Project Title

Optimisation of Outpatient Pharmacy Automation System Drug Dispensing System

Project Lead and Members

Project lead: Lim Shi Zong Nigel

Project members: Chloe Chong Kai Li, Chong Zhi Yan, Norfadhilah Samsuri

Organisation(s) Involved

Ng Teng Fong General Hospital

Healthcare Family Group Involved in this Project

Allied Health (Pharmacy)

Applicable Specialty or Discipline

Pharmacy

Project Period

Start date: January 2022

Completed date: March 2023

Aims

To reduce the average monthly picking failure rate by 50% to 8.98 per 1000 tasks and reduce the average machine error rate from 2.46 errors to 0.5 errors per working day. Ultimately, we hope to reduce the average DDS idle time by 50% to 1.16 minutes per DDS task. The team hopes to achieve these targets by Q4 2022.

Background

See poster appended/ below

Methods

See poster appended/ below

Results

See poster appended/ below

Lessons Learnt

While it may not be possible to eliminate DDS errors due to the complexity of the machine, we can learn to handle the errors more effectively to minimise the impact on DDS task idle time.

Our Outpatient Pharmacy staff are extremely dedicated and capable. The targets were not only achieved ahead of time, but the successes were also sustained.

Working with our external vendor partners can generate a symbiotic relationship. Due to the successes achieved, there are future optimisation works planned with the DDS vendor.

Conclusion

See poster appended/ below

Project Category

Care & Process Redesign

Risk Management, Adverse Outcome Reduction

Keywords

Outpatient Pharmacy, Drug Dispensing System, Optimisation

Name and Email of Project Contact Person(s)

Name: Lim Shi Zong Nigel

Email: Nigel_Lim@nuhs.edu.sg

OPTIMISATION OF OUTPATIENT PHARMACY AUTOMATION SYSTEM DRUG DISPENSING SYSTEM

MEMBERS: LIM SHI ZONG NIGEL, CHLOE CHONG KAI LI, CHONG ZHI YAN, NORFADHILAH SAMSURI

☑ SAFETY   ☑ PRODUCTIVITY
☑ QUALITY   ☐ COST
☑ PATIENT EXPERIENCE

Define Problem, Set Aim

Problem/Opportunity for Improvement
Between Jan and Mar 2022, a high picking failure rate and machine error rate were observed with the Drug Dispensing System (DDS) automated dispensing machine within the Outpatient Pharmacy Automation System.

