33	0.07	0.01	8	0.44	0.53	1	ROLL	1.07	2
Sticker Saturday	RL	14754	Rolls	Outside - 1 wk	ROLLS			2				2	1	2	0.33	0.07	0.01	8	0.44	0.53	1	ROLL	1.07	2
Tape Durapore 2"	CS/10 BX/6 RL	01273	BX	Inside - 2 days	BX	4		2			3	9	3	4	1.50	0.13	0.05	3	0.25	0.40	1	BX	0.80	2
Shur Klenz 20 ml	cs 100 ea.	00289	CASE	Inside - 2 days	CASE	1						1	1	1	0.17	0.03	0.01	3	0.08	0.10	0.25	CASE	0.20	1
Kit Spill Chemo	cs/6 ea.	01202	CASE	Outside - 1 wk	BX							0	0	0	0.00	0.00	0.00	8	0.00	0.00	2	EA.	0.00	1
Tape Microfoam 2"	CS/6 BX/6RL	01277	BX	Inside - 2 days	BX	2	1			1	2	6	4	2	1.00	0.07	0.03	3	0.10	0.20	1	BX	0.40	2
Cap Red R-2000-B	CS/10 BX/100 EA.	04982	BX	Inside - 2 days	BX	10	5	10	5	4	5	39	6	10	6.50	0.33	0.22	3	0.35	1.00	1	BX	2.00	1
Syringe Cap Vygon N/S	CS/10 BG/100	13634	BAG	Inside - 2 days	BAG	6	3	2				11	3	6	1.83	0.20	0.06	3	0.42	0.60	1	BAG	1.20	2
Needle LS 27G X 1/2	BX/100 EA.	10430	BX	Inside - 2 days	BX	1	1					2	2	1	0.33	0.03	0.01	3	0.07	0.10	1	BX	0.20	2
Cup Graduate	cs/8 bg/500 ea.	00876	SLEEVE	CS - 1 day	SLEEVE		12		1		4	17	3	12	2.83	0.40	0.09	8	2.44	3.20	1	SLEEVES	6.40	2
Syringe Oral 1ml Vygon	cs/100 ea.	13604	BX	Inside - 2 days	BX	1	1	2		1	1	6	5	2	1.00	0.07	0.03	3	0.10	0.20	1	BX	0.40	1.5
Needle Safety LL 22GX1	CS/10 BX/50 EA.	10429	BX	Inside - 2 days	BX	2	1	1				4	3	2	0.67	0.07	0.02	3	0.13	0.20	1	BX	0.40	2
Pin Micro Cannula	BX/100 EA.	04974	BX	Inside - 2 days	BX		4	4	2	2	7	19	5	7	3.17	0.23	0.11	3	0.38	0.70	1	BX	1.40	1
Cloth Sani Al-Free Green	CS/12 EA	13787	CASE	Outside - 1 wk	EA.		1					1	1	1	0.17	0.03	0.01	8	0.22	0.27	2	EA.	0.53	1
Syringe 20CC L/L	CS/6 BX/250 EA.	02157	BX	Inside - 2 days	BX	2		3			2	7	3	3	1.17	0.10	0.04	3	0.18	0.30	1	BX	0.60	2

(8) Inventory Holding Value Calculations

Item Name	Part Number	Type	Kanban Par	Current Inv	One Time Overage	Pkg cost	Units per pkg	Unit Cost	Overage Cost	Current Value	Future Value	Monthly Savings
Glove Chemo Plus Small	13294	BX	2	23	21	63.9	1	63.90				

Confidential

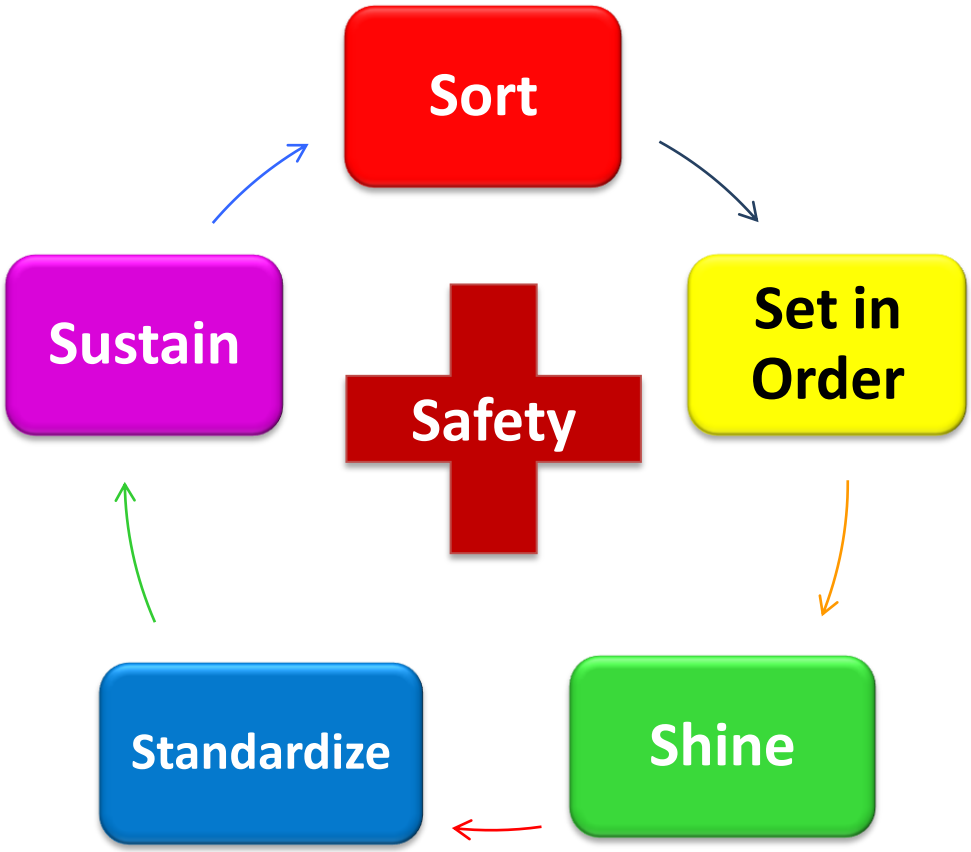
- **One Time Overage Cost** = (Current Inventory Level – Kanban Par Level) x Unit Cost
- **Current Value** = Current Inventory Level x Unit Price
- **Future Value** = Kanban Par Level x Unit Price
- **Monthly Holding Savings** = Current Value – Future Value

Notes on Kanban Calculations

- Validate with staff members and make adjustments as needed.
- Frontline staff have profound knowledge of the work.
- Use this profound knowledge in conjunction with the kanban calculations to reach final agreement on par levels.

