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Supply Chain Management at the National Naval Medical Center Pharmacy

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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

EMBA PROJECT REPORT

**Supply Chain Management at the
National Naval Medical Center Pharmacy**

Prepared for: CDR Thinh Ha, NNMC Pharmacy Department Head

2 September 2010

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EXECUTIVE SUMMARY

Supply Chain Management at the National Naval Medical Center Pharmacy

The National Naval Medical Center (NNMC) in Bethesda, Maryland is the U.S. Navy's flagship of medical centers and is the Navy's third-largest medical center.¹ NNMC provides medical services to approximately 46,000 patients annually,² and its pharmacy has an annual budget of \$46M for drugs dispensed to NNMC patients.³ This consulting project, completed with the support of the NNMC Pharmacy Department Head and facilitated through the Naval Postgraduate School Executive MBA Program, applied operations management and supply chain management principles to the processes used by the NNMC pharmacy to find potential efficiency improvements.

Specifically, the consultant team evaluated drug purchasing data from the Defense Medical Logistics Supply System (DMLSS) and dispensing data from the Composite Healthcare System (CHCS) for specific high-cost and high-volume drugs to identify optimal inventory levels and order points. The NNMC Pharmacy Staff selected the following six drugs for analysis:

- Arimedex (anastrozole) – a breast cancer prevention drug.
- Intelence (extravirine) – an HIV treatment drug.
- Procrit (epoetin alfa) – an anemia treatment drug.
- Seroquel (quetiapine) – depressive disorder (bipolar & schizophrenia) treatment drug.
- Topamax (topiramate) – an anti-seizure/epilepsy medication.
- Vfend (voriconazole) – fungus and yeast infection treatment drug.

¹ NNMC Public Affairs Document “National Naval Medical Center at a Glance,” www.bethesda.med.navy.mil

² Ibid.

³ Personal Interview with LT Bradley Gotto, 29 July 2010

After analyzing historical ordering and dispensing data for these drugs and touring the NNMC drug storage facilities, the consultant team's primary recommendation is that NNMC pharmacy should adjust re-order points, re-order quantities, and safety stock for the subject drugs to reduce high levels of inventory and unnecessary safety stock. Since the NNMC pharmacy can obtain drugs at low cost with minimal (1 day) lead time, NNMC can reduce the average inventory of these drugs and shift the burden of inventory management to the drug suppliers. This has potential to simplify the restocking process at the NNMC pharmacy and reduce the manpower required to fill new orders. Other secondary recommendations to improve the NNMC Pharmacy operations include:

- Perform a full inventory of drugs held at the NNMC Pharmacy to develop a full accounting of all drugs on hand.
- Expand analysis to determine required safety stock for other drugs.
- Promote adoption of a consolidated system to replace DMLSS and CHCS to coordinate ordering and dispensing operations.

ACKNOWLEDGEMENTS

CDR Think Ha

LCDR Benjamin Schwartz

LT Bradley Gotto

Brian Harvey

The consultant team greatly appreciates the time and effort dedicated to our research by our interviewees and the pharmacy staff at NNMC. Their expertise and patience were critical to our team's ability to perform an outside assessment of the NNMC Pharmacy ordering system and was vital in helping us identify potential process improvements.

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I. INTRODUCTION AND BACKGROUND

A. INTRODUCTION

In a recent speech, Defense Secretary Robert Gates stated that “health-care costs are eating the Defense Department alive.”⁴ The Defense Department is actively pursuing ways to cut health care costs across the board. Although the Pharmacy at the National Naval Medical Center (NNMC) in Bethesda, Maryland makes up only about 10% of the total NNMC budget,⁵ even moderate cost savings at the pharmacy could be helpful to NNMC, the Navy, and the Defense Department as a whole.

In this project, the consultant team evaluated the processes used by the NNMC Pharmacy in procuring, storing, and dispensing drugs to find potential efficiency improvements. The consultant team applied operations management and supply chain management principles to attempt to reduce overall pharmacy costs by optimizing inventory levels of specific drugs.

B. BACKGROUND

The National Naval Medical Center (NNMC) in Bethesda, Maryland is the U.S. Navy’s flagship of medical centers and is the Navy’s third-largest medical center.⁶ NNMC provides medical services to approximately 46,000 patients annually,⁷ and its pharmacy has an annual budget of \$46M for drugs dispensed to NNMC patients.⁸ The majority of planning and budgeting for the pharmacy is based upon historical demand with limited application of formal forecasting models or statistical analysis; therefore, there may be potential for savings by applying supply chain management strategies to the procurement, storage, and dispensing of drugs at NNMC.

⁴ Robert Gates Speech at Eisenhower Library in Abilene Kansas 8 May 2010, www.defense.gov/speeches/speech.aspx?speechid=1467

⁵ Personal Interview with LT Bradley Gotto, 29 July 2010

⁶ NNMC Public Affairs Document “National Naval Medical Center at a Glance,” www.bethesda.med.navy.mil

⁷ Ibid.

⁸ Personal Interview with LT Bradley Gotto, 29 July 2010

C. PROJECT OBJECTIVES

This project's goal was to analyze the ordering and dispensing data for six highly utilized or high cost drugs at NNMC, determine if a more effective process for ordering and storing the drugs exists, and recommend any applicable process improvements to the NNMC Pharmacy Staff.