The average monthly picking failure rate was 17.96 per 1000 tasks, while the average machine error rate was 2.46 errors per working day for this period. This resulted in prolonged machine idle time (average idle time of 2.33 minutes per DDS task), and a longer patient waiting time.
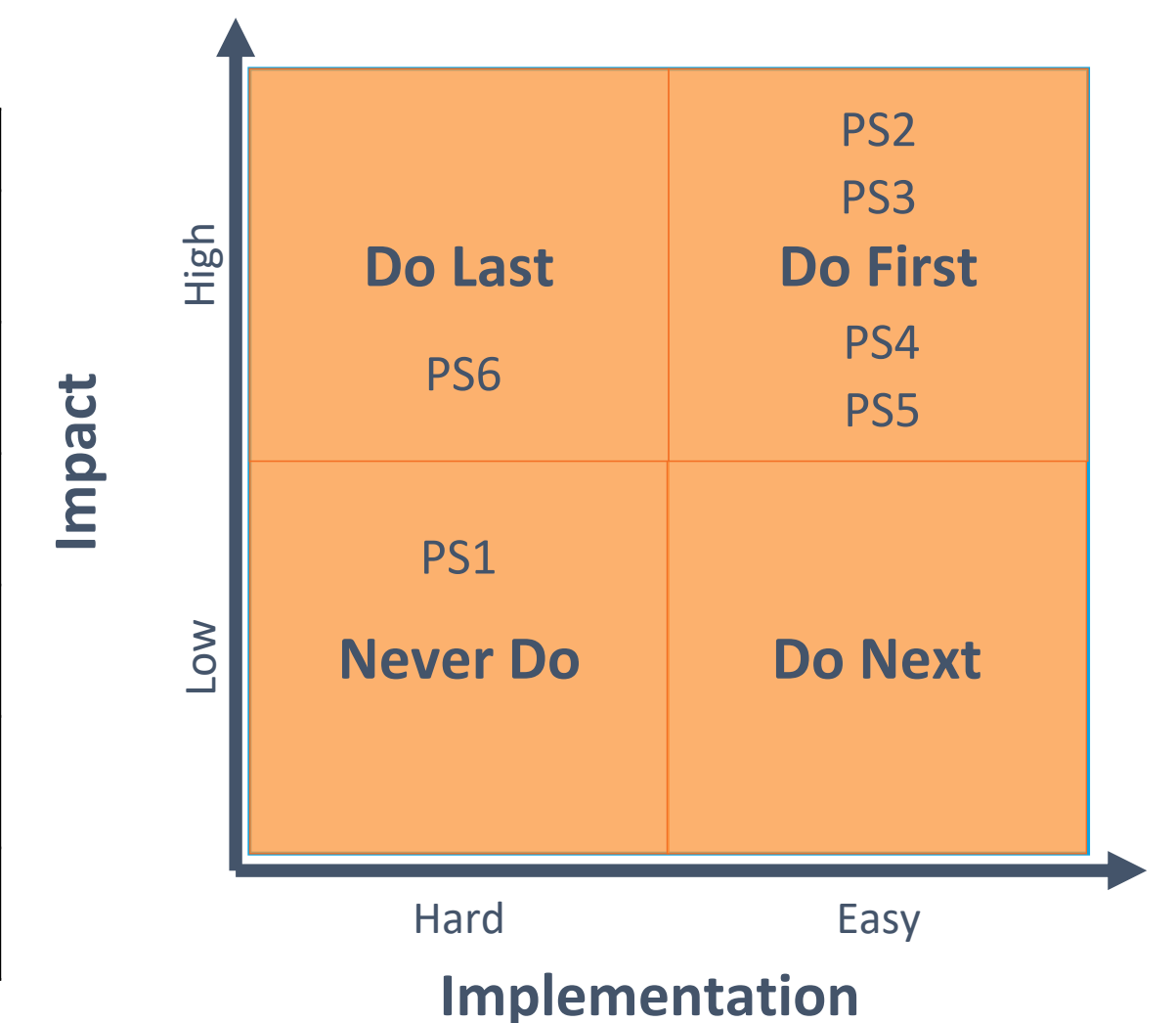
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To reduce the average monthly picking failure rate by 50% to 8.98 per 1000 tasks, and reduce the average machine error rate from 2.46 errors to 0.5 errors per working day. Ultimately, we hope to reduce the average DDS idle time by 50% to 1.16 minutes per DDS task. The team hopes to achieve these targets by Q4 2022.

Establish Measures

DDS Picking Failure Rate (per 1000 Tasks)
Between Jan and Mar 22, the average monthly DDS machine picking failure rate stood at an average of 17.96 (between the two DDS machines).
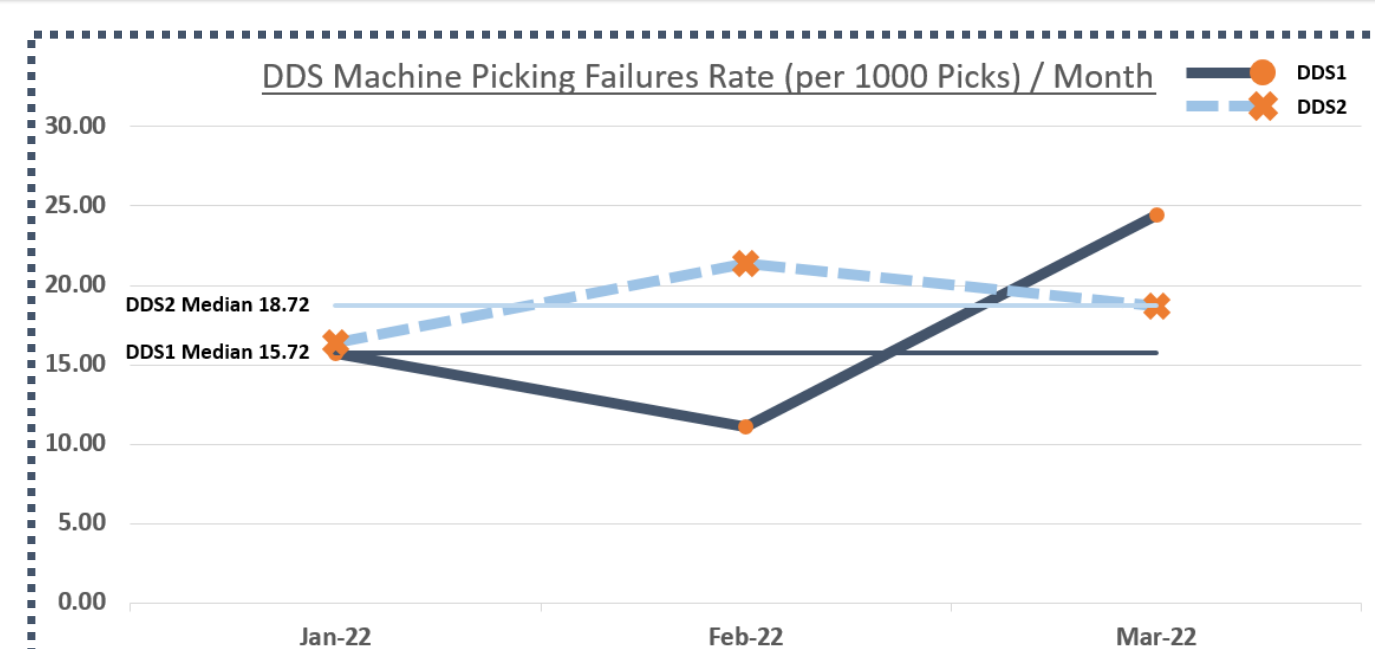
DDS Error Rate (per Working Day)
Between Jan and Mar 22, the average monthly DDS error rate time stood at 2.46 (between the two DDS machines).