(7) 5S + Safety

- 5S is a foundation for a more systematic organized approach to the workplace
- Method for organizing the workplace to reduce wasted time and motion



5S + Safety

SORT: Separating the needed from the not-needed

SET IN ORDER: A place for everything and everything in its place, clean, and ready to use

SHINE: Cleaning for inspection

STANDARDIZE: Developing common methods for consistency

SAFETY: Ensure a safe working environment through inspection, evaluation, and follow-up

SUSTAIN: Holding the gains and improving

5S Pictures

Before:

After:

5S Pictures

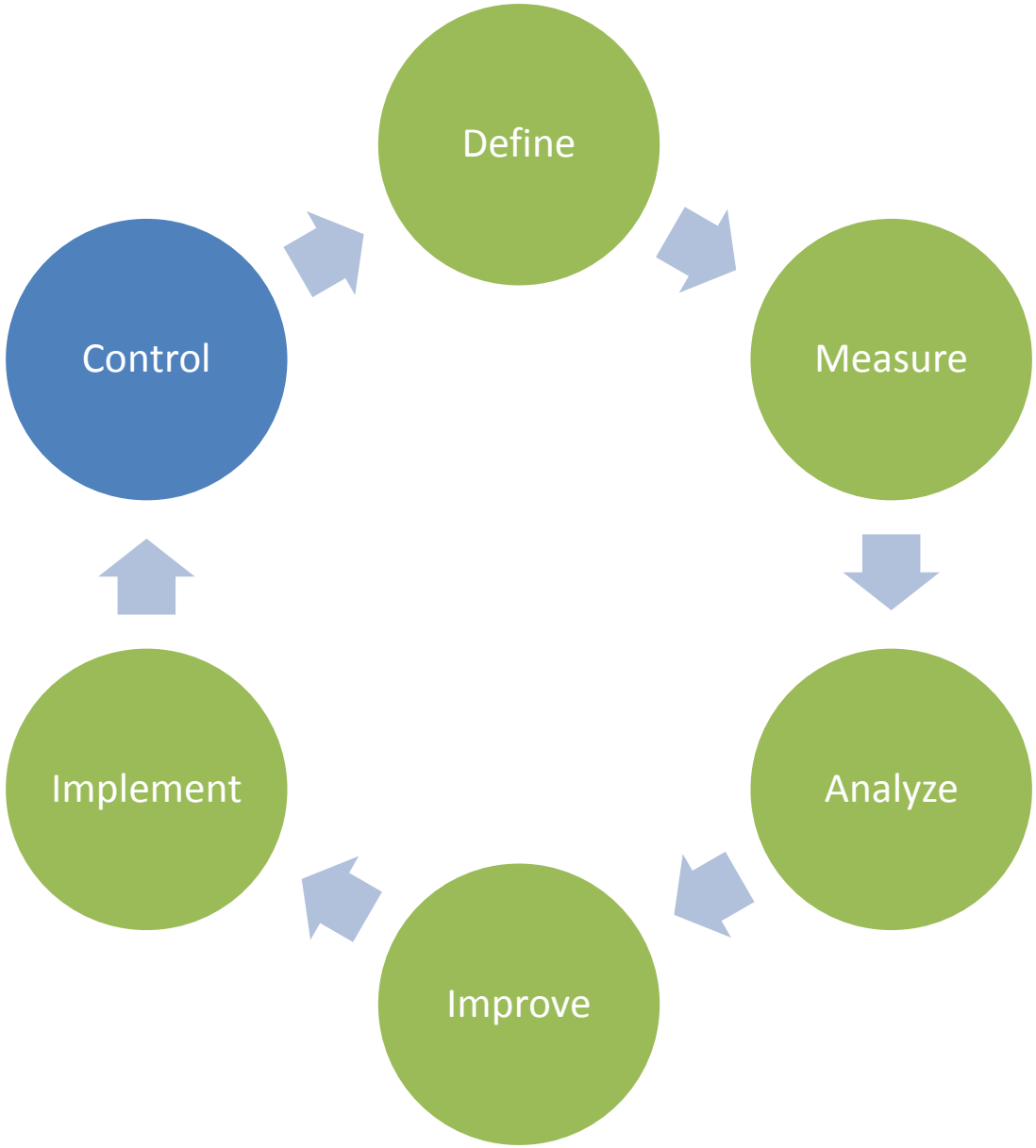
Before:

After:

(7) Benefit of 5S+Safety

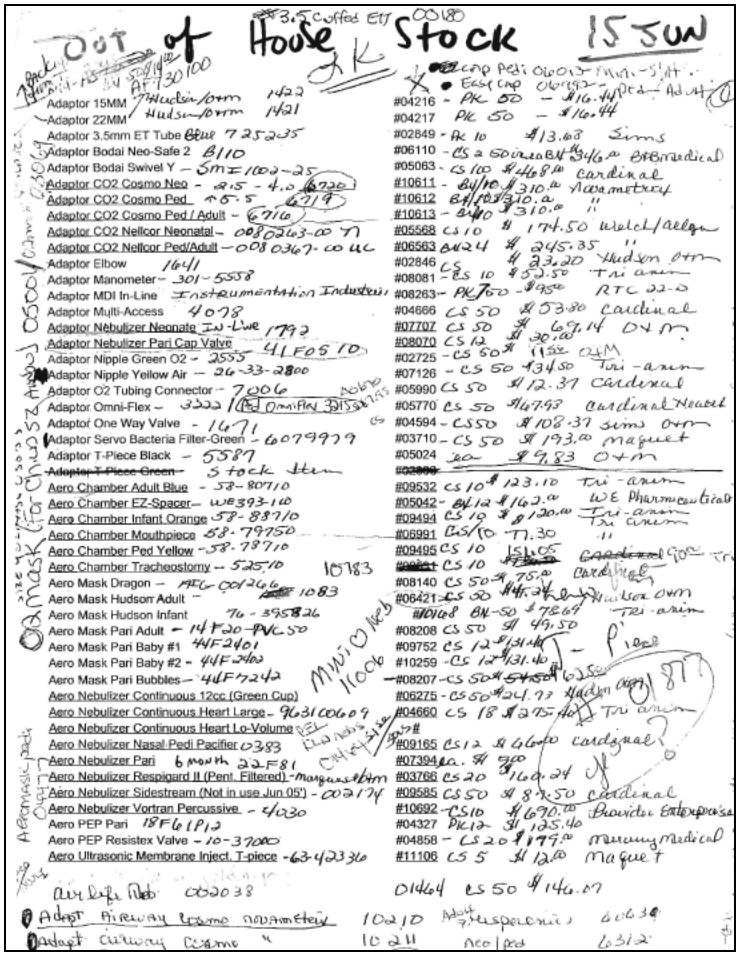
- Cleaner work areas
- More organization
- Safer working conditions
- More effective work processes
- Less wasted time completing work
- Less space needed

Implement



(2-8) Kaizen Event

- **Kaizen Events:** drive change and rapid process improvements
  - Cross functional team of 4-8 people
  - Focus: Kanban System and 5S
  - Set action plan for future improvements and needs



Sample of old inventory sheet

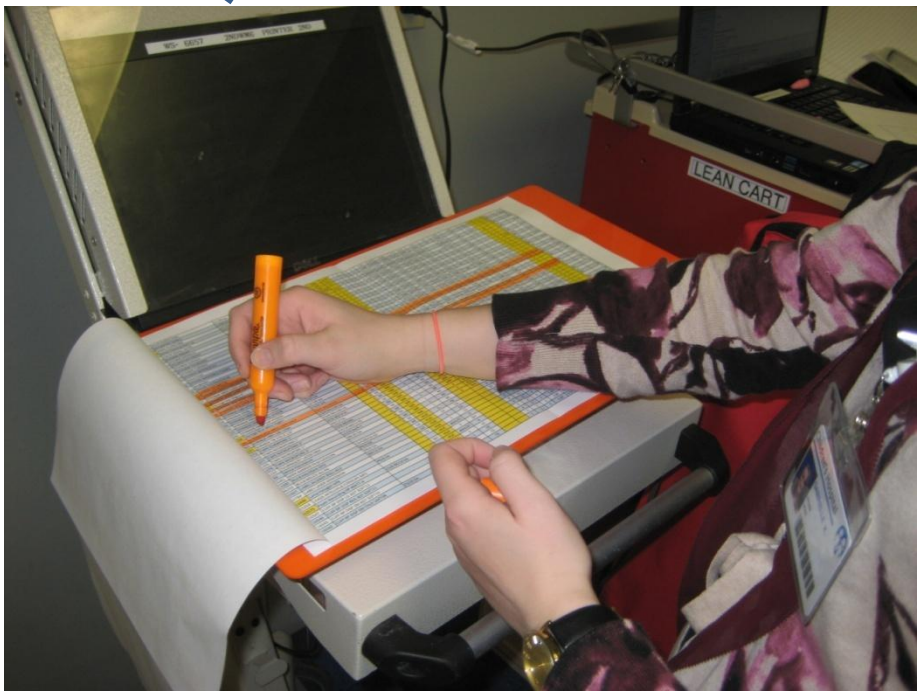
Kaizen Team

Team Members (Left to Right): Marti Jordan, Kim Parker, Gabrielle, Knoll, Steven Burbank, Hayley Edwards , Leandra Church, Isaac Mitchell