D. PROJECT SCOPE

The project scope was limited to six drugs identified by the NNMC Pharmacy Staff as being expensive on a per-pill basis, highly utilized, or both. Although the scope of the analysis is limited to these drugs, there is the potential to apply best practices to other drugs in the system as well. The NNMC Pharmacy Staff suggested study of the following drugs:

- Arimedex (anastrozole) – a breast cancer prevention drug.
- Intelence (extravirine) – an HIV treatment drug.
- Procrit (epoetin alfa) – an anemia treatment drug.
- Seroquel (quetiapine) – depressive disorder (bipolar & schizophrenia) treatment drug.
- Topamax (topiramate) – an anti-seizure/epilepsy medication.
- Vfend (voriconazole) – fungus and yeast infection treatment drug.

This analysis was not intended as a critique of the NNMC Pharmacy's current processes; the analysis represents recommendations only designed to inform the command about potential process improvements. Additionally, due to intricacies of the Navy funding cycle, there are certain end-of-year and mid-year drug purchases that may skew data analysis. For that reason, these mid-year and end-of-year purchases were not taken into account when attempting to quantify potential cost savings. The analysis was limited to inventory control analyses and did not involve queuing theory or other operations management areas.

E. METHODOLOGY

1. Conduct Interviews with NNMC Pharmacy Staff

The Consultant Team met with the NNMC Pharmacy Department Head, CDR Think Ha and two of his staff pharmacists, LT Bradley Gotto and LCDR Benjamin Schwartz to discuss the NNMC Pharmacy process and tour the NNMC pharmaceutical storage facility.

2. Collect historical Data on Drug Ordering and Dispensing Data

Data was requested on the target drugs, and NNMC Pharmacy Staff provided the data in spreadsheets so that it could be analyzed for trends in ordering and stock levels. Ordering information for each drug was provided from the Defense Medical Logistics Standard Support System (DMLSS) and demand (or dispensing) information was supplied from the Composite Health Care System (CHCS). Pharmacy Supply Petty Officers order and receive drugs in DMLSS. Doctors write prescriptions in CHCS which are filled by the command pharmacists. These two systems are not interconnected and do not share data.

3. Evaluate Stock Levels and Ordering Points

The ordering and dispensing data were compared to see how much stock was carried for each drug. The stock levels were evaluated to determine whether the stock could be reduced without undue risk of stock out (i.e., running out of a given drug).

4. Identify Alternative Order Points and Compare to Existing Process for Potential Savings

NNMC and vendor policies were evaluated to determine whether making more frequent orders of smaller drug quantities could save money relative to the existing order timing and quantities. This method of drug buying would reduce the required inventory carried at NNMC by allowing for more frequent, smaller orders to cover the demand with a much smaller safety stock than is currently carried.

5. Provide Recommendations Based on the Most Cost Effective Process

If cost savings can be realized, we recommend a trial period for reducing inventory levels to recommended re-order points and re-order quantities based upon this report's findings. We also recommend further studies be conducted on other drugs in the NNMC pharmacy to see what additional cost savings can be realized with optimal re-order points and re-order quantities based upon set service levels.

II. ASSUMPTIONS AND RESULTS

A. ASSUMPTIONS

The vendor's contract states that there is a one day turnaround for orders. Based on our interview with the NNMC staff and their comments about past vendor performance, our study factored in some variability in lead time. It was assumed that deliveries require one day 75% of the time, two days 10% of the time, three days 10% of the time, and 5% of the orders require up to 7 days to fill which sometimes requires finding a secondary vendor. Lead time demand variability was calculated based on historical data.

B. RESULTS

Using the DMLSS and CHCS data provided by NNMC, profiles for each of the subject drugs were created. These profiles show the Service Levels, re-ordering frequency, and costs associated with current inventory policy. The Service Level is a measure of how much risk exists that a particular drug will "stock out" (not be available) during any individual inventory cycle. Higher service levels indicate a lower risk of stock out, but require more inventory to sit on the shelf. This inventory, called safety stock, compensates for variability in demand while waiting to receive replenishment stock and for variability in the time it takes to receive the replenishment stock (lead time).⁹ Options that can be utilized to increase Service Level, reduce costs, or adjust re-ordering frequency are also presented.

1. Arimidex (generic Anastrozole)

Figure 1a shows that the NNMC currently maintains an inventory of Arimidex that approximates the 99.99% Service Level. On average, the NNMC places an order for Arimidex every 11 days.

⁹ Simchi-Levi, E; Kaminsky, P; and Simchi-Levi, E. (2008) Designing and Managing the Supply Chain. McGraw Hill/Irwin, LLC. p. 42-43.

