

### **Project Title**

Using Six Sigma DMAIC to improve the Inventory Management System

#### **Project Lead and Members**

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#### **Organisation(s) Involved**

Sengkang General Hospital

#### Healthcare Family Group Involved in this Project

Healthcare Administration

#### **Specialty or Discipline**

Inventory Management, Pathology

#### Aims

To utilise the functions within excel to create a lean inventory management system to tackle challenges faced with paper based entries for the diverse range of items associated with the proper functioning of the routine biochemistry analysers

#### Background

See poster appended / below

#### Methods

See poster appended / below



#### Results

See poster appended / below

#### **Lessons Learnt**

See poster appended / below

#### Conclusion

See poster appended / below

#### **Additional Information**

Singapore Healthcare Management (SHM) Conference 2021 – Shortlisted Project (Supply Chain Management Category)

#### **Project Category**

Care & Process Redesign, Quality Improvement, Lean Methodology, Workflow Redesign, Job Effectiveness, Value Based Care, Productivity, Time Saving, Operational Management, Inventory Management, Technology

#### **Keywords**

Six Sigma, Macro-Enabled Spreadsheet, Excel, Electronic Inventory System

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## Introduction

Since the inception of Biochemistry Laboratory, the inventory management has been a manual process. This process involved a lot of material and manpower wastages as we have to manually keep track of approximately 170 reagents and consumables. Some of the wastages were caused by transcription errors, lack of compliance, paper storage, duplicate entries, incomplete or no audit trail and the laborious process of flipping through the files to input entries and to check balance before ordering.

The project aims to utilise the functions within excel to create a lean inventory management system to tackle challenges faced with paper based entries for the diverse range of items associated with the proper functioning of the routine biochemistry analysers.

# Methodology

A small team was formed to look into the issues faced with the inventory management system by adopting a lean six sigma DMAIC (Design, measure, analyse, improve, control) methodology. At the end of the process, the team decided on a macro-enabled spreadsheet to replace the manual inventory system.