Kaizen Event Pictures

5S complete and ready for Kanban

Master list of kanban par levels and bin sizes

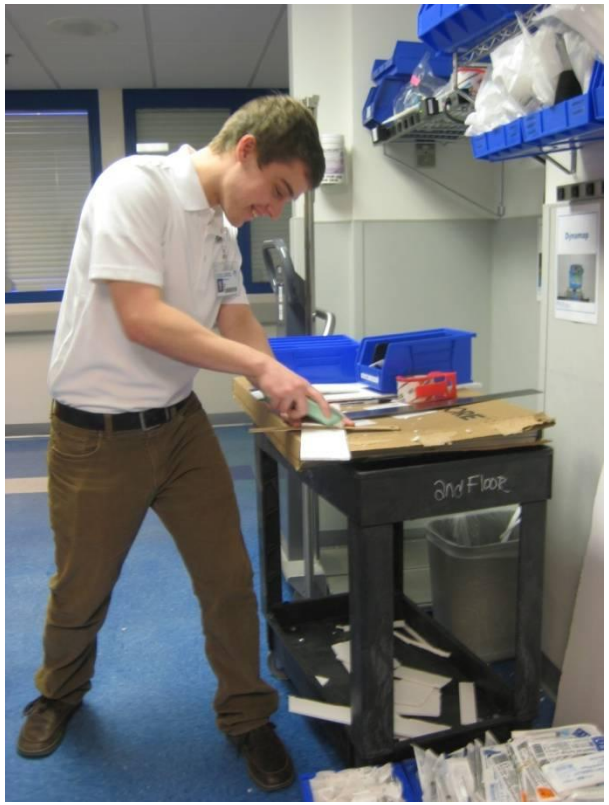


Define | Measure | Analyze | Improve | Implement | Control

Kaizen Event Pictures

Kanban guard to signal staff to pull kanban card

Steven creating kanban signal guards



Define | Measure | Analyze | Improve | Implement | Control

Kaizen Event Pictures

Kanban cards for bin system

Kanban cards for drawer storage

Kaizen Event Pictures

Close up of Kanban cards and guard

Kanban cards order bin

Define | Measure | Analyze | Improve | Implement | Control

Kaizen Event Finished Product

Define | Measure | Analyze | Improve | Implement | Control

Kaizen Team After 11 Hour Event

Define | Measure | Analyze | Improve | Implement | Control

(3 & 4) Post Inventory and Ordering Times

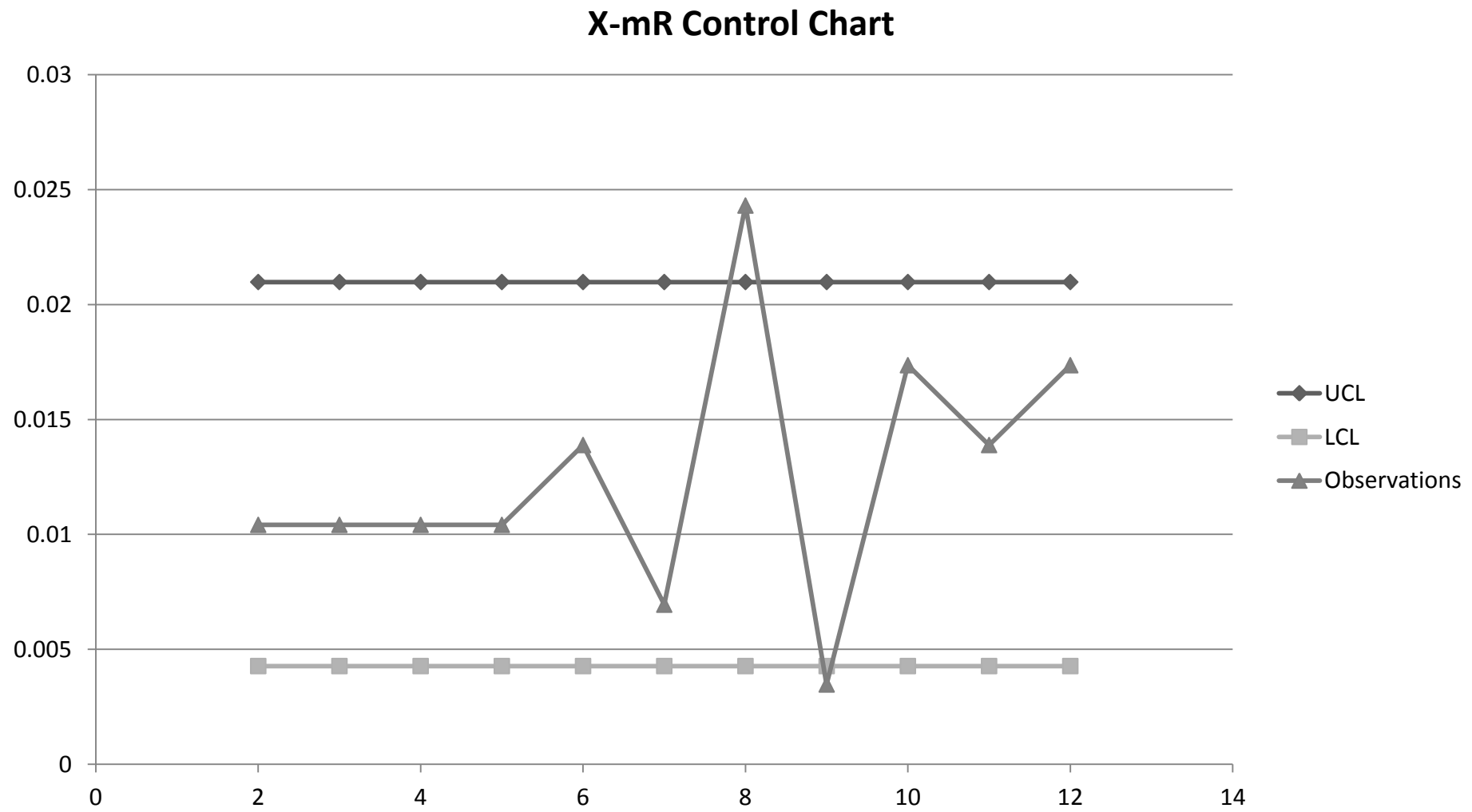
Employee	Debi Hill, Kim Parker, Justin Abbott	Department	2nd Floor

ORDERING/INVENTORYING

Date	Time in	Time out	Total Time	mR (moving range)	UCL	LCL
4/25/2014	11:00	11:15	0:15	0:15	0:30	0.004
4/30/2014	9:15	9:30	0:15	0:00	0:30	0.004
4/30/2014	9:30	9:45	0:15	0:00	0:30	0.004
4/30/2014	10:00	10:15	0:15	0:15	0:30	0.004
5/9/2014	11:00	11:20	0:20	0:05	0:30	0.004
5/9/2014	11:20	11:30	0:10	0:10	0:30	0.004
5/9/2014	12:00	12:35	0:35	0:25	0:30	0.004
5/9/2014	12:45	12:50	0:05	0:30	0:30	0.004
5/12/2014	11:20	11:45	0:25	0:20	0:30	0.004
5/15/2014	17:10	17:30	0:20	0:10	0:30	0.004
5/15/2014	17:45	18:10	0:25	0:10	0:30	0.004
		Means:	0:18	0:12		
		E Value:	0.945			

Define | Measure | Analyze | Improve | Implement | Control

(3 & 4) Post Inventory and Ordering Times Chart



Define | Measure | Analyze | Improve | Implement | Control

(5) Post Stocking Times & Chart

- **Current State:** Not enough data collected. Purchasing Tech position is recently vacant and Patient Care Assistants have to do this job.
- **Outcome:** Random Patient Care Assistants where assigned to stock and did not record time for post data.
- **Future State:** Collect data once Purchasing Tech position is fill. Run t-test to compare pre and post data to determine if there is a statistically significant difference.

