NUS National University of Singapore

Streamlining of Hospital Pharmacy Supply Chain System

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Project Overview

The hospital pharmacy supply chain consists of 3 main players: suppliers, main store and sections. The pharmacy store holds inventory for more than 2000 items. These items are supplied to 140 distribution points including the various pharmacy sections, Omni-cells and patient care locations, like ward shelves and day surgery sections.

Problem Definition

- High ad-hoc and back order rates
- Space constraints in pharmacy main store and sections
- Manual and labour intensive processes

Objectives

- Reduce back order and ad-hoc rates at main store, subjected to current space constraints at all locations
- Automation of distribution amount calculations

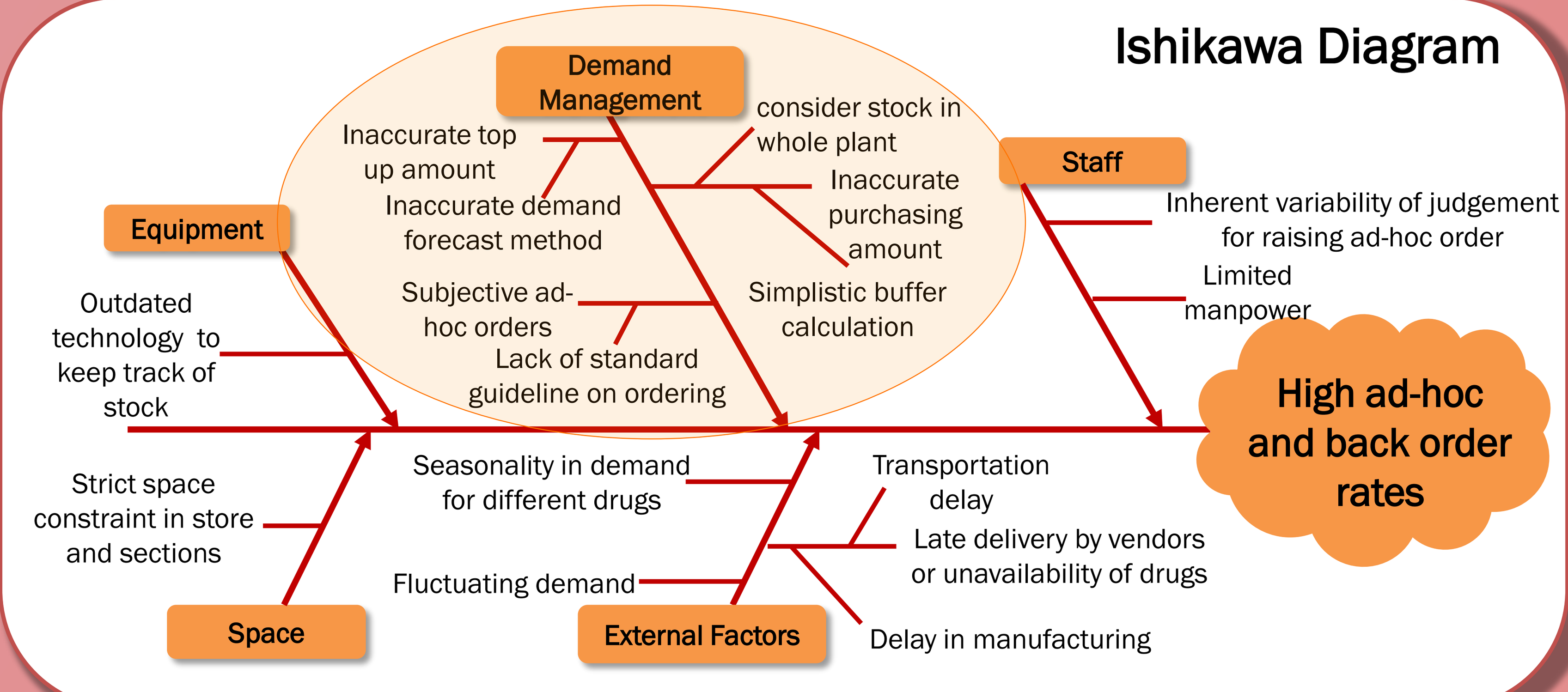
Ad-hoc order rate: no. of ad-hoc orders / total no. of item transactions
Back order rate: no. of KIV orders / total no. of item transactions