Define     Measure     Analyse		<u>Improve</u>	<u>Control</u>		
	extracted from the QR code appropriate programs for	Brainstorm on what can be done to improve the processes	Put end product in use and continuously review and improve the processes		
Before					
<ul> <li>Manual records of "In" and "out" for each item in their respective sheets</li> <li>Multiple erroneous entries due to illegible handwriting</li> <li>Time consuming task of flipping through the files to check for items which are low in stock or expiring before ordering</li> </ul>	Out         Date       09/06/2021         QR or barcode       I         Quantity       I         Initials       Figure 3: Userform for logg	<ul> <li>Refer to images in inventory folder for QR or barcode location</li> <li>Estress</li> <li>Test</li> <li>The second sec</li></ul>	orm (Figure 3) se of logging in and out of stock by anning the QR or barcode sential information will populate in the spective fields in either the log in page or e log out page		
Figure 1: Manual inventory file and form	Sengkang General Hospital SingHealth	xpiry >>>> OUT <<<< halogen 1. Scan QR or	Add New Entry		
After		3.Check entry			
2       Sengkang General Hospital SingHealth       >>>>> INVENTORY <<<	03/03/2021       01076133361603811048508801172107312400         03/03/2021       01040156309398481044689205172107312400         03/03/2021       01040156309400731048500501172108312400         03/03/2021       01040156309183791051350101172108312400         03/03/2021       01076133361589681047494102172108312400         03/03/2021       01076133361589681047494102172108312400         03/03/2021       01076133361589681047494102172108312400         03/03/2021       01076133361589681047494102172108312400         03/03/2021       01076133361589681047494102172108312400         03/03/2021       01040156309165111052271201172109302400         03/03/2021       01040156309289271049158201172109302400         03/03/2021       01040156309248371052395201172110312400	OTO28121190         O4015630939848         Vit B12 II ELECSYS E           OT301715190         04015630940073         PCT BRAHMS ELECSYS           O3028542122         04015630918379         E2/P4 Diluent           O8469873190         07613336158968         TNT HS ELECSYS E2G 30           O3183700190         04015630918911         Lactate           O8469873190         07613336158968         TNT HS ELECSYS E2G 30           O3002721122         04015630916511         GGT           O3002721122         04015630928927         ALT	AG       446892       2021-07-31       1       RL         E2G       485005       2021-08-31       1       RL         513501       2021-08-31       1       RL         0V2       474941       2021-08-31       1       RL         501492       2021-08-31       1       nsss		
51       06779344190       04015630934447       Vancomycin       36       18       200       18       4       14         52       07026706190       04015630939909       AFF ELECSYS E2G       24       14       300       10       2       8         53       07026854190       04015630939900       ANTI-HBS II ELECSYS E2G 300       27       16       300       11       4       7         54       08498610190       07613336160381       Anti-HBs G2 Elecsys E2G 300 V2       16       2       300       14       4       10         55       07026889190       04015630939947       ANTI-HCV II ELECSYS E2G 300 V2       16       2       300       7       5       2         56       07027079190       04015630939947       ANTI-HCV II ELECSYS E2G 300       31       24       300       7       5       2         56       07027079190       04015630939964       CEA ELECSYS E2G       23       11       300       12       4       8         57       07027087190       04015630939968       CMTISOL Gen II ELECSYS E2G       30       17       300       13       8       5         59       09203079190       07613336179444       Elecsys Anti-SARS-CoV-2 <td>03/03/2021       01040156309248371052395201172110312400         03/03/2021       01076133361539701052070101172201312400         03/03/2021       01076133361539701052070101172201312400         03/03/2021       01040156309252611050487201172202282400         03/03/2021       01040156309399781049971201172202282400         03/03/2021       01040156309399781049971201172202282400         03/03/2021       01040156309399781049971201172202282400         03/03/2021       01040156309399781049971172202282400         03/03/2021       01040156309398241050489401172202282400         03/03/2021       01040156309399781049971201172202282400</td> <td>O7976887190         O7613336153970         FT4 III ELECSYS E20           O7976887190         O7613336153970         FT4 III ELECSYS E20           O5172179190         O4015630925261         NACL 9% SI GEN 2, COBA           O7027087190         O4015630939978         CK-MB ELECSYS E20           O3015050122         O4015630917419         Transferrin           O7027966190         O4015630939824         TOTAL PSA ELECSYS E20</td> <td>S       S</td>	03/03/2021       01040156309248371052395201172110312400         03/03/2021       01076133361539701052070101172201312400         03/03/2021       01076133361539701052070101172201312400         03/03/2021       01040156309252611050487201172202282400         03/03/2021       01040156309399781049971201172202282400         03/03/2021       01040156309399781049971201172202282400         03/03/2021       01040156309399781049971201172202282400         03/03/2021       01040156309399781049971172202282400         03/03/2021       01040156309398241050489401172202282400         03/03/2021       01040156309399781049971201172202282400	O7976887190         O7613336153970         FT4 III ELECSYS E20           O7976887190         O7613336153970         FT4 III ELECSYS E20           O5172179190         O4015630925261         NACL 9% SI GEN 2, COBA           O7027087190         O4015630939978         CK-MB ELECSYS E20           O3015050122         O4015630917419         Transferrin           O7027966190         O4015630939824         TOTAL PSA ELECSYS E20	S       S		
62       07027320190       04015630940011       FREE PSA ELECSYS E2G       19       11       300       8       2       6         63       08828610190       07613336166628       free PSA Elecsys E2G 300 V2       18       4       300       14       2       12         64       07027362190       04015630939718       FT3 III ELECSYS E2G       18       9       300       9       5       4         ITEMS IN OUT INVENTORY REAGENT & CONSUMABLES INVENTORY CAL QC check       INVENTORY CAL QC check       Implementation       Implementation       Implementation       Implementation         Figure 2: Summary page for inventory excel sheet	03/03/2021 01040156309399781049971201172202282400	07027087190         04015630939978         CK-MB ELECSYS E2           ES         INVENTORY CAL QC         check              •             •               •               •               •               •               •               •               •               ·               ·               ·                 ·               ·               ·               •               //>               //>                 ·               ·               ·                   ·               · </td <td></td>			