(3, 4, 5) Test of Hypothesis Flow Chart

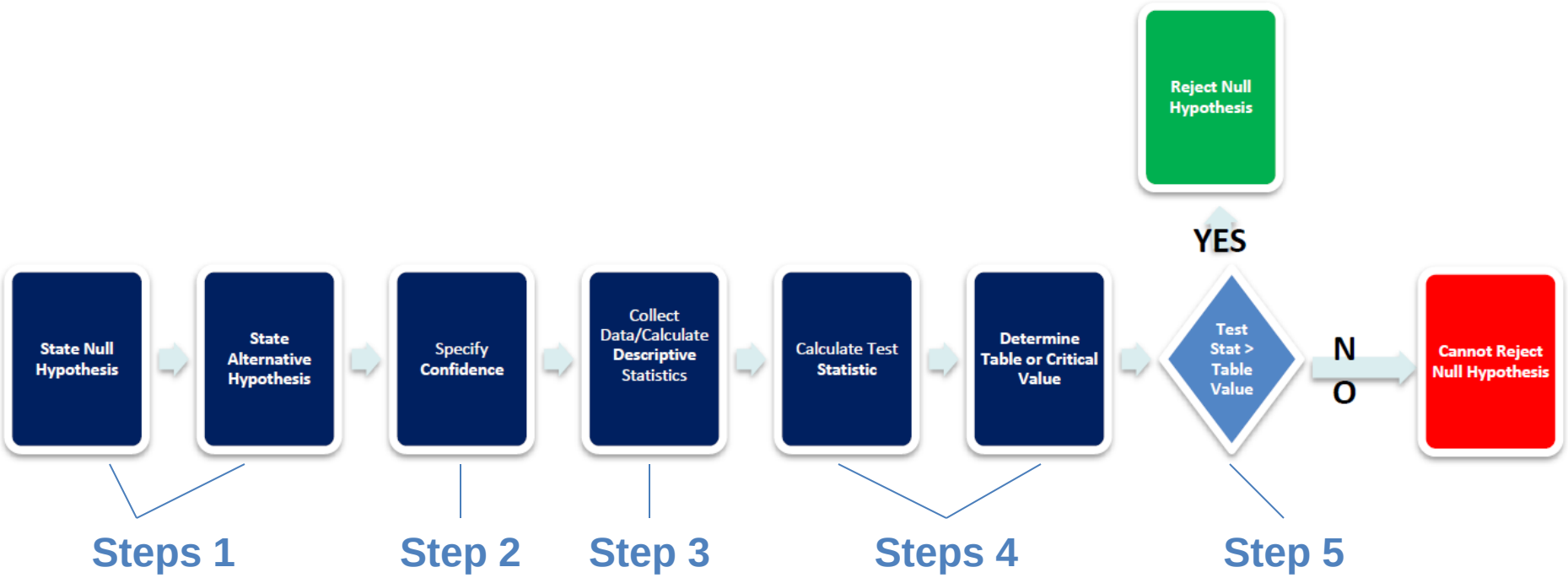


*Image Credit: IIE Six Sigma Black Belt Week 1 – Larry Aft

(3, 4, 5) Test of Hypothesis

Step1: Ho: Pre Data = Post Data

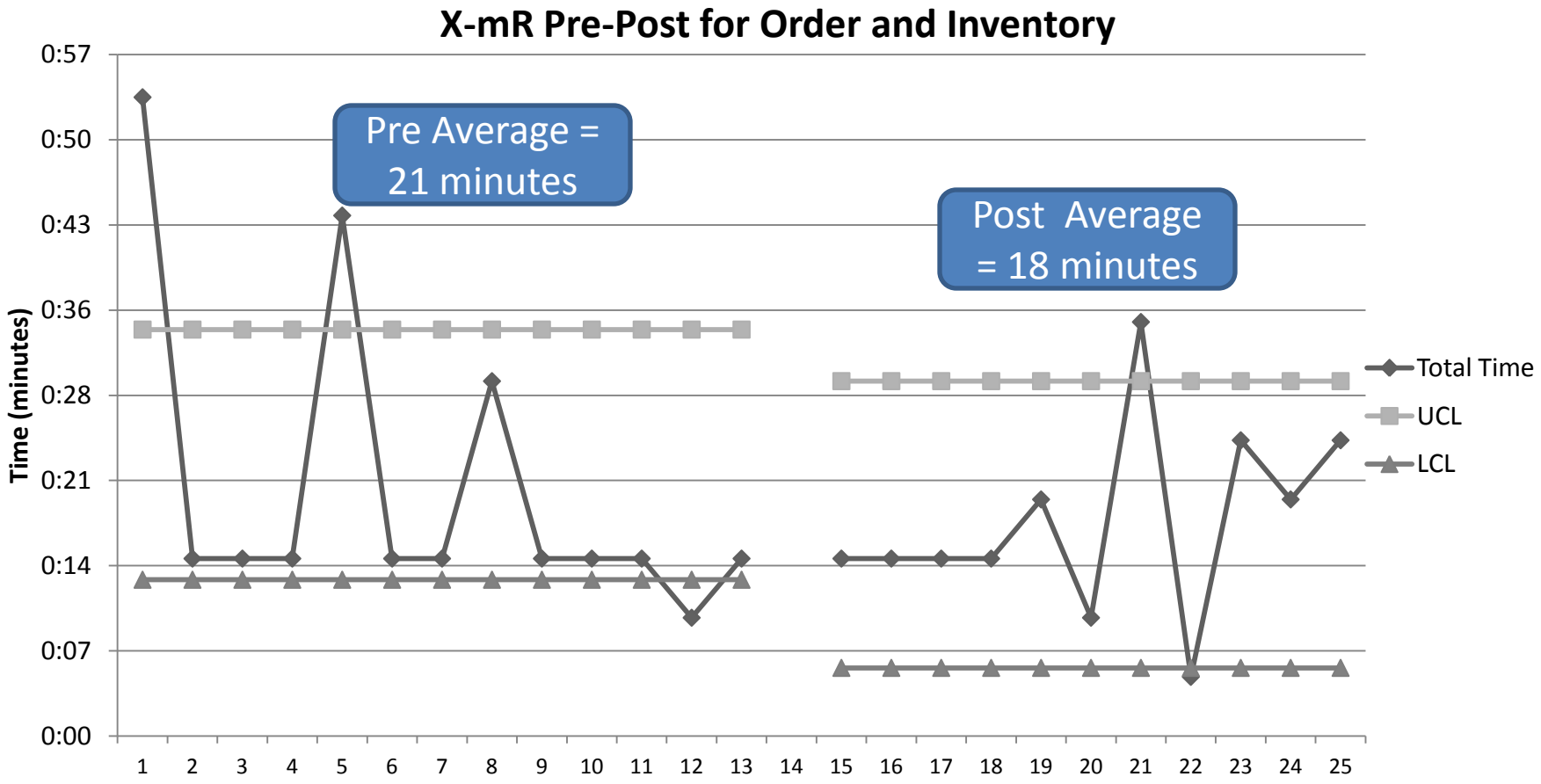
H1: Pre Data > Post Data

Two tail test since H1 is a directional inequality

Step 2: 95% Confidence Level

(3, 4, 5) Test of Hypothesis

Step 3: Descriptive Statistics



(3, 4, 5) Test of Hypothesis

Step 4: Calculate Test Statistic and Table Value

- Two data collections will be compared using the **t-test.**
- T-test examines two related data samples to find whether the data and population mean differ.
- Based on the X-mR Chart graph, my hypotheses is that the two samples will be relatively similar to each other.

