Towards higher efficiency for users in identification of medical devices for preventive maintenance(PM) to improve patient safety

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Background

There are more than 1000 B.Braun pumps (Infusion, Syringe) in SGH, of which approximately 70 are due for preventive maintenance (PM) every month across various locations. PM for this pump is a biyearly maintenance check that ensures the functionality of the equipment is within specification and is safe for use. Conventionally, the workflow *(Figure 1)* starts with the Biomedical Engineering Department (BME) notifying the users with a list of pumps due for PM. Users from various location will then identify the pump by the 7-digit Equipment Control Number (ECN) green sticker located on the top of the pump *(Figure 2)*. Locating the correct pumps for PM may be tedious and time consuming. As each pump is small and compact, it is challenging to check the ECN sticker when pumps are stacked on top one another *(Figure 3)*. It puts a strain on the manpower when nurses are required to occasionally toggle the task of identification with providing clinical care to patients. Consequently, the delay in the identification of the pumps can result in missed PM and ultimately compromising patient safety. Operationally, it will impact the overall completion of PM for the month, which is one of the KPI for BME.
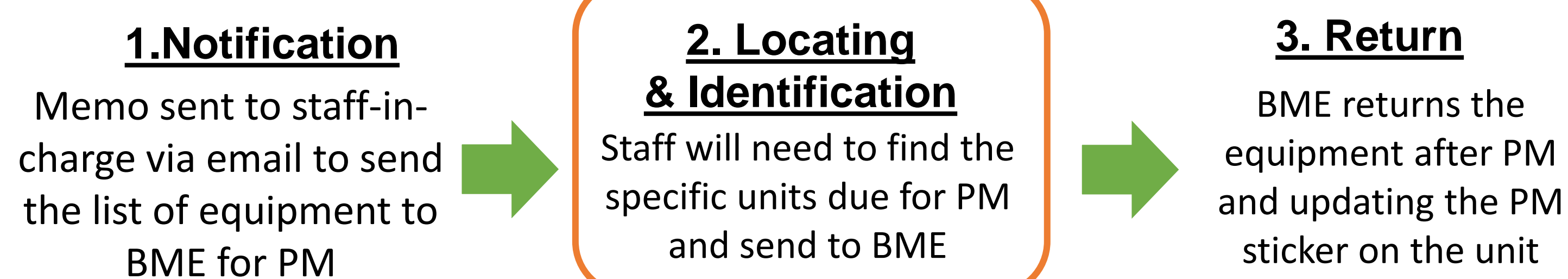
1.Notification
Memo sent to staff-in-charge via email to send the list of equipment to BME for PM