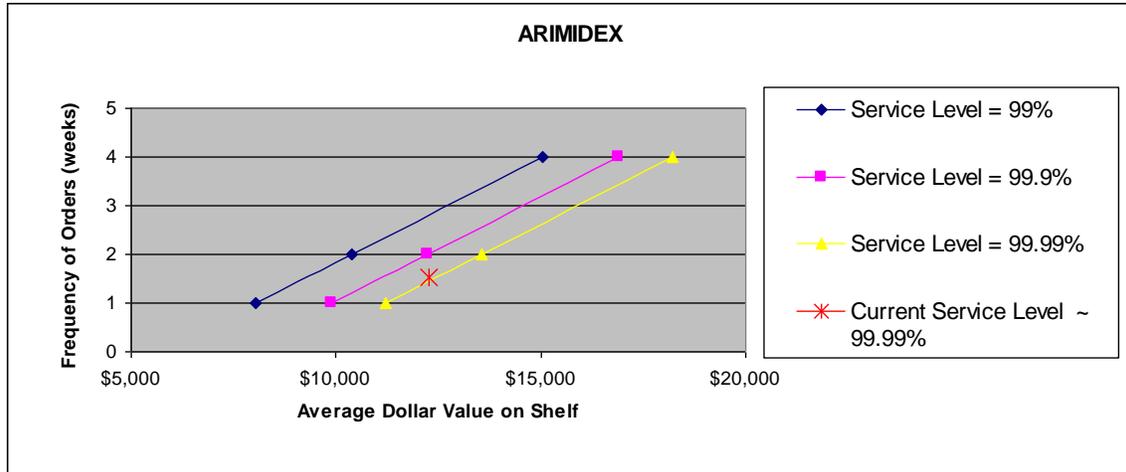


Figure 1a

Figure 1b shows the cost to maintain this Service Level is an average of \$12,258 worth of inventory on the shelf. This figure can also be used to select an alternate Service Level and approximate re-ordering interval to realize cost savings or manpower savings. For example, selecting a Service Level of 99% and an order interval of 2 weeks would result in a yearly savings of \$1,878 and require fewer orders to be placed and fewer deliveries to be handled.

ARIMIDEX				
Current Service Level =	~99.99%			
Avg \$ value on shelf =	\$12,258			
Avg order interval (weeks) =	1.5			
	Approximate order interval			
	1 week	2 weeks	4 weeks	
Service Level = 99%	\$ 8,052.76	\$ 10,380.68	\$ 15,036.52	Avg \$ value on shelves
Service Level = 99.9%	\$ 9,895.52	\$ 12,223.44	\$ 16,879.28	
Service Level = 99.99%	\$ 11,222.31	\$ 13,550.23	\$ 18,206.07	

Figure 1b

Figure 1c shows the re-order points, re-order quantities, and required safety stock associated with the given Service Levels and approximate ordering intervals.

ARIMIDEX				
	Re-Order Point / Re-Order Quantity			
	1 week	2 weeks	4 weeks	
Service Level = 99%	41 / 28	41 / 56	41 / 112	34.4
Service Level = 99.9%	52 / 28	52 / 56	52 / 112	45.5
Service Level = 99.99%	60 / 28	60 / 56	60 / 112	53.5

Figure 1c

2. Intelence (extravirine)

Figure 2a shows that the NNMC currently maintains an inventory of Intelence that approximates the 99.99% Service Level. On average, the NNMC places an order for Intelence every 33 days.

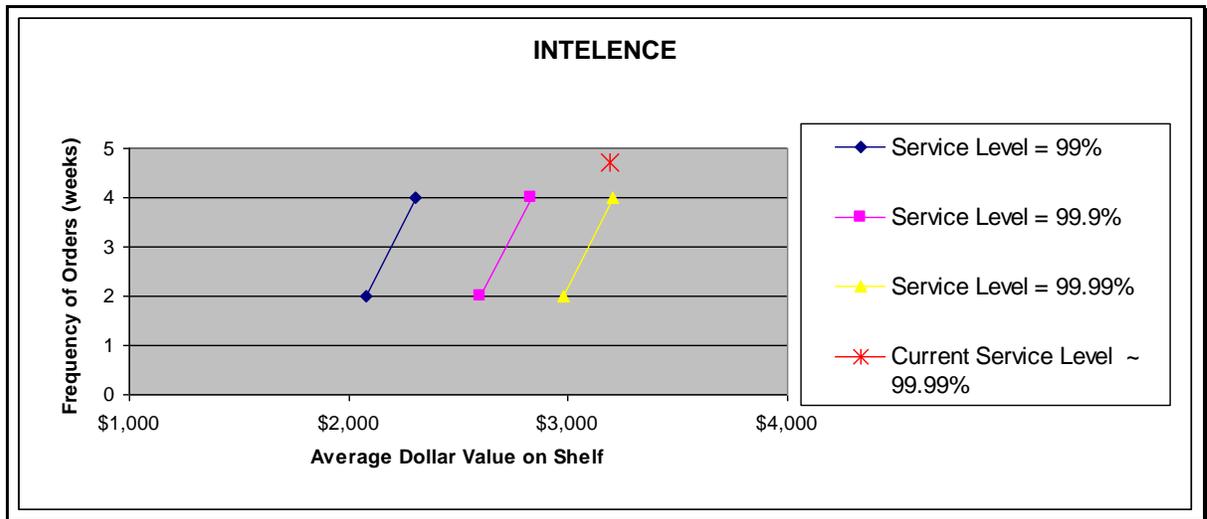


Figure 2a

Figure 2b shows the cost to maintain this Service Level is an average of \$3,189 worth of inventory on the shelf. This figure can also be used to select an alternate Service Level and approximate re-ordering interval to realize cost savings or manpower savings. For example, selecting a Service Level of 99% and an order interval of 2 weeks would result in a yearly savings of \$1,110. Due to the large quantity (120) of Intelence per unit of order and relatively low demand, it does not make sense to order Intelence more frequently than every two weeks.

