Project Title

Use of Failure Mode and Effect Analysis (FMEA) to reduce risk of medication errors in medication delivery service in outpatient oncology pharmacy.

Project Lead and Members

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Organisation(s) Involved

National Cancer Centre Singapore

Healthcare Family Group Involved in this Project

Medical, Pharmacy

Applicable Specialty or Discipline

Oncology

Aims

- To investigate the potential failure modes of MDS processes in an outpatient oncology pharmacy using Failure Mode and Effect Analysis (FMEA).
- To recommend corrective measures to minimise risks in areas with higher Risk Priority Numbers (RPNs).

Background

See poster appended / below

Methods

See poster appended / below

Results

See poster appended / below

Conclusion

See poster appended / below

Additional Information

Singapore Healthcare Management (SHM) Conference 2021 – 1st Prize (Risk Management Category)

Project Category

Care & Process Redesign, Value Based Care, Safe Care, Risk Management, Care Continuum, Outpatient Care, Specialist Outpatient Clinics

Keywords

Failure Mode and Effect Analysis, Risk Priority Numbers, Medication Delivery Service, COVID-19, National Pharmacy Strategy, Risk Analysis Tool, Prospective Observational Study, Lean, 5S System

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Use of FMEA to reduce the risk of errors for medication delivery service in outpatient oncology pharmacy

National Cancer Centre Singapore — SingHealth

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INTRODUCTION

- National Cancer Centre Singapore (NCCS) saw an increase in demand of medication delivery service (MDS) during the COVID pandemic and its quick adoption could potentially increase the risk for medication errors
- MDS is also part of the National Pharmacy Strategy to provide patients with timely and convenient access to medication[1]
- Failure Mode and Effect Analysis (FMEA) is a risk analytical tool employed in this study to identify known and potential errors ('failure modes') and assign Risk Priority Numbers (RPNs) to the failure modes by taking the product of severity, occurrence and detectability based on a scale of 1 to 5 (Table 1)
- Areas with higher RPNs are prioritised for corrective interventions[2,3]

OBJECTIVES

1. To investigate the potential failure modes of MDS processes in an outpatient oncology pharmacy using FMEA
2. To recommend corrective measures to minimise risks in areas with higher RPNs.

METHODS

Study design
- A prospective observational study conducted at the Specialist Outpatient Clinic (SOC) pharmacy of NCCS, from June to September 2020

1 Form an FMEA team	2 Identify failure modes, causes, effects	3 Preliminary risk analysis	4 Final risk analysis	5 Interview to develop corrective actions	6 Evaluate effectiveness (PDSA Phase 1)

Sample size
- **Preliminary risk analysis:** n=19, mean practice period=8.58 years (SD 9.90)
- **Final risk analysis**: n=8, mean practice period=11.80 years (SD 12.80)

Table 1. Rating Scale of 1 to 5 to calculate RPN

Score	Severity	Occurrence	Detectability
1	Negligible	Less than once a year	Almost certain
2	Minor	Yearly	Moderately high
3	Moderate	Quarterly	Low
4	Major	Monthly	Remote
5	Catastrophic	Weekly	Absolute uncertain

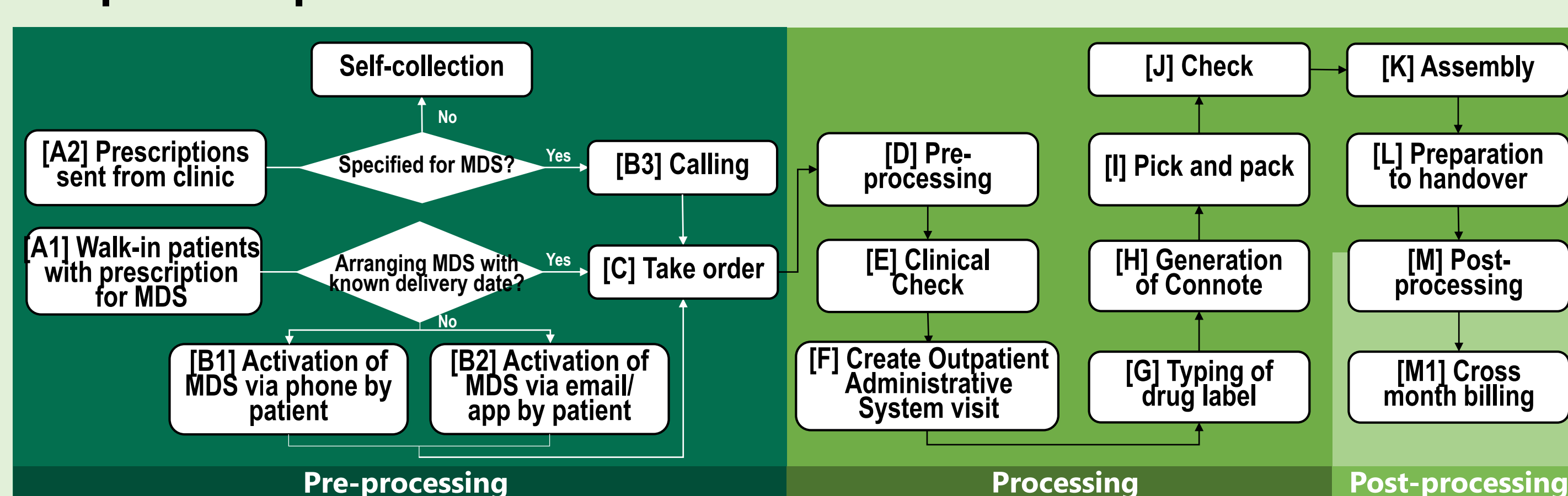### Use of 5S Lean Manufacturing in Step 5
- Originally used as a housekeeping tool in production setting[4], we adopted its concept to facilitate devising corrective actions in a more systematic manner
- **5S: Sort, Set in order/ Straighten, Shine/ Scrub, Standardise, Sustain**