2. Locating & Identification
Staff will need to find the specific units due for PM and send to BME

3. Return
BME returns the equipment after PM and updating the PM sticker on the unit

Figure 1. The existing workflow for equipment due for PM every month

COMMISSION:
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40021889

B. Braun Singapore Pte Ltd
Tel: 6213 0933 Email: techsupport.sg@bbraun.com
PM Date: 4th Oct 2022
Done By: Guan Lin
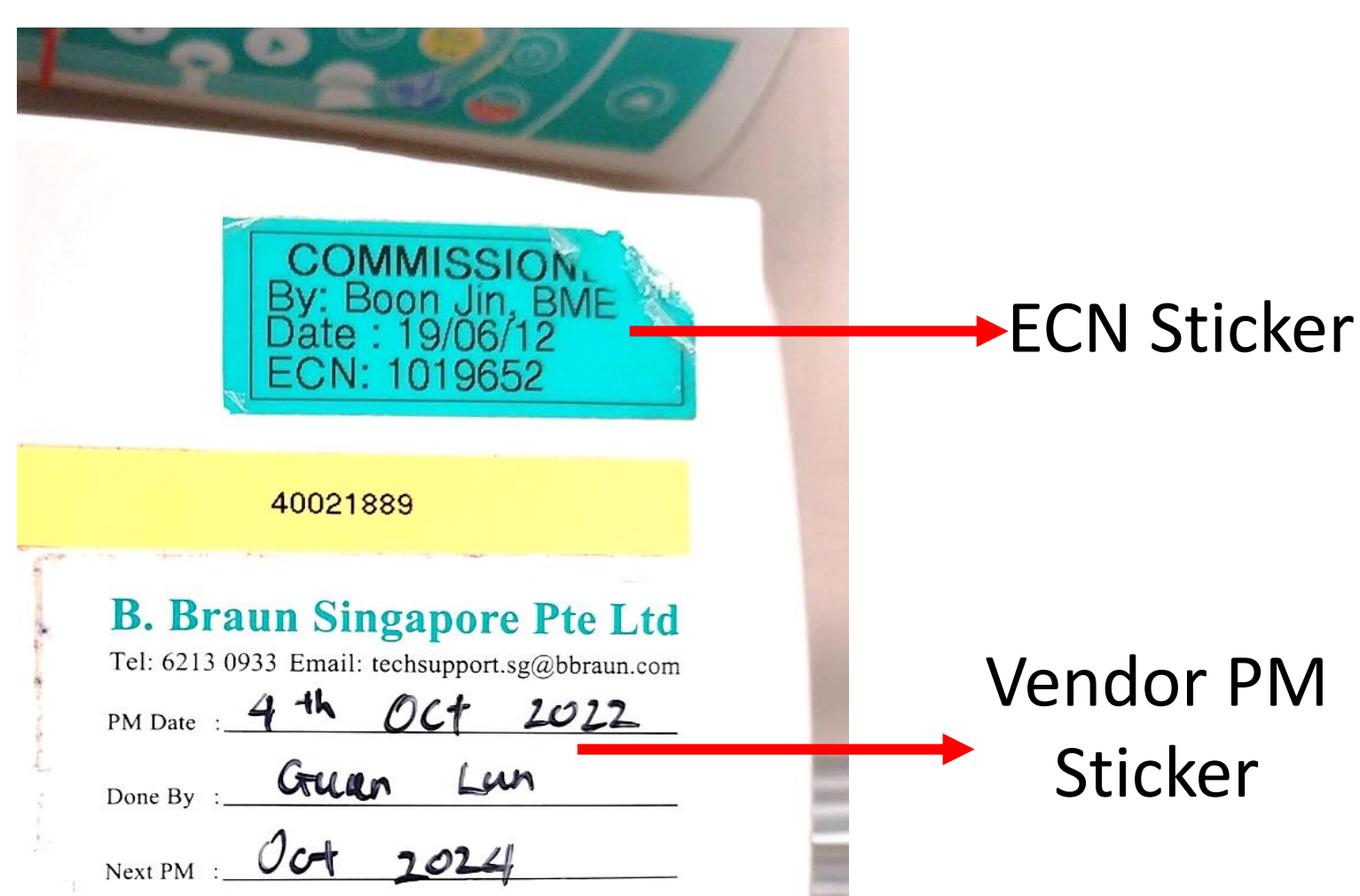Next PM: Oct 2024

← ECN Sticker

← Vendor PM Sticker

Figure 2. Picture from the top of the pump

Figure 3. Picture of stacked B.Braun Pumps

Mission Statement

To reduce the average time taken to identify one B.Braun Pump by 40% for the staff in W45, W48 and BME at accuracy of 100%, within a time frame of 5 months