INTELENCE		
Current Service Level =	~99.99%	
Avg \$ value on shelf =	\$3,189	
Avg order interval (weeks) =	4.7	
	Approximate order interval	
	2 weeks	4 weeks
Service Level = 99%	\$ 2,078.51	\$ 2,307.03
Service Level = 99.9%	\$ 2,600.44	\$ 2,828.96
Service Level = 99.99%	\$ 2,976.22	\$ 3,204.75

Avg \$ value on shelves

Figure 2b

Figure 2c shows the re-order points, re-order quantities, and required safety stock associated with the given Service Levels and approximate ordering intervals.

INTELENCE	Re-Order Point / Re-Order Quantity		Required Safety Stock
	2 weeks	4 weeks	
Service Level = 99%	4 / 2	4 / 3	3.5
Service Level = 99.9%	5 / 2	5 / 3	4.7
Service Level = 99.99%	6 / 2	6 / 3	5.5

Figure 2c

3. Procrit (epoetin alfa)

Figure 3a shows that the NNMC currently maintains an inventory of Procrit that approximates the 99.99% Service Level. On average, the NNMC places an order for Procrit every 41 days.

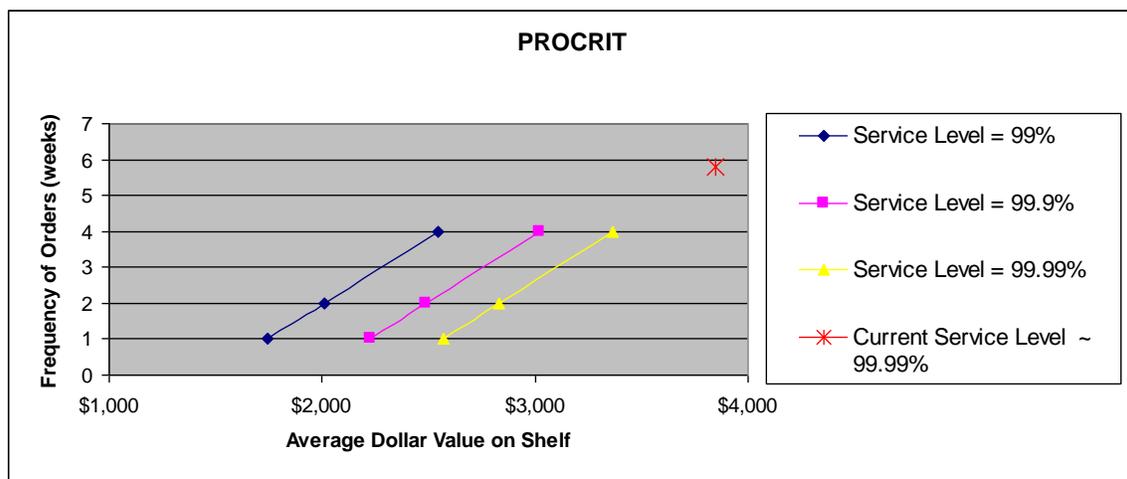


Figure 3a

Figure 3b shows the cost to maintain this Service Level is an average of \$3,847 worth of inventory on the shelf. This figure can also be used to select an alternate Service Level and approximate re-ordering interval to realize cost savings or manpower savings. For example, selecting a Service Level of 99% and an order interval of 2 weeks would result in a yearly savings of \$1,835.

PROCRIT			
Current Service Level =	~99.99%		
Avg \$ value on shelf =	\$3,847		
Avg order interval (weeks) =	5.8		
	Approximate order interval		
	1 week	2 weeks	4 weeks
Service Level = 99%	\$ 1,746.66	\$ 2,011.88	\$ 2,542.32
Service Level = 99.9%	\$ 2,223.52	\$ 2,488.74	\$ 3,019.18
Service Level = 99.99%	\$ 2,566.86	\$ 2,832.08	\$ 3,362.52

Avg \$ value on shelves

Figure 3b

Figure 3c shows the re-order points, re-order quantities, and required safety stock associated with the given Service Levels and approximate ordering intervals.

PROCRIT			
	Re-Order Point / Re-Order Quantity		
	1 week	2 weeks	4 weeks
Service Level = 99%	3 / 1	3 / 2	3 / 4
Service Level = 99.9%	4 / 1	4 / 2	4 / 4
Service Level = 99.99%	5 / 1	5 / 2	5 / 4

2.8
3.7
4.3

Required Safety Stock

Figure 3c

4. Seroquel (quetiapine)

Figure 4a shows that the NNMC currently maintains an inventory of Seroquel that approximates the 99% Service Level. On average, the NNMC places an order for Seroquel every 41 days.