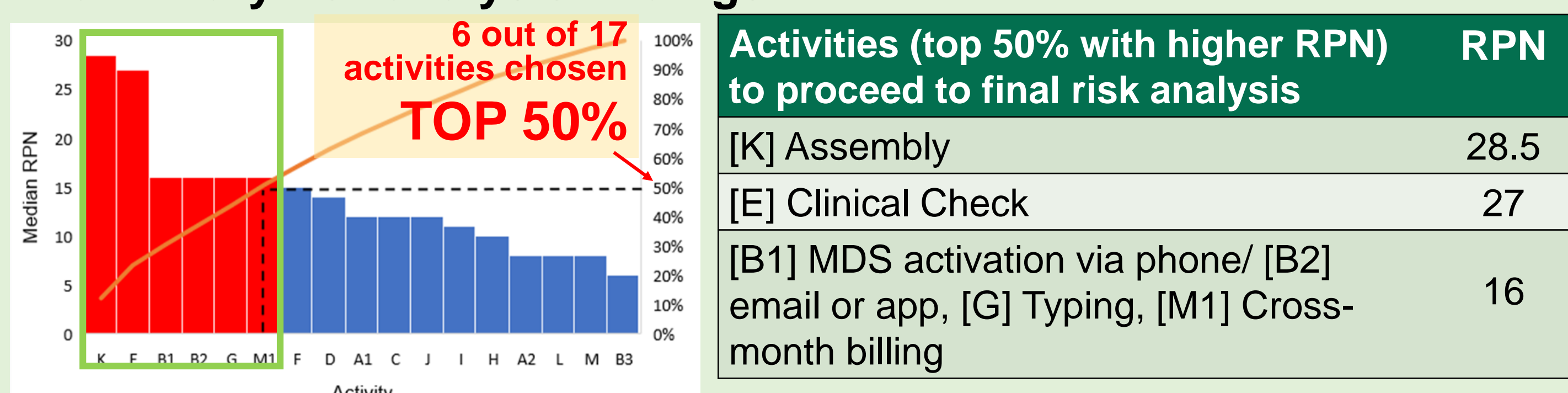### Implementing Plan Do Study Act (PDSA) cycle
- Used to help to systematically plan the details and means of monitoring changes
- Monitor the reduction in near misses/ actual error rates
- Gather feedbacks from pharmacy staff