DDS Average Idle Time (per Task)
Between Jan and Mar 22, the average DDS task idle time stood at 2.33 (between the two DDS machines).

Analyse Problem

What is your process *before* interventions?

What are the probable *root* causes?

Select Changes

What are all the potential solutions? Which ones are selected for testing?
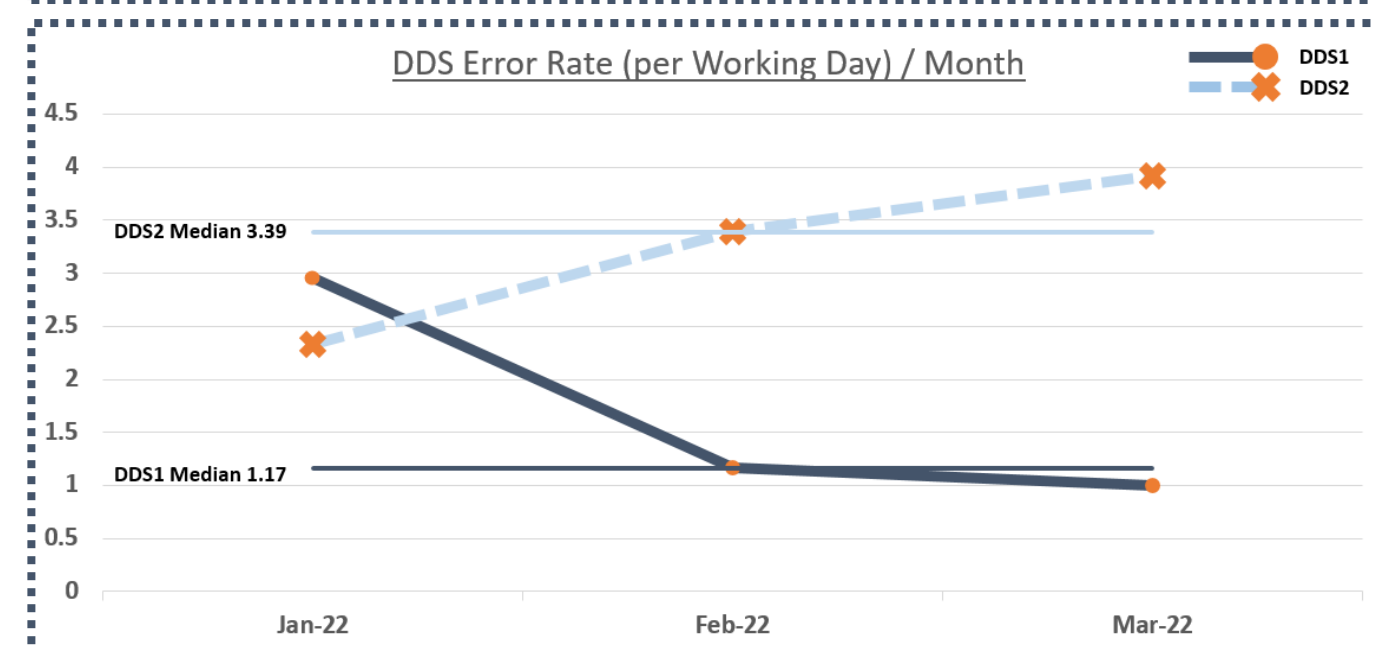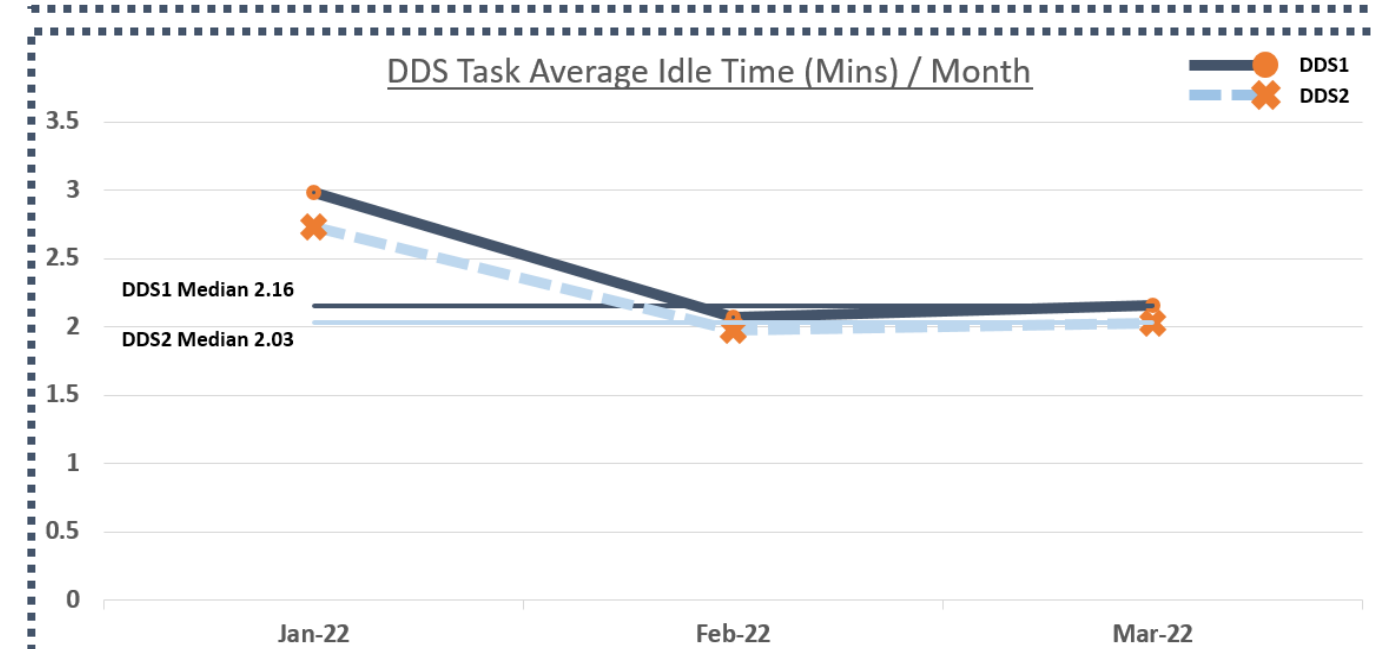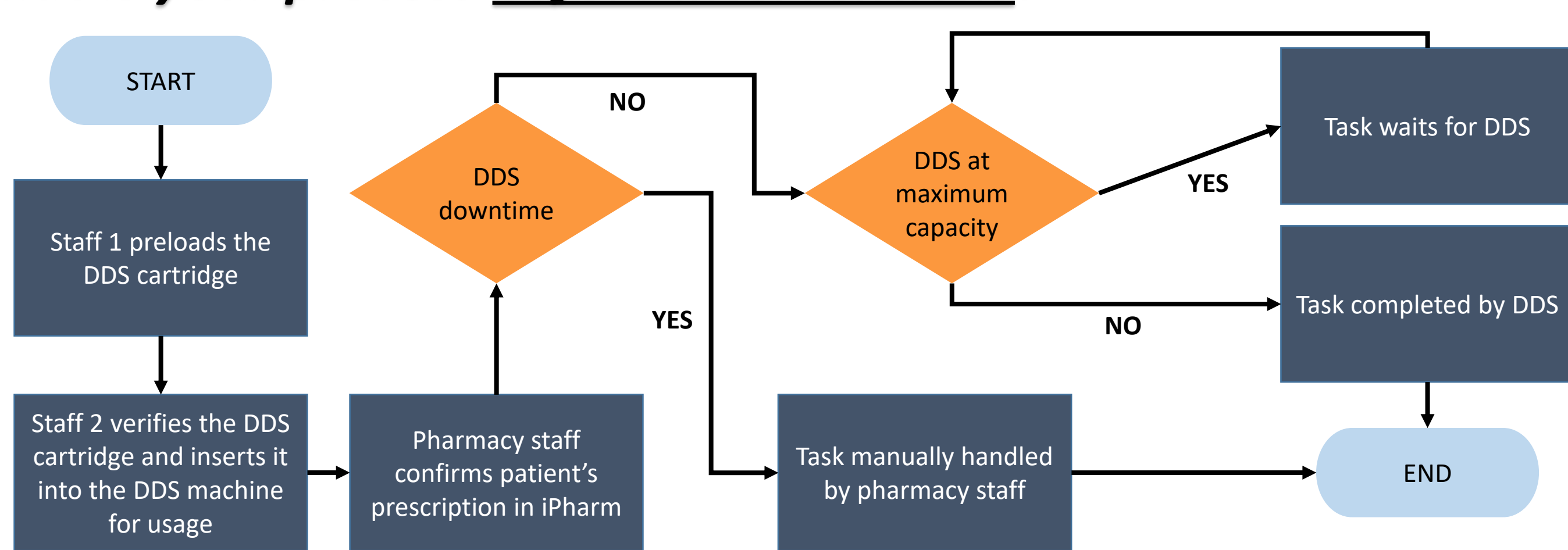