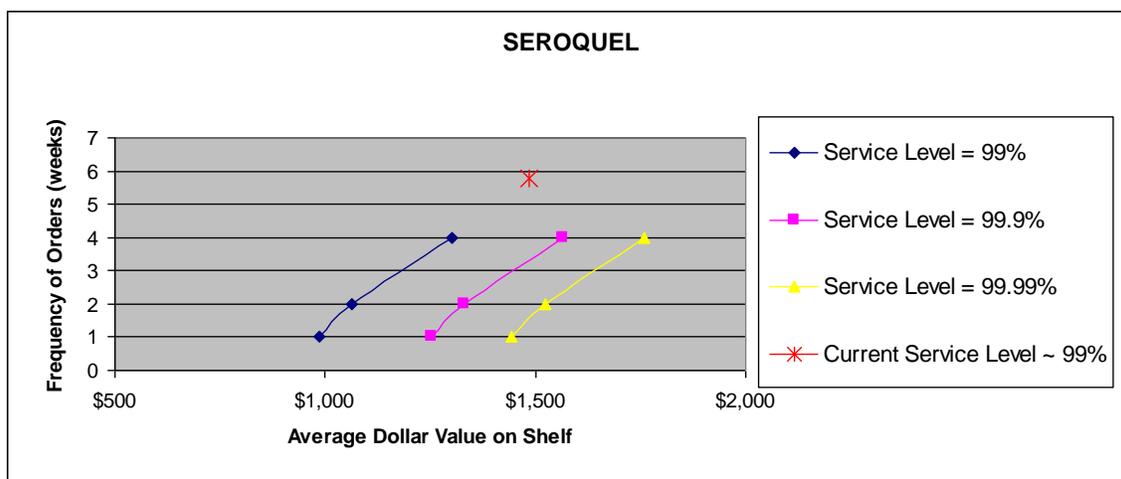


Figure 4a

Figure 4b shows the cost to maintain this Service Level is an average of \$1,485 worth of inventory on the shelf. This figure can also be used to select an alternate Service Level and approximate re-ordering interval to realize cost savings or manpower savings. For example, reducing the order interval to 2 weeks would result in a yearly savings of \$421.

SEROQUEL			
Current Service Level =	~99%		
Avg \$ value on shelf =	\$1,485		
Avg order interval (weeks) =	5.8		
	Approximate order interval		
	1 week	2 weeks	4 weeks
Service Level = 99%	\$ 985.39	\$ 1,064.18	\$ 1,300.53
Service Level = 99.9%	\$ 1,251.86	\$ 1,330.65	\$ 1,567.00
Service Level = 99.99%	\$ 1,443.72	\$ 1,522.50	\$ 1,758.86

Avg \$ value on shelves

Figure 4b

Figure 4c shows the re-order points, re-order quantities, and required safety stock associated with the given Service Levels and approximate ordering intervals.

SEROQUEL			
	Re-Order Point / Re-Order Quantity		
	1 week	2 weeks	4 weeks
Service Level = 99%	6 / 2	6 / 3	6 / 6
Service Level = 99.9%	8 / 2	8 / 3	8 / 6
Service Level = 99.99%	9 / 2	9 / 3	9 / 6

5.3
6.9
8.2
Required Safety Stock

Figure 4c

5. Topamax (Topiramate)

Figure 5a shows that the NNMC currently maintains an inventory of Topamax that approximates the 84% Service Level. On average, the NNMC places an order for Topamax every 14 days.

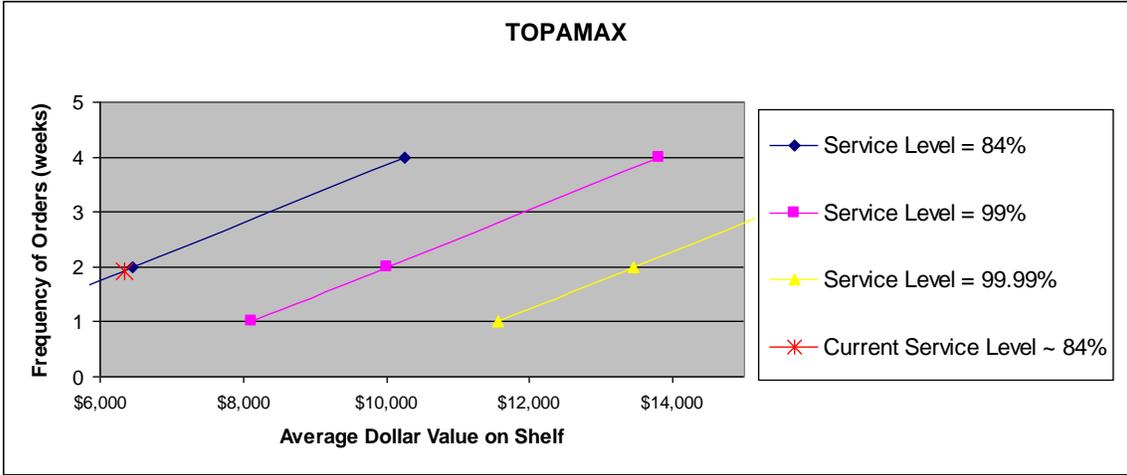


Figure 5a

Figure 5b shows the cost to maintain this Service Level is an average of \$6,338 worth of inventory on the shelf. This figure can also be used to select an alternate Service Level and approximate re-ordering interval to realize cost savings or manpower savings. For example, to increase the Service Level to 99% with an order interval of 2 weeks would cost an extra \$3,675 per year.

TOPAMAX			
Current Service Level =	~84%		
Avg \$ value on shelf =	\$6,338		
Avg order interval (weeks) =	1.9		
	Approximate order interval		
	1 week	2 weeks	4 weeks
Service Level = 84%	\$ 4,565.96	\$ 6,461.40	\$ 10,252.28
Service Level = 99%	\$ 8,117.76	\$ 10,013.20	\$ 13,804.08
Service Level = 99.99%	\$ 11,562.74	\$ 13,458.18	\$ 17,249.06

Avg \$ value on shelves

Figure 5b

Figure 5c shows the re-order points, re-order quantities, and required safety stock associated with the given Service Levels and approximate ordering intervals.