RESULTS

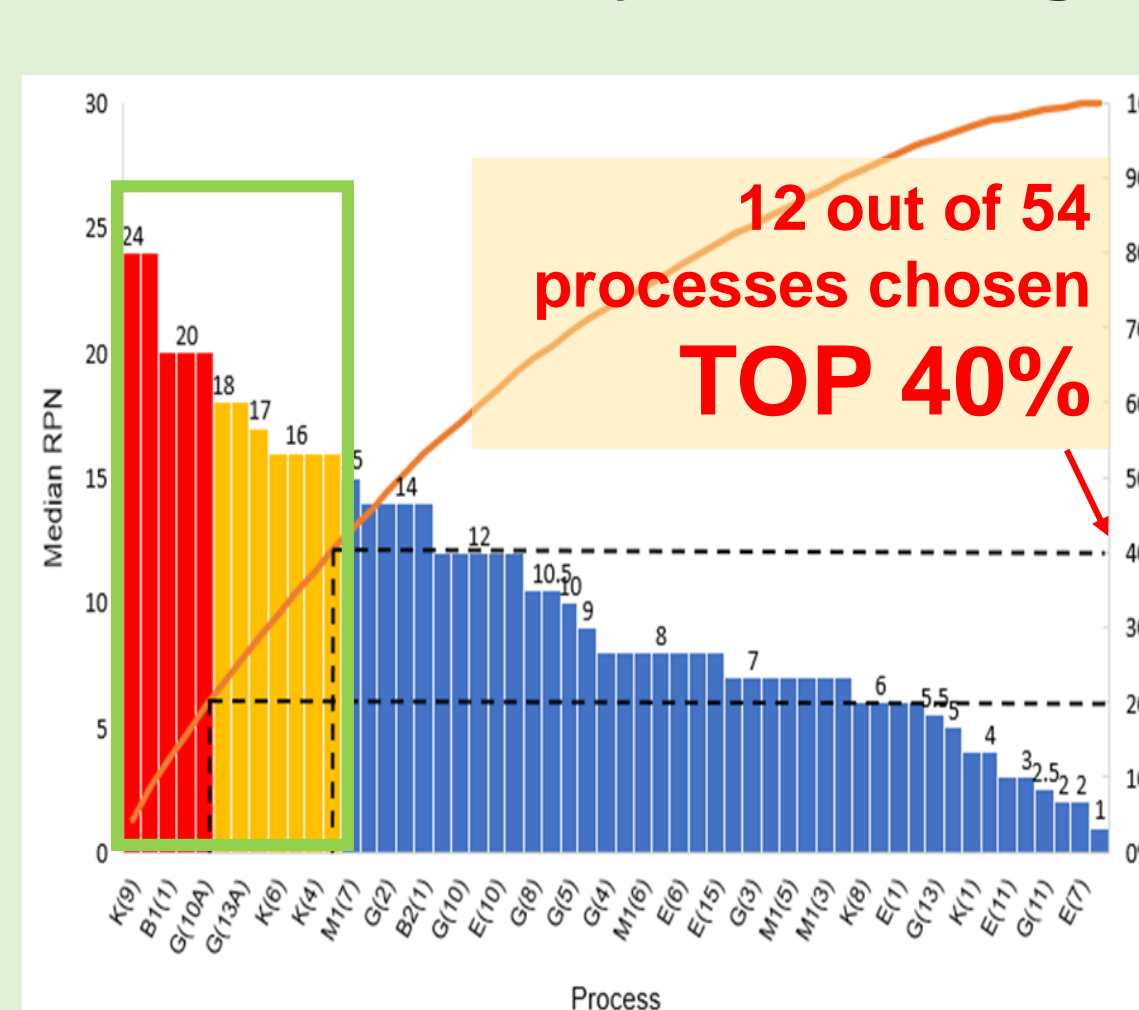### Graphical representation of MDS activities

Preliminary risk analysis findings

6 out of 17 activities chosen TOP 50%

Activities (top 50% with higher RPN) to proceed to final risk analysis	RPN
[K] Assembly	28.5
[E] Clinical Check	27
[B1] MDS activation via phone/ [B2] email or app, [G] Typing, [M1] Cross-month billing	16

RESULTS (cont.)

