Project Title

Reducing Incidences of overdue Preventive Maintenance via Asset Tracking and Management Biomedical Engineering (BME)

Project Lead and Members

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Project members: Salma Binte Taib Ali, Sr Naw Pwint Hmone Oo, Mohamed Rizwan s/o Habib Rahiman

Organisation(s) Involved

Mount Alvernia Hospital

Healthcare Family Group(s) Involved in this Project

Nursing, Medical, Surgery, Allied Health

Applicable Specialty or Discipline

Medical & Laboratory Technology, General Practice

Project Period

Start date: Jul 2023

Completed date: Dec 2023

Aims

The aim was to reduce the number of falls by 75% by the end of 2023, with the target of ensuring 100% user participation of SmartPeep for patients with high falls risk.

Background

Singapore is grappling with an aging population, this plays out in our acute hospitals, where we see an increasing number of older patients. In Parkway East Hospital (PEH), we noticed an increase in the number of falls in 2022, mostly among the elderly, rising

from 0.4 to 1.3 falls per 1000 patient days. Approximately 87% of the falls in 2022 were above 60 years old. Of these falls, we had 3 cases that resulted in significant harm to the patient, which resulted in additional length of stay and financial stress to the patient and family.

Methods

We utilise the Inpatient Falls per 1,000 Patient Days indicator to monitor the patient falls rate.

Results

From January 2022 to June 2023, there were 18 falls. Since the start of SmartPeep in July 2023, it has dropped significantly. 2 counts of the falls in September 2023 and the 1 count of fall in October 2023, were excluded as they were not within the monitoring of the SmartPeep system. Under the SmartPeep system monitoring, there were 0 falls in Jul to Dec 2023 period.

The impact of the new implementation is the drop in the number of actual falls, which has improved staff morale and patient outcomes. Staff are able to attend to patients' attempt to get out of bed in a more predictable manner.

Conclusion

See poster appended/below

Project Category

Technology

Digital Health, Data Management, Data Platform, Digitalisation, Automation, Autonomous System

Care & Process Redesign

Value Based Care, Utilisation, Operational Management, Inventory Management, Productivity, Cost Saving

Keywords

Asset Tracking, Medical devices, Patient's Care, Preventive Maintenance, Tracker, Equipment, Standard Operating Procedures, Protocols

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Reducing Incidences of overdue Preventive Maintenance via Asset Tracking and Management

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I. Background

Medical devices are an essential part of a patient's care journey and treatment plans. Critical equipment used by patients are typically high-value and shared across its location. Currently, to locate an equipment in wards, clinics or operation theatres, nurses or/and BME have to search for the equipment room by room. If the equipment is not found, nurses or/and BME would have to check their records or ask other staff on its whereabouts. On occasion, if the equipment is urgently needed, its replacement would have to be borrowed from other locations across MAH. Consequently, a lot of time and resources are spent on locating a single equipment. The frequent incidences of missing equipment have caused Preventive Maintenance (PM) for the equipment to become overdue. This may pose undue risks to patient and staff safety, as the equipment may not be properly calibrated or maintained for clinical use. Although BME is informed of the respective cost centres of the equipment, there is no clear visibility on its location or utilisation.

II. Evidence for a problem worth solving

1. BME

   As illustrated in Figure 1, among the main causes for overdue PM of equipment would be that the equipment is in use or that it cannot be found. The equipment may be in use or missing for weeks or months, causing it to not be properly maintained. The performance and safety of the devices might be affected, and this might lead to various negative consequences such as improper readings on equipment due to the lack of calibration or minor electrical shocks due to the presence of leakage currents. Quantitatively, this affects BME's Global Key Performance Index (KPI) tracker for its Medical Device PM status. In 2021, the KPI standard and target of missing less than one equipment's due monthly PM (see Figure 2) was not met due to the various challenges and causes mentioned in Figure 1.