TOPAMAX			
	Re-Order Point / Re-Order Quantity		
	1 week	2 weeks	4 weeks
Service Level = 84%	18 / 19	18 / 38	18 / 76
Service Level = 99%	36 / 19	36 / 38	36 / 76
Service Level = 99.99%	53 / 19	53 / 38	53 / 76

13.4
31.2
48.5
Required Safety Stock

Figure 5c

6. Vfend (voriconazole)

Figure 6a shows that the NNMC currently maintains an inventory of Vfend that approximates the 96% Service Level. On average, the NNMC places an order for Vfend every 14 days.

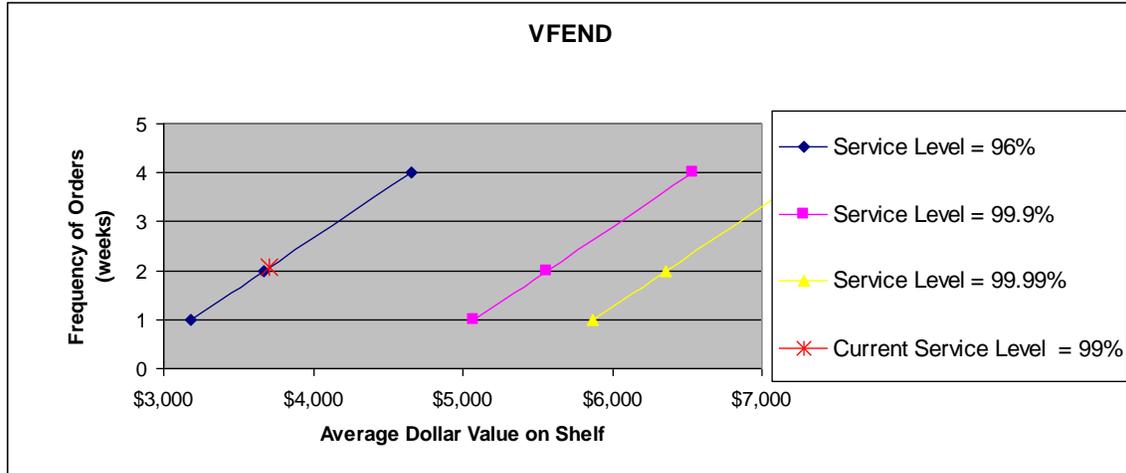


Figure 6a

Figure 6b shows the cost to maintain this Service Level is an average of \$3,704 worth of inventory on the shelf. This figure can also be used to select an alternate Service Level and approximate re-ordering interval to realize cost savings or manpower savings. Switching to a one week ordering interval would save approximately \$522 per year, but may not be worth the additional manpower burden.

VFEND			
Current Service Level =	~96%		
Avg \$ value on shelf =	\$3,704		
Avg order interval (weeks) =	2.1		
	Approximate order interval		
	1 week	2 weeks	4 weeks
Service Level = 96%	\$ 3,182.42	\$ 3,672.49	\$ 4,652.63
Service Level = 99.9%	\$ 5,072.08	\$ 5,562.15	\$ 6,542.29
Service Level = 99.99%	\$ 5,869.28	\$ 6,359.35	\$ 7,339.49

Avg \$ value on shelves

Figure 6b

Figure 6c shows the re-order points, re-order quantities, and required safety stock associated with the given Service Levels and approximate ordering intervals.

VFEND	Re-Order Point / Re-Order Quantity			
	1 week	2 weeks	4 weeks	
Service Level = 96%	42 / 15	42 / 29	42 / 57	38.0
Service Level = 99.9%	69 / 15	69 / 29	69 / 57	64.9
Service Level = 99.99%	80 / 15	80 / 29	80 / 57	76.3

Required
Safety Stock

Figure 6c

As illustrated by the preceding figures, each drug has trade-offs that could be made by NNMC to either reduce manpower requirements or reduce yearly inventory costs. In general, higher service levels and larger order intervals cost more, while lower service levels and shorter order intervals cost less. Manpower requirements were not quantified in this study.

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III. CONCLUSION AND RECOMMENDATIONS

A. CONCLUSION

The primary goal of the NNMC is to attain as close to a 100% service level as possible for all drugs that it dispenses. This is understandable because without the drugs required for treatment, doctors are unable to adequately care for service members, veterans and their dependents. This faultless service level, however, comes at a price, as each incremental increase in service level requires a larger incremental increase in safety stock. Safety stock is inventory beyond that required to fill average demand during the average lead time required to replenish the inventory. Safety stock is required to offset variability caused by a possible surge in demand for a drug while waiting to receive it from the vendor, and the possibility that the vendor takes longer than promised to deliver the drug.

The near 100% Service Level goal is also becoming more difficult to achieve as the number of patients increase, the cost of drugs increase, and budgets are projected to decrease. Further complicating the issue is the lack of a single automated system to manage the ordering, inventory control, dispensing, and re-stocking of drugs. This increases manpower requirements and introduces human error into the process.