(3, 4, 5) Test of Hypothesis

Step 4 (cont.): Calculate Test Statistic and Table Value

t-Test: Two-Sample Assuming Unequal Variances		
	Pre Data	*Post Data*
Mean	0.014583	0.012626263
Variance	8.62E-05	3.20041E-05
Observations	13	11
Hypothesized Mean Difference	0	
df	20	
t Stat	0.633713	= Ho
P(T<=t) one-tail	0.266725	= H1
t Critical one-tail	1.724718	
P(T<=t) two-tail	0.533449	
t Critical two-tail	2.085963	

(3, 4, 5) Test of Hypothesis

Step 5: Decision Making

t-Test: Two-Sample Assuming Unequal Variances		
	Pre Data	*Post Data*
Mean	0.014583	0.012626263
Variance	8.62E-05	3.20041E-05
Observations	13	11
Hypothesized Mean Difference	0	
df	20	
t Stat	0.633713	= Ho
P(T<=t) one-tail	0.266725	= H1
t Critical one-tail	1.724718	
P(T<=t) two-tail	0.533449	
t Critical two-tail	2.085963	

H1 < Ho , Reject Ho and Accept H1

Post Data is not significantly lower the Pre Data

(3, 4, 5) Test of Hypothesis Interpretation

- The t-test shows there is no significant difference in the pre and post times.
- Reflection on the post data results:
  - The process is new and there is a learning curve.
  - The Purchasing Tech position is recently vacant and Patient Care Assistants are having to do this job. They are not as efficient and there are different PCAs doing the job as needed instead of a dedicated Purchasing Tech.
- Next Steps:
  - Apply the learning curve theory to show what the results could be once there is a dedicated staff member hired.

(3, 4, 5) Learning Curve Theory

- As people gain experience in doing a task, the usually can do the task more quickly.
- The learning curve analytical tool is used to estimate the rate at which cumulative experience allows workers to do tasks faster.

$$T_n = T_1 (n^b)$$

Where:

T_n = time required to complete the nth task

r = learning rate percentage

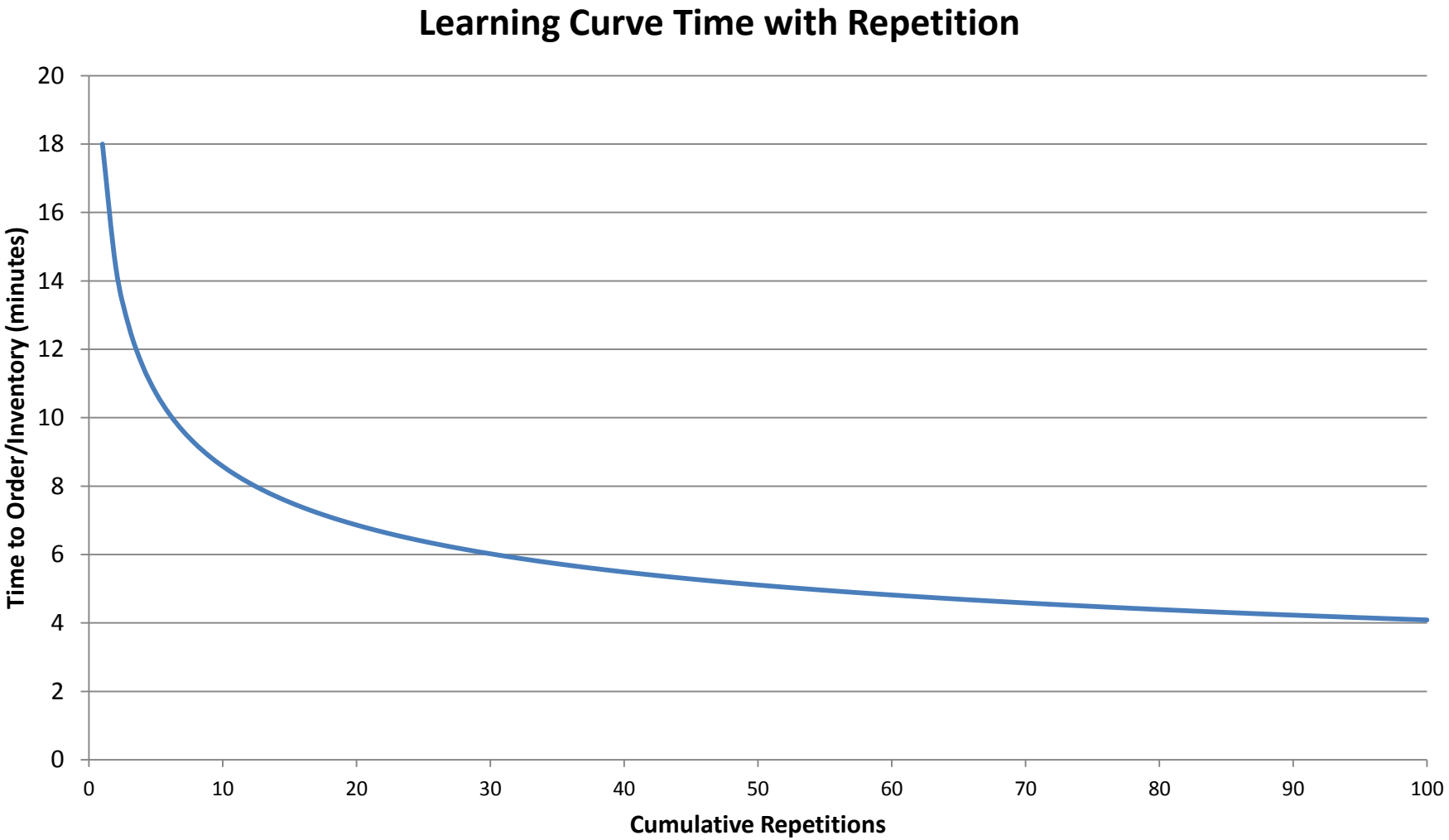
$b = \ln(r)/\ln(2)$

(3, 4, 5) Learning Curve Theory

- T_1 = 18 minutes r = 80% learning rate

n	Tn	n	Tn	n	Tn	n	Tn	n	Tn
1	18.00	**21**	6.75	**41**	5.44	**61**	4.79	**81**	4.37
2	14.40	**22**	6.65	**42**	5.40	**62**	4.77	**82**	4.36
3	12.64	**23**	6.56	**43**	5.36	**63**	4.74	**83**	4.34
4	11.52	**24**	6.47	**44**	5.32	**64**	4.72	**84**	4.32
5	10.72	**25**	6.38	**45**	5.28	**65**	4.69	**85**	4.31
6	10.11	**26**	6.30	**46**	5.25	**66**	4.67	**86**	4.29
7	9.62	**27**	6.23	**47**	5.21	**67**	4.65	**87**	4.27
8	9.21	**28**	6.16	**48**	5.18	**68**	4.63	**88**	4.26
9	8.87	**29**	6.09	**49**	5.14	**69**	4.60	**89**	4.24
10	8.58	**30**	6.02	**50**	5.11	**70**	4.58	**90**	4.23
11	8.32	**31**	5.96	**51**	5.07	**71**	4.56	**91**	4.21
12	8.09	**32**	5.90	**52**	5.04	**72**	4.54	**92**	4.20
13	7.88	**33**	5.84	**53**	5.01	**73**	4.52	**93**	4.18
14	7.70	**34**	5.78	**54**	4.98	**74**	4.50	**94**	4.17
15	7.53	**35**	5.73	**55**	4.95	**75**	4.48	**95**	4.15
16	7.37	**36**	5.68	**56**	4.92	**76**	4.46	**96**	4.14
17	7.23	**37**	5.63	**57**	4.90	**77**	4.44	**97**	4.13
18	7.10	**38**	5.58	**58**	4.87	**78**	4.43	**98**	4.11
19	6.97	**39**	5.53	**59**	4.84	**79**	4.41	**99**	4.10
20	6.86	**40**	5.49	**60**	4.82	**80**	4.39	**100**	4.09