Final risk analysis findings

12 out of 54 processes chosen TOP 40%

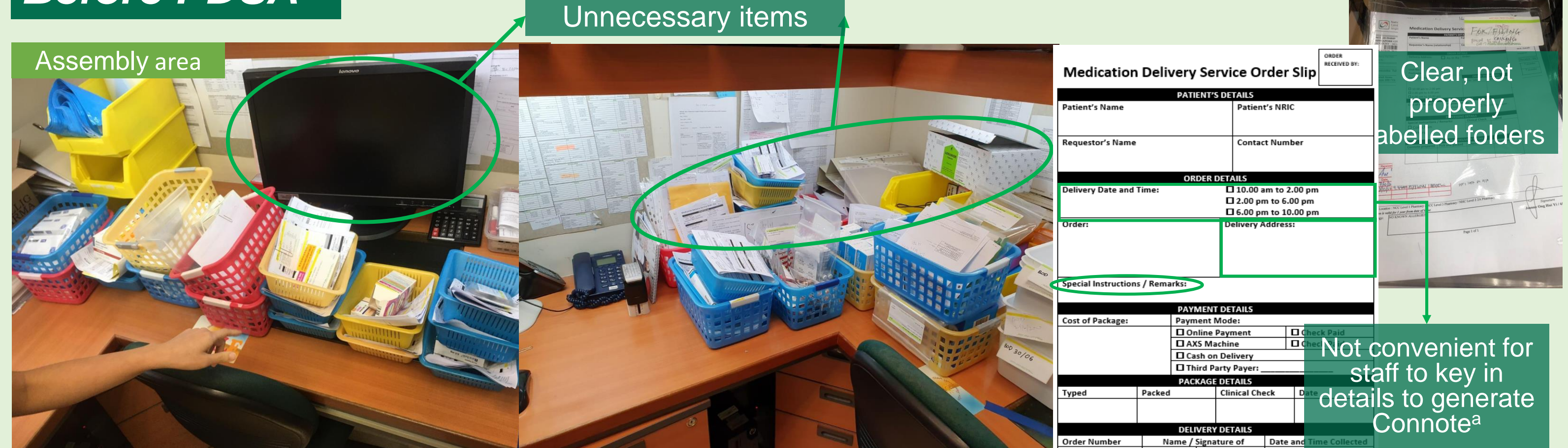|	Processes (top 40% with higher RPN) to devise corrective actions	RPN
E	Review laboratory readings/other investigations	24
K	Place prescription and consent form in appropriate trays	
G	Enter remarks for MDS	20
B1	Receive patient or caregiver's call for MDS/ Retrieve prescription from file for processing	
G	(If applicable) Record cross-month billing on order slip	18
K	Complete assembly process	
M1	Retrieve summary labels for cross month billing	17
G	(If applicable) Select "3rd Party Payer"	
K	Check drug(s) packed/ Connote[b]/ Check if order slip matches processed order	16

Proposed corrective actions
- 38 general and process-specific measures were devised using 5S methods: 2 sort, 14 set in order, 7 standardize, 3 shine and 12 sustain strategies
- Most focused on improving the modes of MDS activation, design of MDS order slip, and working environment, and reducing workload
- 8 were implemented in phase 1 of the PDSA, with positive reduction in incidence of near misses and encouraging feedback from pharmacists
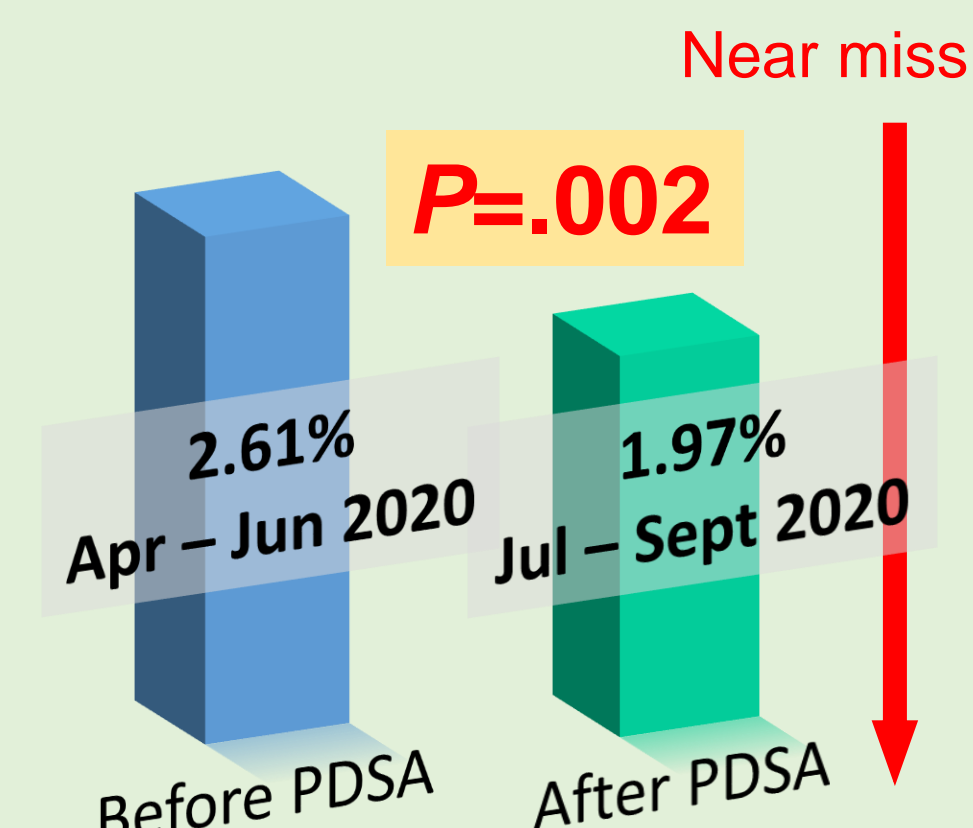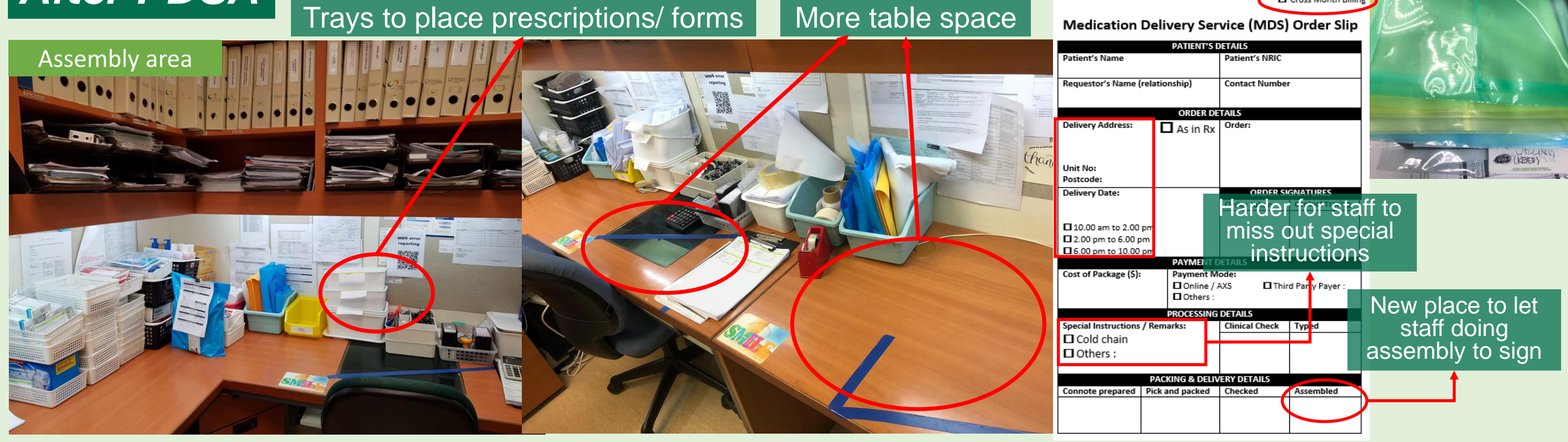
Improvements made during phase 1 of the PDSA