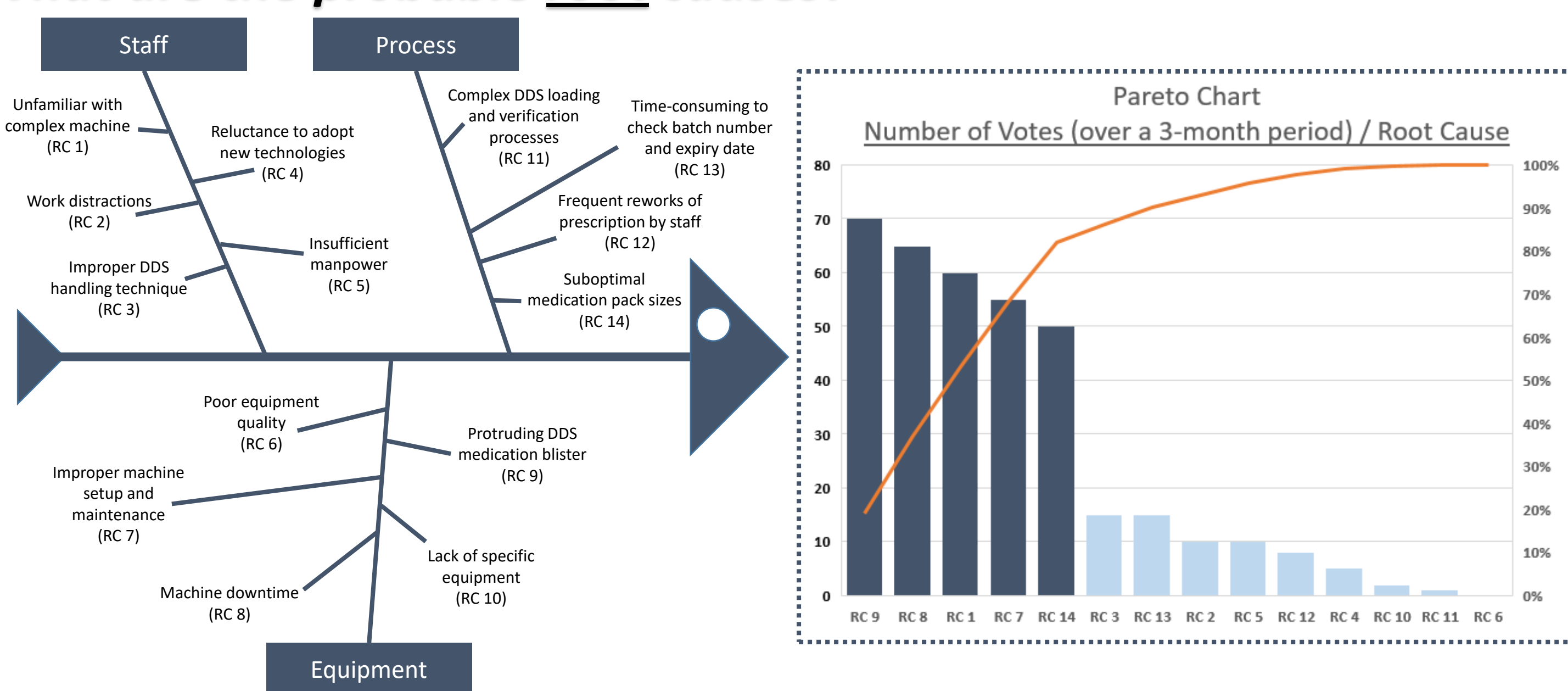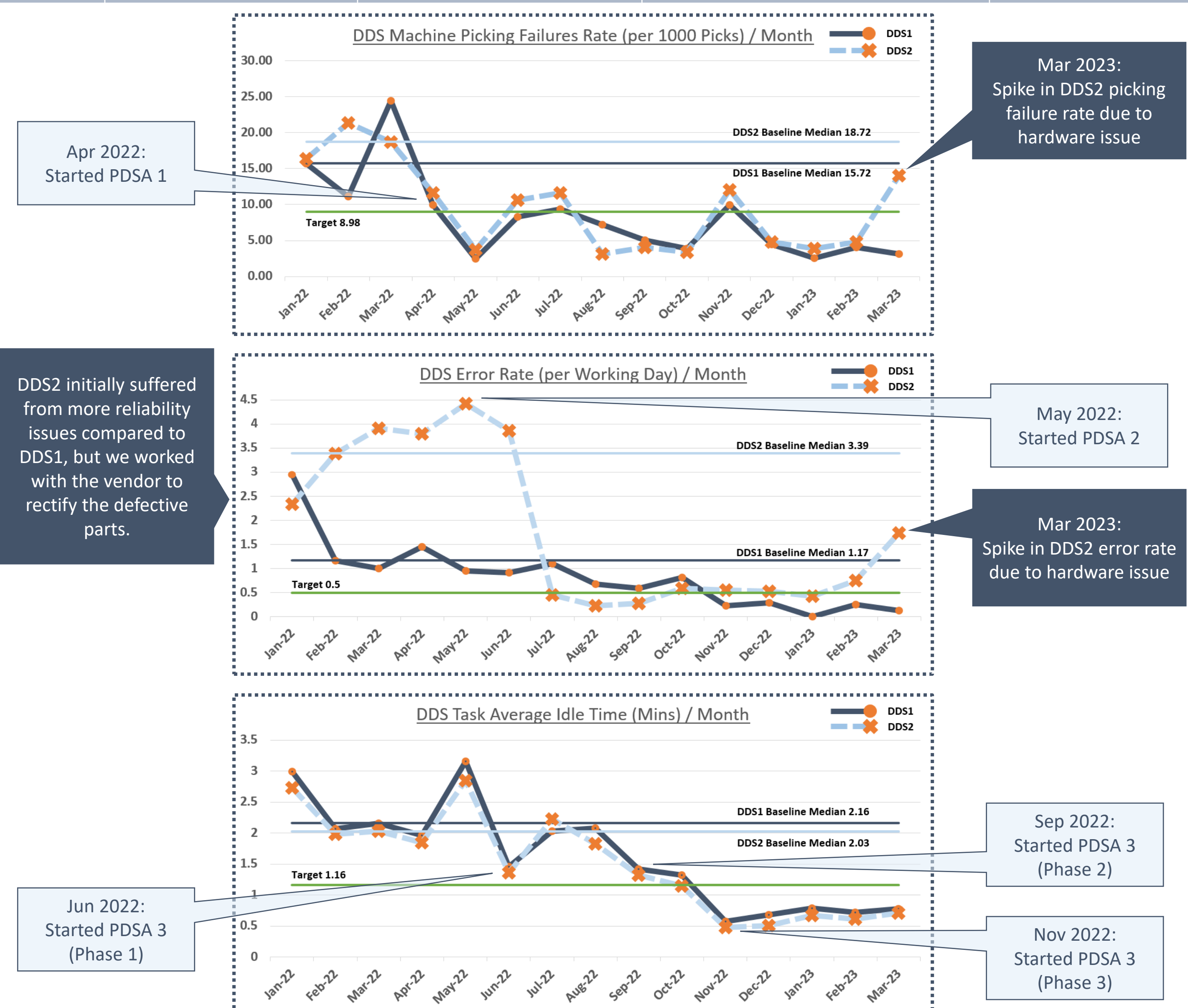
Root Cause		Potential Solutions
Protruding Medication Blisters	1	*Remove Medications from DDS*
	2	*Optimise DDS Cartridge Spring Force*
Staff Unfamiliarity with Machine	3	*Staff Education & Training*
	4	*Creation of DDS Daily Checklist*
Machine Downtime	5	*Periodic In-House Maintenance*
Suboptimal Medication Pack Sizes	6	*Redesign Entire OPAS Pack Sizes*