(3, 4, 5) Learning Curve Theory



(3 , 4 , 5) Kanban Time and Cost

- Estimated labor savings with kanban system and process improvements

Inventory		Order		Stocking	
3	minutes average order/inventory	12	minutes average order/inventory	28	minutes average order/inventory
0.05	in hours	0.20	in hours	0.47	in hours
0.35	hours 7 occurrence a week	1.40	hours 7 occurrence a week	3.27	hours 7 occurrence a week
18.20	hours 52 weeks a year	72.80	hours 52 weeks a year	169.87	hours 52 weeks a year
163.8	hours 9 units in study	655.2	hours 9 units in study	1528.8	hours 9 units in study
Confidential		Confidential		Confidential	
$20,405	Process Improvement & 100% Receiving Clerk	$15,901	Process Improvement & 100% Receiving Clerk	$6,613	Process Improvement & 100% Receiving Clerk

$42,919 Yearly Labor Savings With Process Improvements!

Define | Measure | Analyze | Improve | Implement | Control

(6) Post Data Expired Supplies

- **Question 2:** Are all reconstituted drugs properly dated, timed, and stored, and have all discontinued, expired or deteriorated drugs and/or IV fluids been removed and returned to Pharmacy?

	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Sum	Projected Year
2E			1	1									**2**	6
2W													**0**	0
3E													**0**	0
3W				1									**1**	3
4E			1										**1**	3
4W				1									**1**	3
NICU 1													**0**	0
NICU 2			1										**1**	3
PICU	1			1									**2**	6
ER FT				1									**1**	3
ER Cen			1										**1**	3
ER UR													**0**	0
2nd Clinc													**0**	0
3rd Clinic													**0**	0

2nd Floor: From **2.25** occurrences/month to a projected **1.5** occurrences/month

(7) Post Data 5S Effectiveness

- **Question 1:** Are arrangements and neatness satisfactory; Is the designated Injection Prep area free of clutter?

	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Sum	Projected Year
2E													**0**	0
2W	1												**1**	3
3E													**0**	0
3W	1		1										**2**	6
4E		1	1	1									**3**	9
4W													**0**	0
NICU 1													**0**	0
NICU 2				1									**1**	3
PICU													**0**	0
ER FT													**0**	0
ER Cen			1	1									**2**	6
ER UR		1											**1**	3
2nd Clinc			1										**1**	3
3rd Clinic													**0**	0

2nd Floor: No change in projected Occurrences/Month

(8) Inventory Holding Value Totals

2nd East

- **Sum Overage Cost** = $6,724
- **Sum Current Value** = $11,740
- **Sum Future Value** = $5,945
- **Monthly Savings** = $5,795

2nd West

- **Sum Overage Cost** = $1,867
- **Sum Current Value** = $4,750
- **Sum Future Value** = $3,769
- **Monthly Savings** = $981

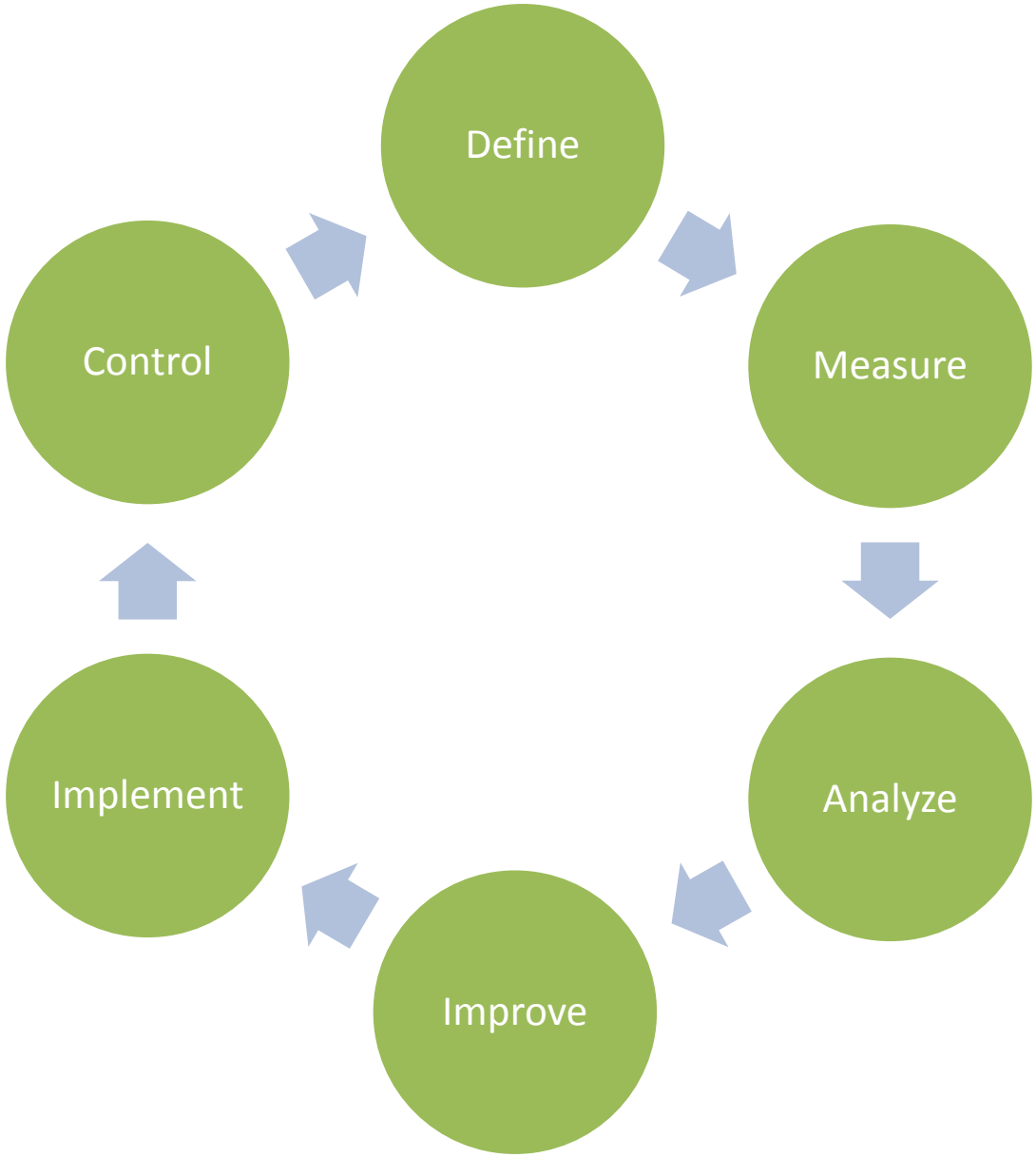
$89,903 Yearly Savings

41% Reduction!