	— After								
2	Sengkang								
3	General Hospital			>>>>>	<b>INVENTORY</b>	′ <<<<<			
4	SingHealth								
5	CLINICAL BIOCHEMISTRY								
6	Cat no 👻	GTIN 🖵	ITEM NAME	JT TOTAL IN 🚽	TOTAL OUT 🖵	Pack size 👻	STOCKS 🚽	MONTHLY USAGE 🖵	REPLENISH
43	04491025190	04015630997787	Theophylline	32	18	100	14	4	10
4	03333825190	04015630919536	Total Protein, Urine (TPUC)	61	38	150	23	7	16
15	05171385190	04015630925100	TP GEN 2	66	46	700	20	11	9
16	03015050122	04015630917419	Transferrin	78	66	100	12	11	1
7	20767107322	04015630918393	Triglyceride	48	29	250	19	4	15
8	05171873190	04015630925131	Urea	55	30	1900	25	8	17
9	03183807190	04015630919154	Uric Acid	45	26	400	19	2	17
0	05108438190	04015630999385	Valproic Acid	25	11	200	14	3	11
1	06779344190	04015630934447	Vancomycin	36	18	200	18	4	14
2	07026706190	04015630939909	AFP ELECSYS E2G	24	14	300	10	2	8
3	07026854190	04015630939930	ANTI-HBS II ELECSYS E2G 300	27	16	300	11	4	7
4	08498610190	07613336160381	Anti-HBs G2 Elecsys E2G 300 V2	16	2	300	14	4	10
5	07026889190	04015630939947	ANTI-HCV II ELECSYS E2G 300	31	24	300	7	5	2
6	07027079190	04015630939664	CEA ELECSYS E2G	23	11	300	12	4	8
7	07027087190	04015630939978	CK-MB ELECSYS E2G	180	172	100	8	32	-24
8	07027150190	04015630939985	CORTISOL Gen II ELECSYS E2G	30	17	300	13	8	5
9	09203079190	07613336179444	Elecsys Anti-SARS-CoV-2	10	10		0		0
0	07027273190	04015630939688	FERRITIN ELECSYS E2G	29	20	300	9	5	4
51	07027290190	04015630939695	FOLATE III ELECSYS E2G	29	18	300	11	5	6
2	07027320190	04015630940011	FREE PSA ELECSYS E2G	19	11	300	8	2	6
3	08828610190	07613336166628	free PSA Elecsys E2G 300 V2	18	4	300	14	2	12
4	07027362190	04015630939718	FT3 III ELECSYS E2G	18	9	300	9	5	4
4	ITEMS IN OUT	INVENTORY REAGENT	& CONSUMABLES INVENTORY CAL QC check	+		: •			-

Figure 2: Summary page for inventory excel sheet

### Summary page (Figure 2)

- Provides details about stocks logged in and out and quantity at hand
- Easily keep track of the amount of stocks and gauge the amount to be replenished

### Log in and Log out sheets

- Contain various logical functions which extract information, such as item name, reagent lot  $\bullet$ and expiry date from the QR or barcode (Figure 4)
- Table filters allow for sorting of items for investigation or tracking purposes  $\bullet$

### Results

The new system has thus led to the following improvements in the inventory

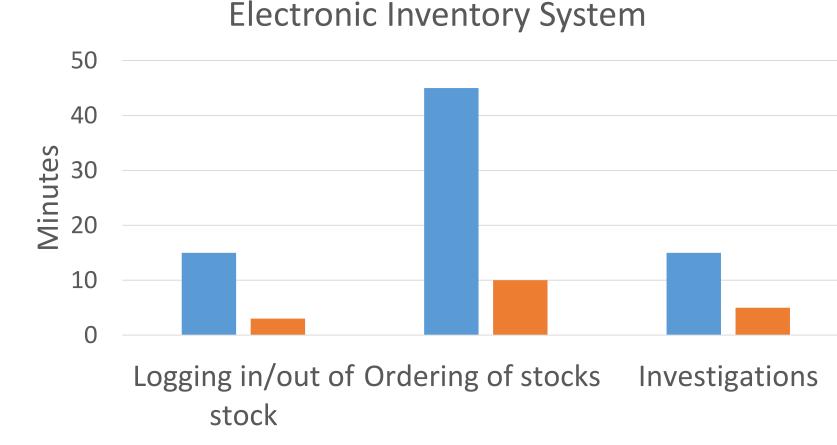
Amount of time spent on Manual vs

Manual Inventory Entries February 2019

4.3%

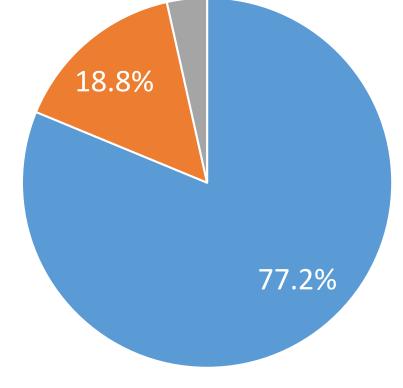
- management:
- 1. Staff are able to reduce time required for processes involved in inventory management (Figure 5) and focus on other tasks at hand
- 2. Data from February 2019 shows that transcriptional errors accounts for 18.8% of the monthly entries, with the new system in place, such issues are eliminated (Figure 6)
- 3. Departmental cost savings in terms of supplies used for manual system which are absent in the electronic system, such as files, paper, dividers, etc.

## Conclusion



Manual Electronic

Figure 5: Comparison of time taken between manual vs electronic systems



Total entries Transcriptional errors Missed Entries Figure 6: Comparison of time taken between manual vs electronic systems

Inventory management has to do with keeping precise records of goods that are not only available but also viable for use on site. Through the lean six sigma approach, the team established a new set of workflow to enhance performance and eliminate unprofitable activities for better organisation of the great multitude of items under our charge. The team continuously works on the system to further improve and eliminate wastes generated as per the six sigma approach.