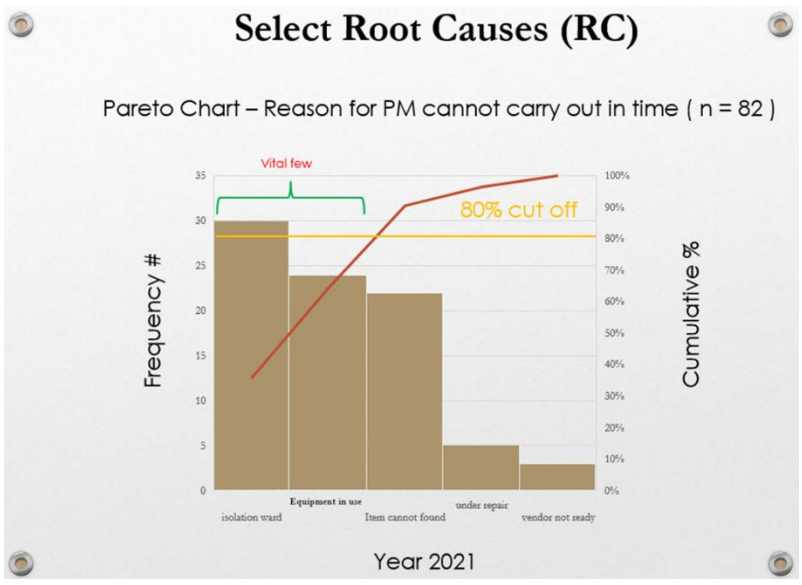

Figure 2 Root Causes of Overdue PM

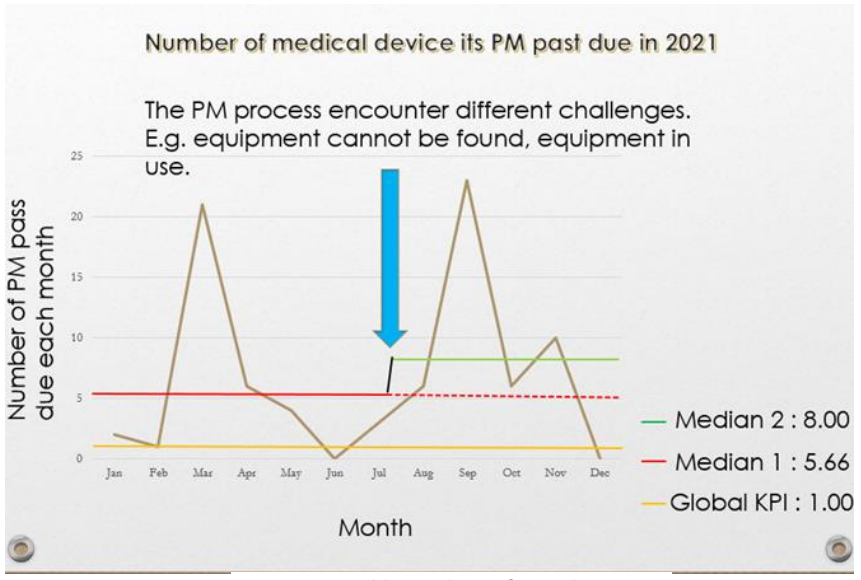

Figure 1 Monthly Tracking of Overdue PM

2. Nurses team

   a) Searching for Equipment

   It is time-consuming to search and retrieve equipment for usage or to assist BME when PM is due for the device. If the nurse is not able to find a spare equipment for use, a replacement has to be borrowed from other wards, clinics or rooms. As there is no information available to indicate the equipment is in use or not, finding a spare or replacement equipment is a tedious, time-consuming process. Nurses have to enquire other wards and document the loan, as well as its return. In addition, equipment that are small or mobile usually moves around a lot, contributing to the difficulty in locating in.

   b) Inventory Tracking

   Nurses conduct stock-taking to update and maintain inventory listing of their equipment. Staff would have to look through the various storage areas and rooms to manually count and check each equipment. This process takes up a substantial amount of time and resources as all of the equipment have to be accounted for under the respective cost centres. When there is a high patient load, this task, in tandem with locating available equipment, will be especially challenging.

3. Patients

   Unnecessary time is taken up to locate an equipment required, contributing to delays in administering treatment to patient. Equipment that are not regularly maintained tend to breakdown more frequently and may not be safe to use. Swapping and replacing equipment mid-treatment may introduce potential patient safety issues due to pre-mature stopping or reprogramming.