Impact (High / Low) vs **Implementation** (Hard / Easy)
- Do Last: PS6
- Do First: PS2, PS3, PS4, PS5
- Never Do: PS1
- Do Next

Test & Implement Changes

How do we pilot the changes? What are the initial results?

CYCLE	PLAN	DO	STUDY	ACT
1	Reduce DDS picking failures resulting from protruding medication blisters, and improper loading techniques.	In-house modification of DDS cartridge spring force (from 0.8N to 0.4N) to reduce incidence of blister protrusion. Staff training and education conducted on all aspects of DDS.	Achieving the target in reducing DDS machine picking failure rate to an average of 3.09 per 1000 tasks.	Implementation of in-house modification. Idea escalated and accepted by external vendor.
2	Ensure consistency among all staff handling the DDS machines, as well as perform basic troubleshooting to resolve errors	Introduced DDS daily checklist to standardise machine inspection, to ensure proper setup at all times. Periodic in-house maintenance also performed weekly on vital components.	DDS2 error rate decreased to 0.45 per working day in July 2022, while DDS1 error rate down-trended in the following months. Staff required time to familiarise themselves with the different machine errors before being able to troubleshoot them effectively.	Introduced as part of official DDS operational workflow and training. Strictly enforced to ensure accountability.
3	To further reduce the average idle time of each DDS task through redesign of medication pack sizes.	Large-scale optimisation of entire OPAS inventory, to better distribute the workload amongst the other machines.	Increasing DDS reliability through decreasing picking failure rate and error rate formed the foundation which allowed the idle time target to be met via pack size optimisation.	Workflow logic to be employed by all future medications within OPAS.

- Apr 2022: Started PDSA 1
- Mar 2023: Spike in DDS2 picking failure rate due to hardware issue
- DDS2 initially suffered from more reliability issues compared to DDS1, but we worked with the vendor to rectify the defective parts.
- May 2022: Started PDSA 2
- Mar 2023: Spike in DDS2 error rate due to hardware issue
- Jun 2022: Started PDSA 3 (Phase 1)
- Sep 2022: Started PDSA 3 (Phase 2)
- Nov 2022: Started PDSA 3 (Phase 3)

Spread Changes, Learning Points

What are/were the strategies to spread change after implementation?
- New staff will only be trained by experienced DDS staff.
- Regular updates conducted during Outpatient Pharmacy meetings to inform all staff of not only the changes, but successes of the implementation measures.

What are the key learnings from this project?
- While it may not possible to eliminate DDS errors due to the complexity of the machine, we can learn to handle the errors more effectively to minimise the impact on DDS task idle time.
- Our Outpatient Pharmacy staff are extremely dedicated and capable. The targets were not only achieved ahead of time, but the successes were also sustained.
- Working with our external vendor partners can generate a symbiotic relationship. Due to the successes achieved, there are future optimisation works planned with the DDS vendor.

Ng Teng Fong General Hospital

Jurong Community Hospital