Methodology

The team measured and calculated the average time taken to identify one pump, with total of 180 samples across three different locations, W48, W45 and BME accordingly. General observations and staff interviews were carried out after every set of data collection. The team acknowledged that the time taken is indeed lengthy due to the repetitive moving of pumps from housing stacks to check the 7-digit ECN against the list that they were given. This workflow, along with the large quantities of medical devices to identify, resulted in much frustration among the staff. Even with the new Real-Time Location Tracking System (RTLS), it is only indicative of zones in the wards and manpower is still required to locate the pump specifically within the zone.
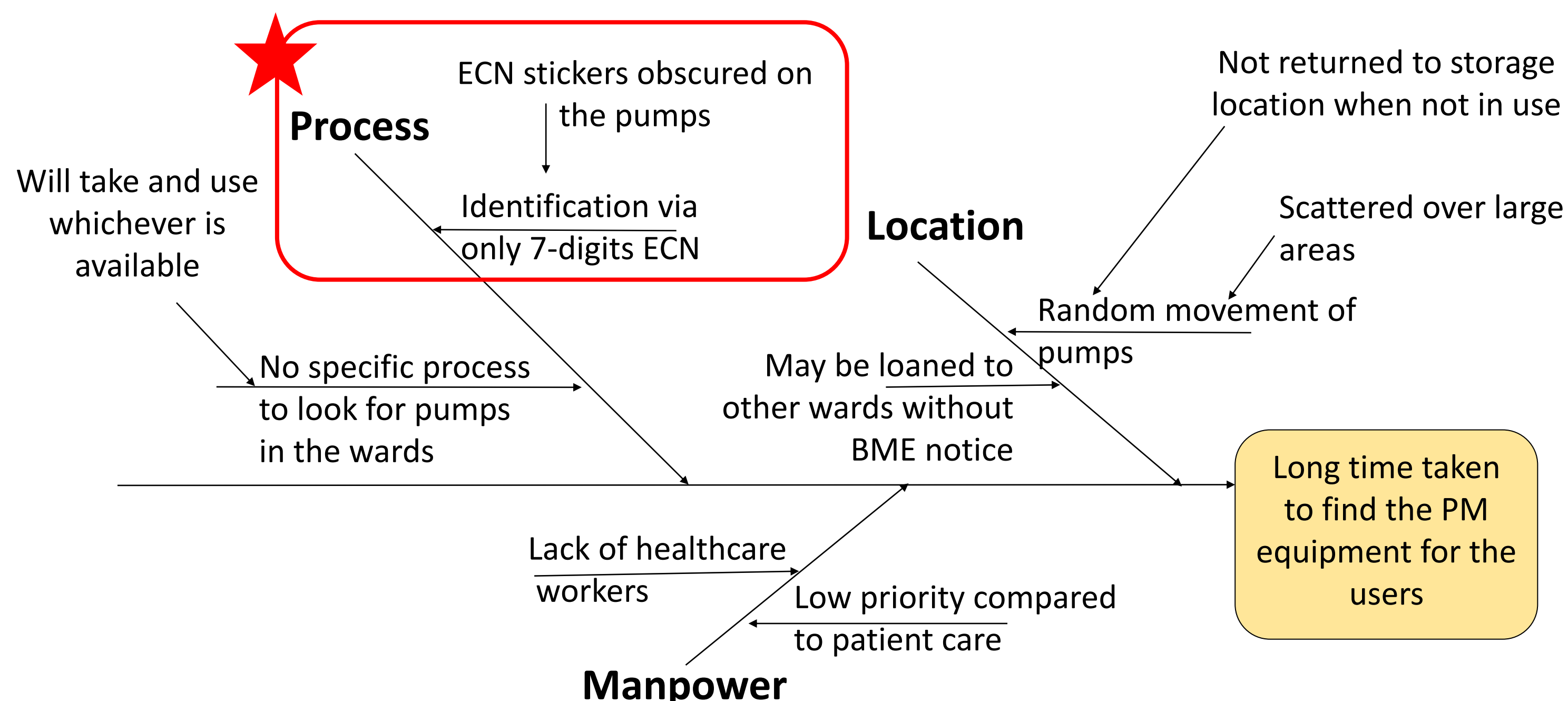

Figure 4. Cause and Effect Diagram of the problem statement

Using Fishbone Diagram in *Figure 4*, we analyzed the key determinants that slowed down the search of the equipment: 1) Process, identification using ECN is arduous and with stacked pumps, it takes even longer time to unstack and check the ECN. 2) Location, the pumps are spread across different locations 3) Lack of manpower. As some factors are not within BME's control, the team decided to simplify the process on effective identification of pumps for the users.