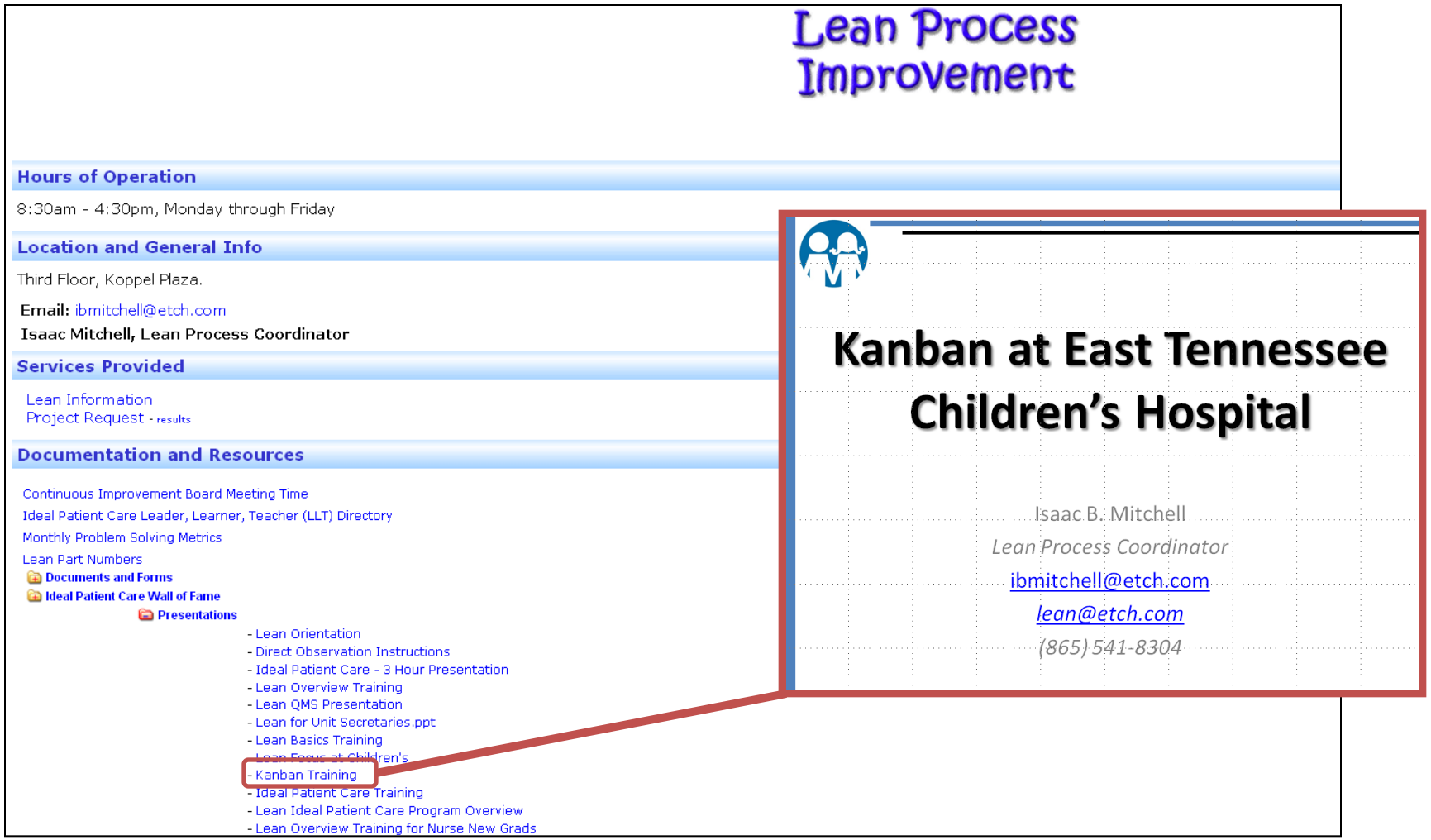
Implementation Next Steps

1. Expand kanban to remaining units
   i. ED & 3rd Floor – July 2014
   ii. PICU & NICU – September 2014
   iii. 2nd Clinic & 3rd Clinic – November 2014
   iv. IPS & OPS – January 2015
2. Transfer task responsibility to Receiving Clerk/Purchasing Tech in Materials Management
   a. FTE Transfer
3. Budget for e-Kanban Fiscal Year 2015/2016

Control



Staff Education of Change



Staff Education of Change

- Classroom Training

Kanban Card Audits

- Quarterly audits will be conducted on kanban cards
  - Kanban card count
  - Reorder point review
  - Par level review
- 2nd Floor First Audit
  - August 1, 2014

Part Number	Item Name	ReOrder Point	Type	Procurement	Loc	Kanban Par	Kanban Type
01501	ADDIPAK NORMAL SALINE	2	BX	Inside - 2 days	MR	4	BX
00158	APPLICATOR COTTON TIP	1	BX	Inside - 2 days	MR	1	BX
02620	ASPIRATOR NASAL BBG	1	CS	Outside - 8 days	MR	3	CS
RX	Bacitracin	1	RX	Inside - 2 days	MR	1	RX
11735	Bag Clear Qt Resealable	1	CS	Outside - 8 days	MR	1	CS
15384	Bag eme-bag, sic-sac bag	1	CS	Outside - 8 days	MR	1	CS
16604	BAG QUICK CLEAN MICRO STEAM	1	BG	Outside - 8 days	MR	7	BG
00821	BAG WHITE SMALL #4	1	EA	Inside - 2 days	MR	3	EA
00871	Ball Cotton Prep	1	BAG	Inside - 2 days	MR	1	BAG
10405	BANDAGE COFLEX MULTI	1	CS	Outside - 8 days	MR	2	CS
01708	BANDAID SNOOPY 3/4"	1	BX	Inside - 2 days	MR	1	BX
01683	BANDAID SPOT	1	BX	Inside - 2 days	MR	1	BX
00873	BASIN EMESIS 9" DISPOSABLE	7	EA	Inside - 2 days	MR	7	EA
01571	BLADE TONGUE JR ST	1	BX	Inside - 2 days	MR	1	BX
16119	BOTTLE 2.7 OZ SNAPIES	1	CS	Outside - 8 days	MR	1	CS
14674	CANNULA INFANT	1	CS	Outside - 8 days	MR	2	CS
01084	CANNULA NASAL ADULT	1	CS	Outside - 8 days	MR	2	CS
01856	CANNULA SALTER PED	1	CS	Outside - 8 days	MR	2	CS
04982	CAP RED	1	BX	Inside - 2 days	MR	3	BX
06066	CONNECTOR DISP FLUID	1	CS	Outside - 8 days	MR	2	CS
07645	CREAM PROSHIELD 6OZ	1	EA	Inside - 2 days	MR	1	EA
01376	CUP FOAM 12 OZ WHITE	27	PKG	Inside - 2 days	MR	27	PKG
00876	CUP GRADUATE	1	PK	Inside - 2 days	MR	1	PK
00885	CUP MEDICINE 1 OZ	1	SL	Inside - 2 days	MR	2	SL
09059	CUP SIPPY WITH LID 7OZ	1	CS	Outside - 8 days	MR	1	CS
01764	Cup Specimen Sterile 5OZ	1	CS	Inside - 2 days	MR	1	CS
16438	DISHWASHING LIQUID 30Z	1	CS	Outside - 8 days	MR	1	CS
04976	FILTER STRAW MICRON	1	CS	Inside - 2 days	MR	1	CS
01676	FOAM HAND SANITIZER ALCAR	1	EA	Inside - 2 days	MR	1	EA
03949	HUMIDIFIER 500ML W/AD	1	CS	Inside - 2 days	MR	1	CS
01458	LABEL MEDICATION ADDED	1	EA	Inside - 2 days	MR	1	EA
08541	LID F/12*24OZ CUP WHTE	2	CS	Inside - 2 days	MR	1	CS
10398	NEEDLE LL 18G X 1-1/2	1	BX	Inside - 2 days	MR	1	BX
10430	NEEDLE LS 27G X 1/2	1	BX	Inside - 2 days	MR	1	BX

Expired Items and 5S Occurrences

- Continue Pharmacy audits in each area for expired supplies and 5S effectiveness.