III. Cause and effect diagram

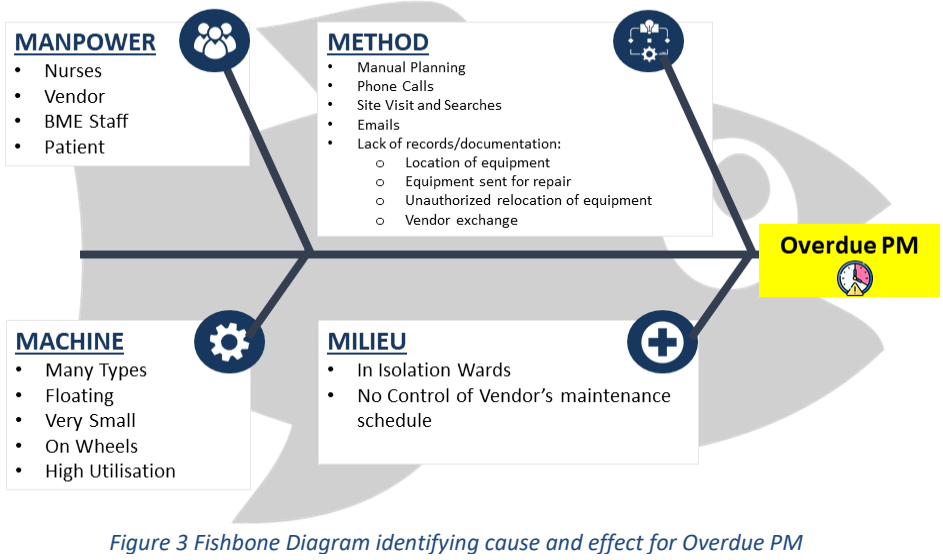

Figure 3 Fishbone Diagram identifying cause and effect for Overdue PM

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IV. Implementation of interventions

Root Cause(s)	Intervention
Lack of visibility on the equipment location	Asset Tracking and Management System - Implemented on Sep 2022: • System is able to indicate and display real time, accurate data on location of equipment • Automatic updates to online asset management system which tracks all equipment in the particular location • Ability to notify and indicate the utilisation status of device
Lack of records/documentation on location of equipment when it is sent for repair, exchange or relocation	
Equipment is not accessible as it is located in isolation wards or in use	

V. Results

With the implementation of an asset management and tracking system (see Figure 4), the incidences of overdue PM have been reduced as indicated in Figure 5. The asset management system is able to display in exactly which room the device is located in and tracks the number and records of all equipment in the wards, location and operation theatre. Staff can simply log into the system and search for a particular equipment by its serial or asset number.