Solution

Inspired by a phone battery bar, we created a visual identification system *(Figure 5)* in the form of a sticker. It consists of three bars which represent every month in a quarter, denoted by a distinct bright color for every quarter. Also, whenever PM is done, BME will paste the color of the year on the last column *(Figure 6)*. Its systematic and colorful nature eliminates the need for users to meticulously cross-reference the ECN, allowing users to distinguish the right pumps from a distance away.
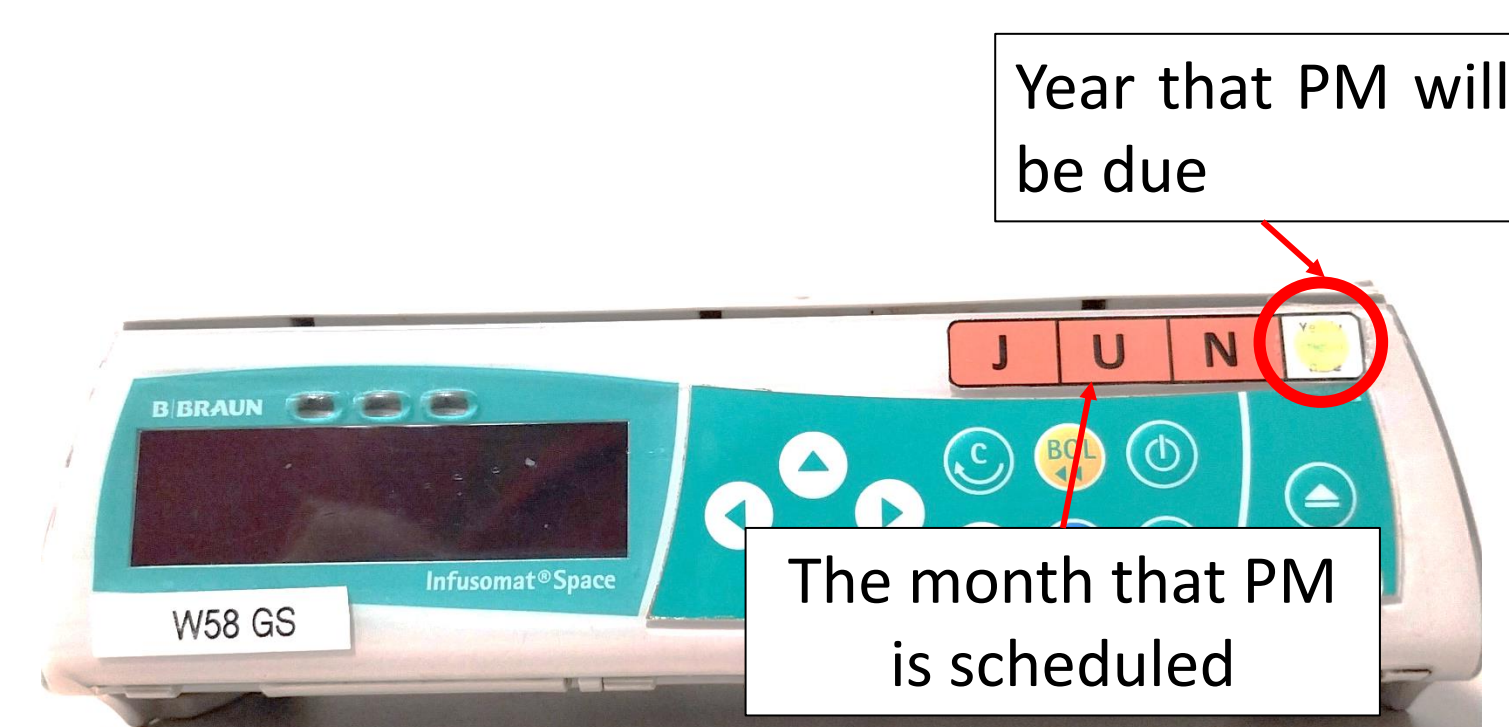