PHARMACY SERVICES INSPECTION # 1 **Department: 2E**

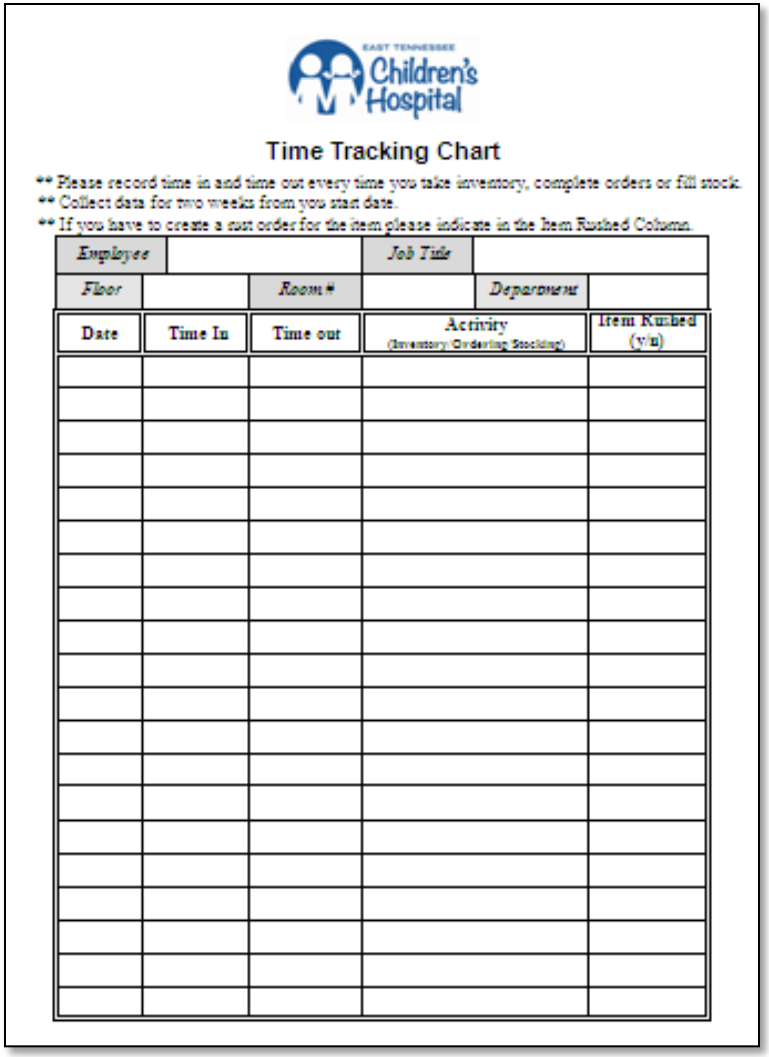
INSPECTED BY: Shenaiah Draper, CPhT Date/Time: 12/19/13 11:00

	FLOOR STOCK AND SUPPLIES	Yes	No
1	Are arrangements and neatness satisfactory; Is the designated Injection Prep area free of clutter?	X	
2	Are all reconstituted drugs properly dated, timed, and stored, and have all discontinued, expired or deteriorated drugs and/or IV fluids been removed and returned to Pharmacy?	X	
3	Is the amount of drugs stocked appropriate? Stock list, approved by Pharmacy and Nursing, with PAR levels and exp dates, is posted.	X	
4	Are there any patient's own prescriptions present not Identified by Pharmacy and approved for use?		X
5	Are internal drugs separated from external drugs?	X	
6	Are test agents, germicides, disinfectants, and other household substances separated from drugs?	X	
7	Is/are the floor stock cabinet(s) properly secured?	X	
8	Is/are the medication cart(s) locked if not in use?	X	
9	Are all other drugs secured if not in use?	X	
10	Are High Alert medications properly tagged and/or separated, and the list posted?	X	
11	Are Sound-alike/Look-alike medications separated and tagged, and the list posted?	X	
12	Are Central Supply kits present that contain medication in date?	X	
13	Are necessary drip charts accompanying Dopamine bags/vials, Dobutamine bags/vials, Nitroglycerine bags, and Epinephrine vials? (Remember NICU has specified Dopamine and Epinephrine charts)	X	

Mailed: (enter date)	1/3/2014
Returned: (enter date)	1/10/2014
Turn around:	7 days

Data Collection Sheets and X-mR Charts

- Collect two weeks of data on time spent ordering, inventory, and stock supplies bi-annually.
- Document on X-mR chart to validate process control.
- Next Data Collection:
  - 7/27/14 to 8/8/14



East Tennessee Children's Hospital

Time Tracking Chart

** Please record time in and time out every time you take inventory, complete orders or fill stock.
** Collect data for two weeks from you start date.
** If you have to create a rust order for the item please indicate in the Item Rushed Column.

Employee		Job Title			
Floor		Room #		Department	

Date	Time In	Time out	Activity (Inventory Ordering Stocking)	Item Rushed (y/n)

Business Results

- Reduction of the holding value of supplies on 2nd Floor by **$89,903** annually.
- Projected the labor cost reduction 2nd Floor of **$7,208** associated with the inventorying, ordering and stocking of theses supplies annually.
- If we see similar results in all nine areas we could see a potential savings of **$873,995** annually.
  - $809,127 in Supplies and $64,868 in Labor

Final Impact to the Business

Metric	Goal	Units	Baseline (2nd Floor)	Project Results (2nd Floor)	Baseline (House-wide)	Project Potentials (House-wide)
1. Time to inventory	1 minute	Minutes per room	17 mins	4 mins. 76% Reduction	17 minutes	3 minutes 82% Reduction
2. Cost to inventory	Confidential	$USD per hour	Confidential			
				91% Reduction		89% Reduction
3. Time to order supplies	10% reduction	Minutes per order	19 minutes	No Data	19 minutes	12 minutes 37% Reduction
4. Cost to order supplies	Confidential	$USD per hour	Confidential			
				61% Reduction (Labor Savings Only)		62% Reduction
5. Time to stock supplies	10% reduction	Minutes per department	31 minutes	No Data	31 minutes	28 minutes 10% Reduction
6. Cost to stock supplies	Confidential	$USD per hour	Confidential			
				37% Reduction (Labor Savings Only)		23% Reduction
7. Expired Supplies	50% reduction	Occurrences of Expired Supplies	9 Occurrences	6 Occurrence 33% Reduction	33	11 Occurrence 33% Reduction
8. Inventory Level	25% reduction	Total value of supplies in nine department annually	$197,880	$107,911 41% Reduction	$3,254,900	$2,445,773 25% Reduction

Conclusion

- $873,995 combined savings in labor, materials, and holding cost.
- Reduction of expired supplies from 2.25 occurrences/month to a 1.5 occurrences/month.
- Develop one best method for ordering which results in six fewer process steps and chances for error.
- Transfer of inventorying, ordering, and stocking responsibility to the right job code to free up nursing time to take ideal care of patients.

Contact

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