Sort	• Use colored, labelled folders to store prescriptions intended for storage or processing • Sort the necessary and unnecessary to remove the unnecessary equipment/ items from assembly area
Set in order	• Redesign the MDS order slip • Change from white to colored paper to paste summary labels for cross-month billing
Shine	• Place dedicated trays on table strategically to ensure easy access for staff doing assembly
Sustain	• Preparation of database to allow auto-population of patient details using NRIC to generate Connote[b]

[b] Connote: Delivery label with patient's delivery address and order number

Near miss

P=.002

2.61% Apr – Jun 2020 (Before PDSA)
1.97% Jul – Sept 2020 (After PDSA)

Before PDSA

Assembly area — Unnecessary items — Clear, not properly labelled folders — Not convenient for staff to key in details to generate Connote[b]

After PDSA

Assembly area — Trays to place prescriptions/ forms — More table space — New checkbox for cross-month billing — Coloured and labelled folders — Harder for staff to miss out special instructions — New place to let staff doing assembly to sign

DISCUSSION & CONCLUSION

- **Majority of processes in *MDS activation via phone* and *assembly* were flagged out with higher RPNs.** Both were critical as majority of MDS orders was activated by calling and *assembly* was the last activity before medications were sent out for delivery.
- **Messy** work environment, absence of measures to ensure **protected space and time** for staff doing *assembly,* and **lack of standardised way of assembling medications** were some major problems identified.
- Immediate solution: increase number of telephone lines and dedicated phone receptionists; long-term solutions: promote use of email and mobile applications to facilitate convenient activation of MDS.
- Improve **IT software** to allow electronic transmission of medication order for auto-populations of fields to produce drug labels.
- The study highlighted the shortcomings of **near-misses self-reporting system.** Improvement to the system is needed to allow staff to report – when, where and how the near-miss occurred.
- FMEA findings helped to illustrate the complex nature of MDS and prioritised various critical key failures for corrective actions.

Reference
1. Ministry of Health Singapore. National Pharmacy Strategy Information Pack. 2020.
2. Stamatis DH. *Failure Mode and Effect Analysis: FMEA from Theory to Execution.*; 1995.
3. Young FY. *Int J Bus Soc Sci.* 2014;5(10)
4. Hughes RG. *Patient Safety and Quality: An Evidence-Based Handbook for Nurses.* 2008