Our analysis shows that for some of our sample drugs, the NNMC currently carries inventory near that required to maintain a 99.99% service level. This means that for each inventory cycle, there is approximately a .01% chance that a particular drug will be unavailable (stock out) when a patient requests it. This probability is not cumulative and does not mean that a stock out must happen .01% of the time at a 99.99% Service Level. The cost associated with achieving this high service level is reflected in additional inventory sitting on the shelf.

Excess inventory should be avoided whenever possible. It results in unnecessary expenditures of dollars that could be used more effectively elsewhere in the pharmacy and/or the command. Additionally, excess inventory may result in inventory being lost in the warehouse and/or expired. Although expired drugs can be returned for credit with the vendor, this comes at a significant loss (staff estimates this at approximately 70% of original value). There is a process to extend expirations through the DoD shelf life extension

program (SLEP), but this is a lengthy and cumbersome process which is normally avoided by the pharmacy staff¹⁰.

The analysis also shows that for some of the drugs, the NNMC is currently operating at or below the 99% service level. This is acceptable if the NNMC is willing to accept an increased chance that these drugs may stock out during any inventory cycle. In these cases, the pharmacy could potentially increase the service level and still save money by ordering these drugs more frequently in smaller quantities. The effect on the supply staff's workload would need to be factored into this decision as well.

B. LIMITATIONS

A limitation realized in the beginning of this project was the number of drugs that could be analyzed in the limited time to complete this report. Also, as noted by the NNMC pharmacy staff, is the fact that CHCS and DMLSS data systems do not share data. A comparison of CHCS data and DMLSS data show that the two systems do not agree on the number of drugs that have been dispensed. As it exists now, drugs that are not picked up by patients are returned to inventory but might not be re-entered into the CHCS system (staff estimate this at 10% of all drugs dispensed). Additionally, the pharmacy inventory in DMLSS is managed by the supply PO's based upon their periodic visual inspections. Orders are based upon these visual inspections and not directly tied to the dispensing system (CHCS). The current system of inventory management is not standardized and increases opportunities for errors. A flow chart of the current process is provided in Appendix A. Acquiring a single system that performs all of the required functions to manage the pharmacy operations would increase efficiency and reduce the workload of the pharmacy staff.

The inefficiencies described above introduced anomalies in the data used for this analysis. For example, the data for Topamax, an anti-seizure medication that should have stable demand, has a month where demand exceeds 500 units and other months where demand is zero. For that reason, the numerical results presented in this report are approximate.

¹⁰ Interview with Pharmacy staff dated 27 July 2010

The calculated Service Level probabilities are based on the inventory policy alone and do not take into account events beyond the NNMC's control. Events such as a nationwide shortage of a drug due to a production problem or a nationwide recall may have an effect on the NNMC regardless of the Service Level policy in use.

C. RECOMMENDATIONS

It is recommended NNMC Pharmacy staff utilize the figures provided in this report to adjust re-order points, re-order quantities, and safety stock for the subject drugs to reduce high levels of inventory and unnecessary safety stock. The Pharmacy staff will have to set these levels based upon their desired Service Level and manpower availability. The team recommends that NNMC resupply pharmaceuticals on a periodic basis (e.g., weekly or monthly). The periodicity will need to balance manpower required for ordering and shelving, which will drive a less frequent ordering schedule, with the inventory costs for a particular service level, which will drive a more frequent ordering schedule. To reduce excess inventory and improve efficiencies, the team also recommends that order quantities be set to only replenish the volume that was actually dispensed during the previous ordering cycle. This will potentially reduce the manpower needed to determine the actual inventory in stock on a continuous basis. Due to the limitations in the dispensing data discussed above, the NNMC staff will need to conduct a regular inventory (e.g., annual) of each drug.

Further, we recommend that NNMC apply this analysis to all of their drugs to identify areas of cost-savings / risk so that appropriate action can be taken. If possible, we recommend the command accomplish a full inventory to ascertain exactly what they currently have on hand in their system. Overall, NNMC is performing admirably within the constraints of their systems. By implementing the recommendations noted above, the pharmacy could reduce unnecessary storage space and streamline the management of their inventory.

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LIST OF REFERENCES

- NNMC Public Affairs Document “National Naval Medical Center at a Glance,”
www.bethesda.med.navy.mil
- Personal Interview with LT Bradley Gotto, 29 July 2010
- Robert Gates Speech at Eisenhower Library in Abilene Kansas 8 May 2010,
www.defense.gov/speeches/speech.aspx?speechid=1467
- Simchi-Levi, E; Kaminsky, P; and Simchi-Levi, E. (2008) Designing and Managing the Supply Chain. McGraw Hill/Irwin, LLC.