Pharmacy Supply Chain

Methodology

Root Cause Analysis → Data Analysis → Supply Chain Management → Simulation → Results

Root Cause Analysis



Data Analysis

10% of drugs account for **50%** of back orders

1 SAP Transactions
- Identify drugs with the highest stock out and back order rates

2 Drug Demand
- Demand forecasting and fitting of distribution models using iPharm data
- Aggregate historical data to capture distribution of drugs to other locations
- Identify fast moving, slow moving, erratic demand drugs

Supply Chain Management

- Usage of automatic ROP calculation in SAP
- ROP = Average consumption during lead time + safety stock
- **Tuning of lead time parameters**
  1. **GR Processing Time**
  2. **Planned Delivery Time**

Fast Moving Drugs
- Distribution calculation: $Q_d = \mu_c + SS - I$

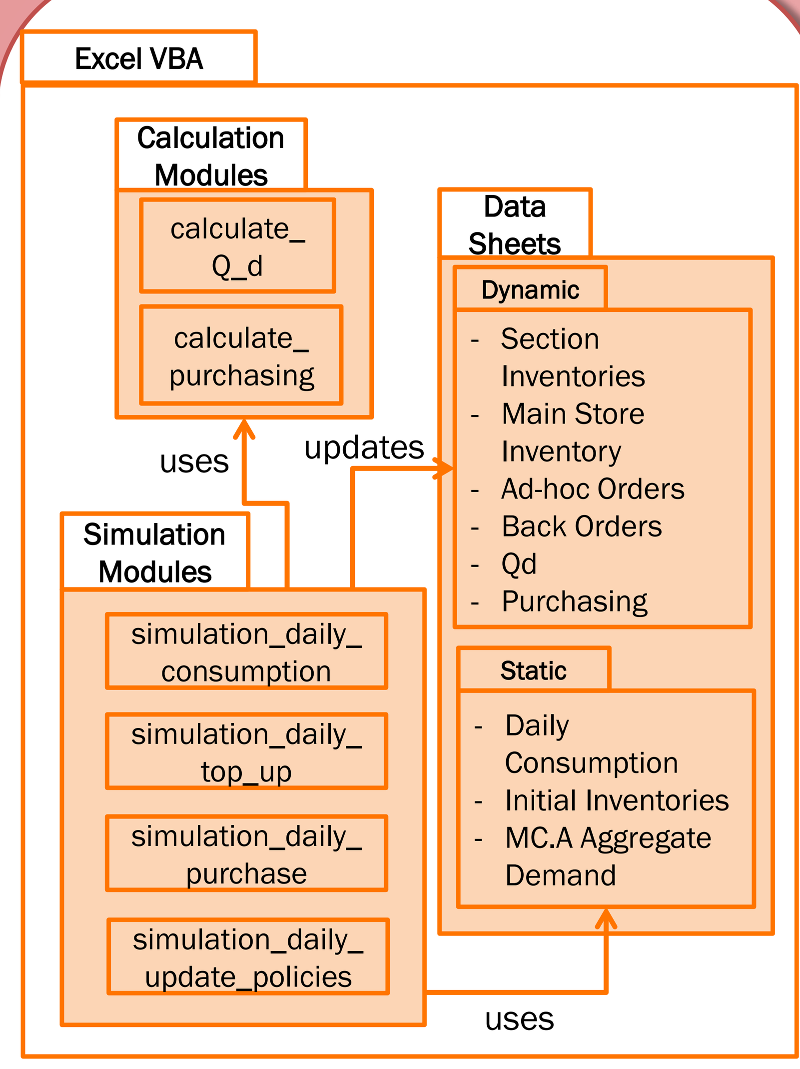
Q_d: Distribution Quantity
μ_c : 2 weeks mean consumption
SS : Safety Stock
I : *Current Inventory*