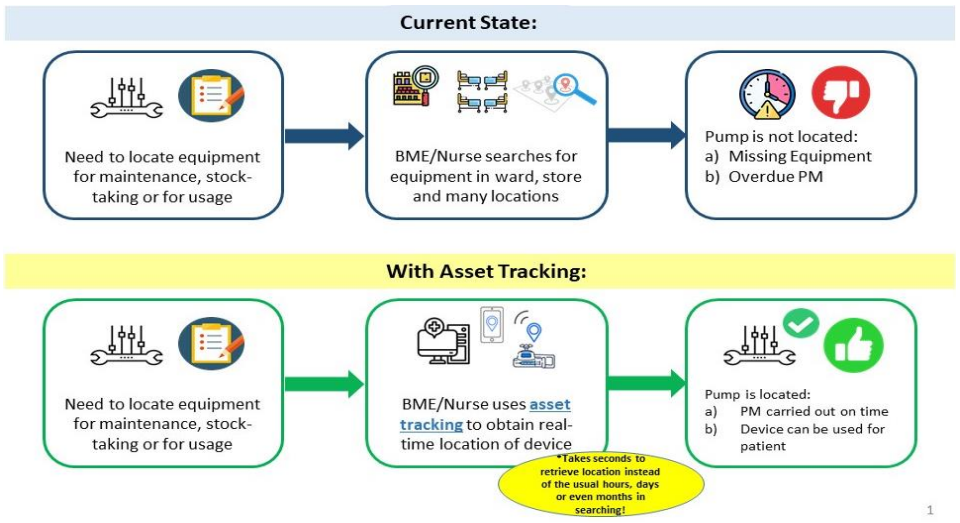

Figure 4 Improved Workflow with Intervention

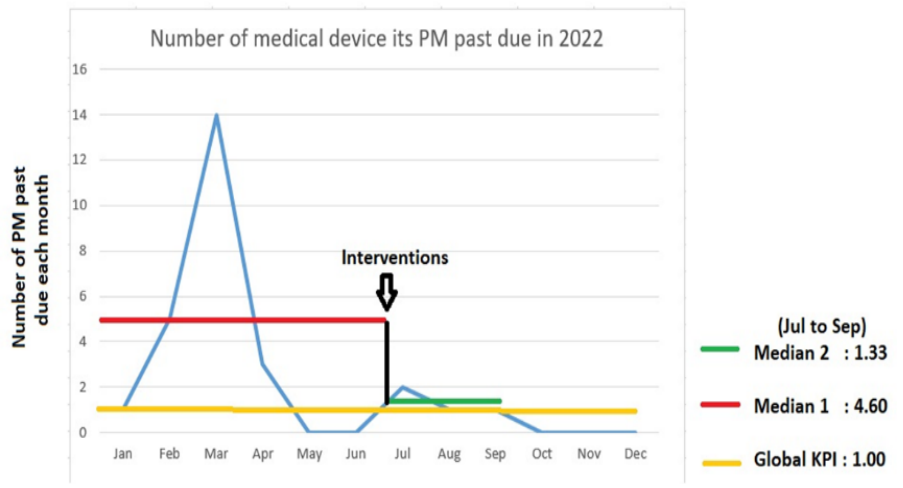

Figure 5 Reduced number of overdue PM after intervention

The implementation of asset tracking and management system:

- Optimises asset utilisation as it allows the deployment if available equipment across the hospitals to meet fluctuating operational needs such as the COVID-19 outbreak
- Allows for equipment in the wards, clinics and operation theatre to be easily located for timely maintenance
- Enhances staff efficiency by reducing the amount of non-value-added tasks such as manual stock-taking and searching of equipment
- Provides real-time, accessible data on the equipment at all times
- Avoids unexpected downtime of equipment as PM has been done on time, reducing emergency repair costs
- Provides redeployed time and resources for staff to focus on clinical tasks and caring for patient

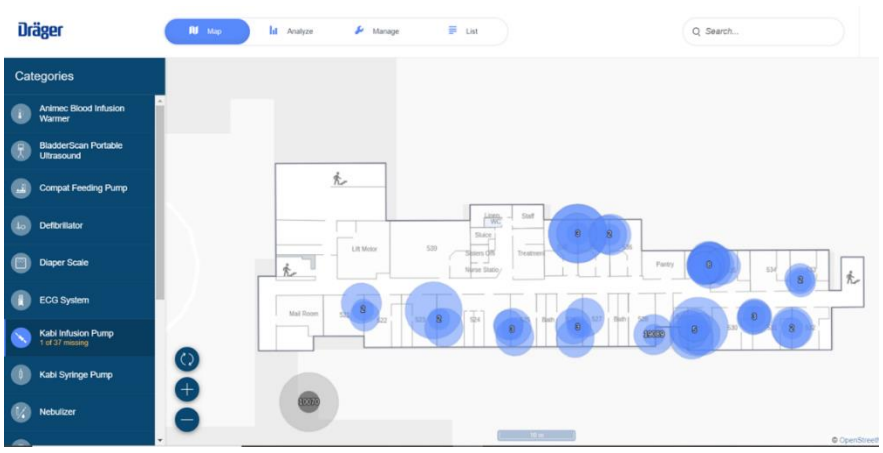

Figure 4 Real Time Asset Tracking and Management System

VI. Cost or Productivity Savings

Since the implementation of the Asset Tracking System in Saint Claire Ward, all of its equipment can be easily found and there are no incidences of Overdue PM. We estimated that with the implementation of a hospital-wide asset tracking and management system, approximately 3.57 FTE can be saved. Staff saves an approximate 15-30 minutes in searching, tracking and managing an equipment in the hospital manually. This assumes that each FTE works a total of 1940.4 hours in a year. As all the equipment is maintained regularly, there will be lesser incidences of unexpected breakdown of the equipment, saving an average of $200 for each equipment. Taking into account the total number of equipment in the hospital, a substantial amount of cost will be saved. The time and resources utilised in searching for the equipment and addressing the consequence of overdue PM can be redeployed to completing tasks and meeting each cost centre's respective KPI.

VII. Problems encountered and learning points

Some of the issues encountered was the evaluation of appropriate asset tracking and management system for implementation. Different technology and vendors have their advantages and disadvantages. An infra-red tag would only be suitable for short range tracking and is highly susceptible to interferences. We carried out a thorough evaluation and opted for a Bluetooth/Wi-Fi based Asset Tracking and Management system which is stable, cost-effective, easy to implement and can be used for mid to long ranges. While it was challenging, we managed to learn more about the different types of Asset Tracking technologies and adjusted our implementation plan accordingly to the technology requirements. With data and root cause analysis via tools such as the fishbone diagram, as indicated in Figure 3, we were able to identify and tackle the issue at hand appropriately.

VIII. Sustaining

We intend to develop a Standard Operating Procedures and Protocols to maintain and ensure that the tags and sensors of the tags are functioning well. To further sustain and develop the implemented Asset Tracking and Management system, we aim to roll it out hospital-wide to maximise time and cost savings, and improve the quality of care delivered to patients.