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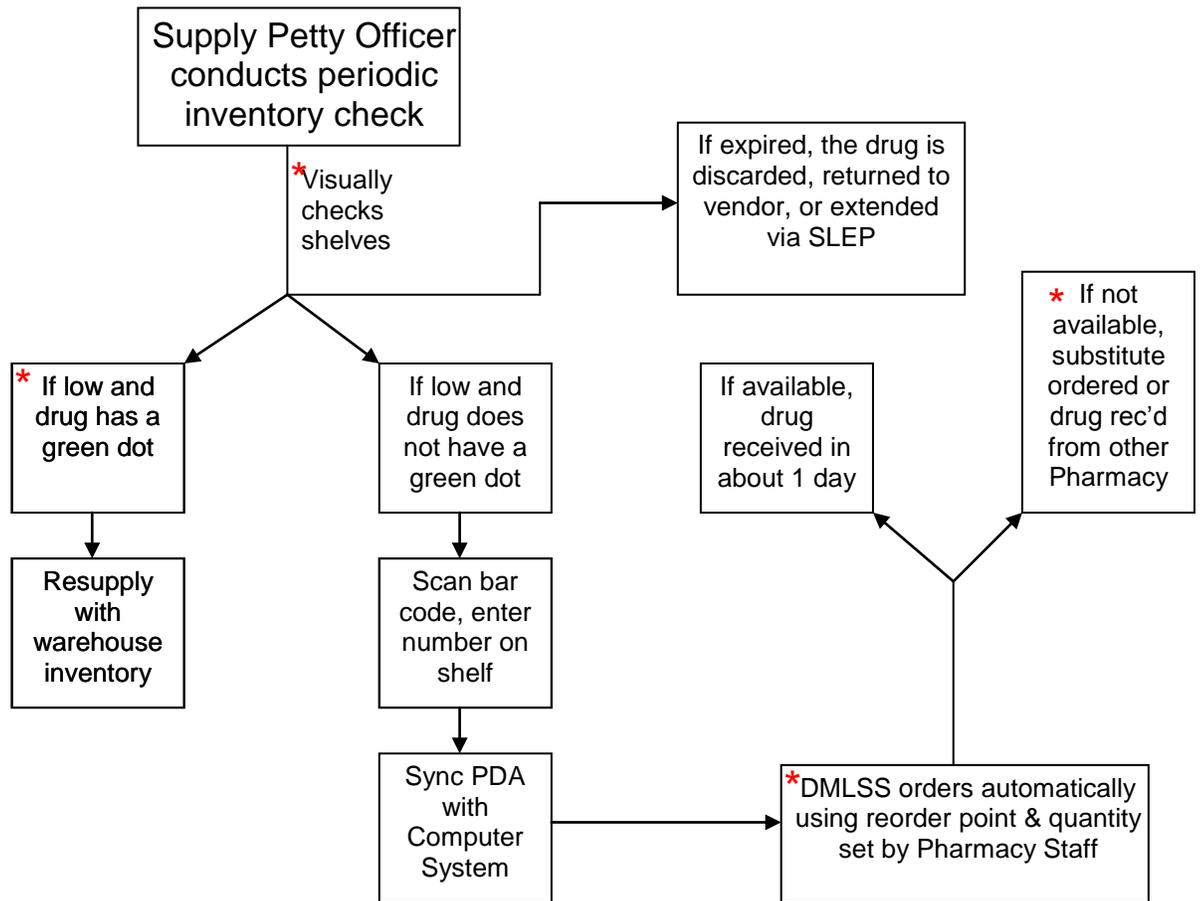
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APPENDIX A

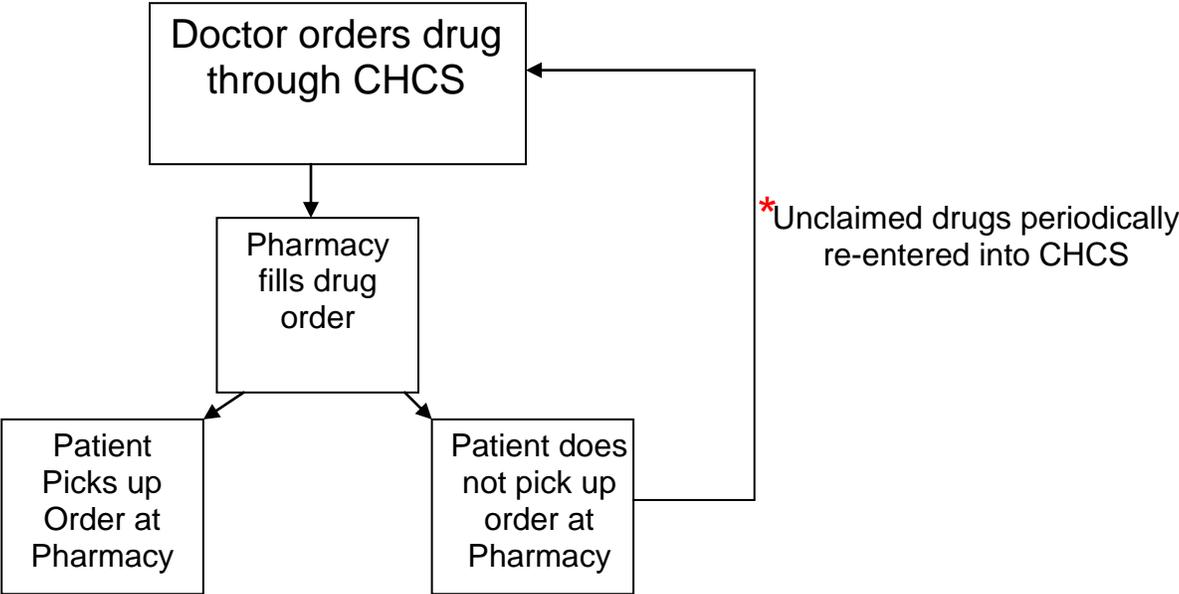
NNMC Pharmacy Flow Chart

Ordering Process for an Individual Drug



* Indicates process steps that the Consultant Team believes could be improved

Dispensing Process for an Individual Drug



* Indicates process steps that the Consultant Team believes could be improved