Drugs with Erratic Demand
- Maintain min inventory level

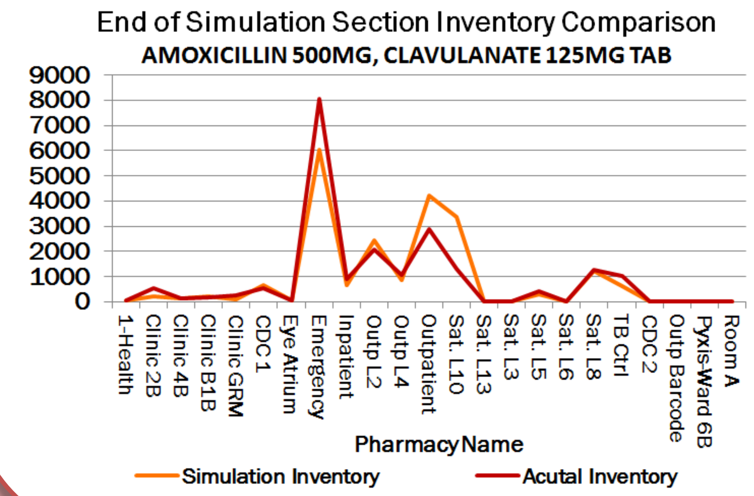
Ad-hoc Order Probability Model

Inventory Level	Probability to order
$\mu \le I$	0
$\mu - \sigma \le I < \mu$	0.005
$\mu - 2\sigma \le I < \mu - \sigma$	0.025
$\mu - 3\sigma \le I < \mu - 2\sigma$	0.05
$I < \mu - 3\sigma$	0.25

Simulation



Simulation Model Validation

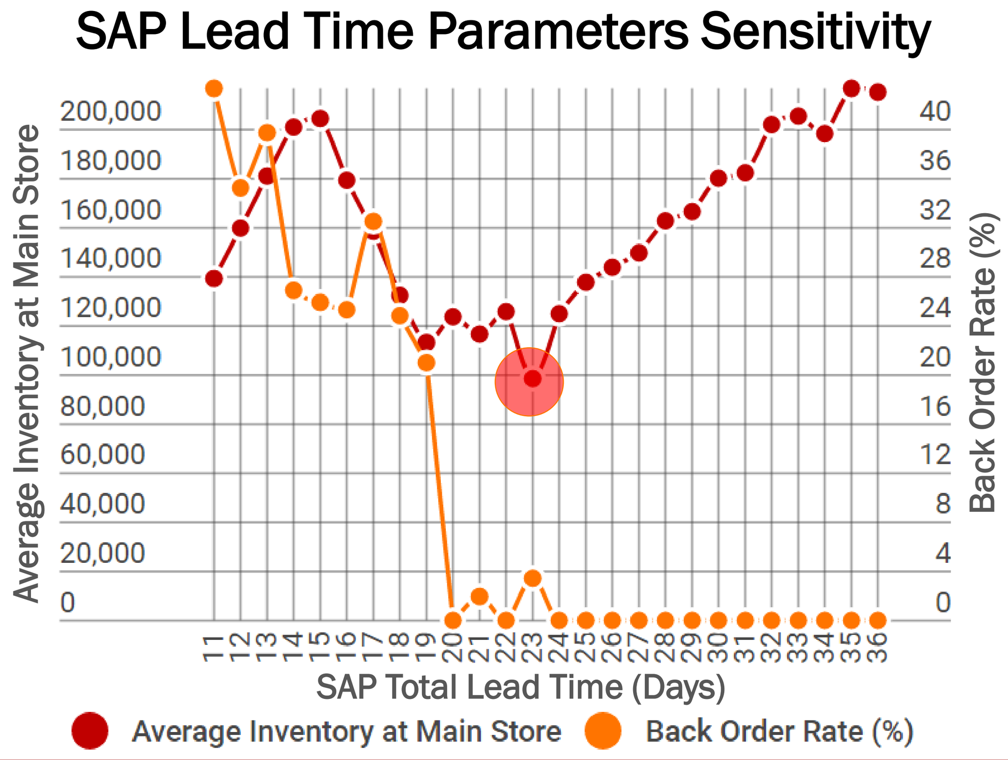


Results

2000 Drugs Simulation

Weekly Orders	35691
Ad-hoc Orders	6391
Back Orders	4965
Other Transactions	18296
Total Transactions	65343
Ad-hoc Order Rate	**9.78%**
Back Order Rate	**7.60%**

SAP Lead Time Parameters Sensitivity



- Back order rate decrease with an increase in SAP lead time
- Optimise input parameters in SAP by minimising back order rate and inventory level

Future Improvements

- Capturing drug movement and demand at other locations
- Rules and guidelines for triggering ad-hoc orders