Year that PM will be due

The month that PM is scheduled

Figure 5. Picture of a fully labelled pump

Due in :
2025 (yellow) 2026 (green) 2027 (cyan)
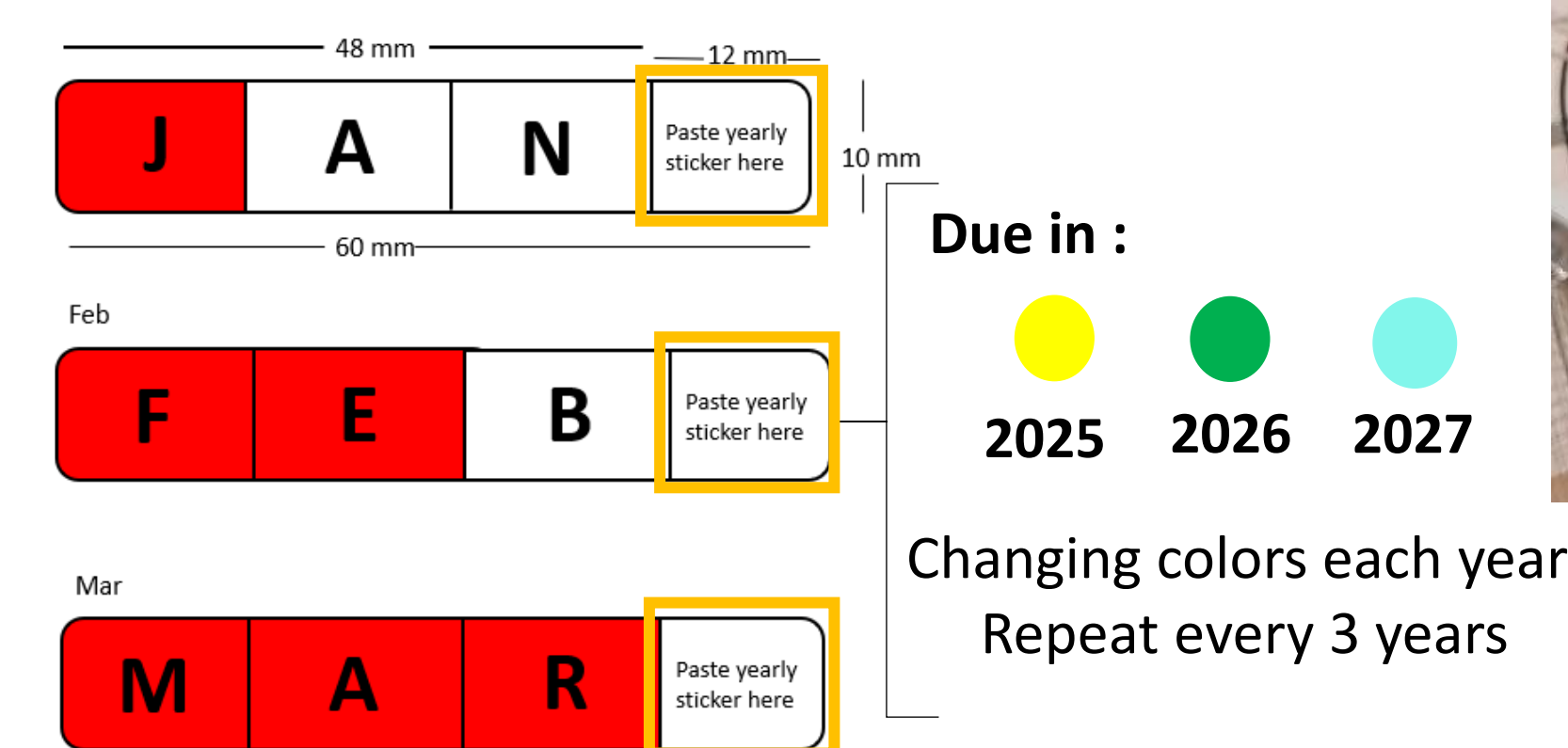Changing colors each year
Repeat every 3 years
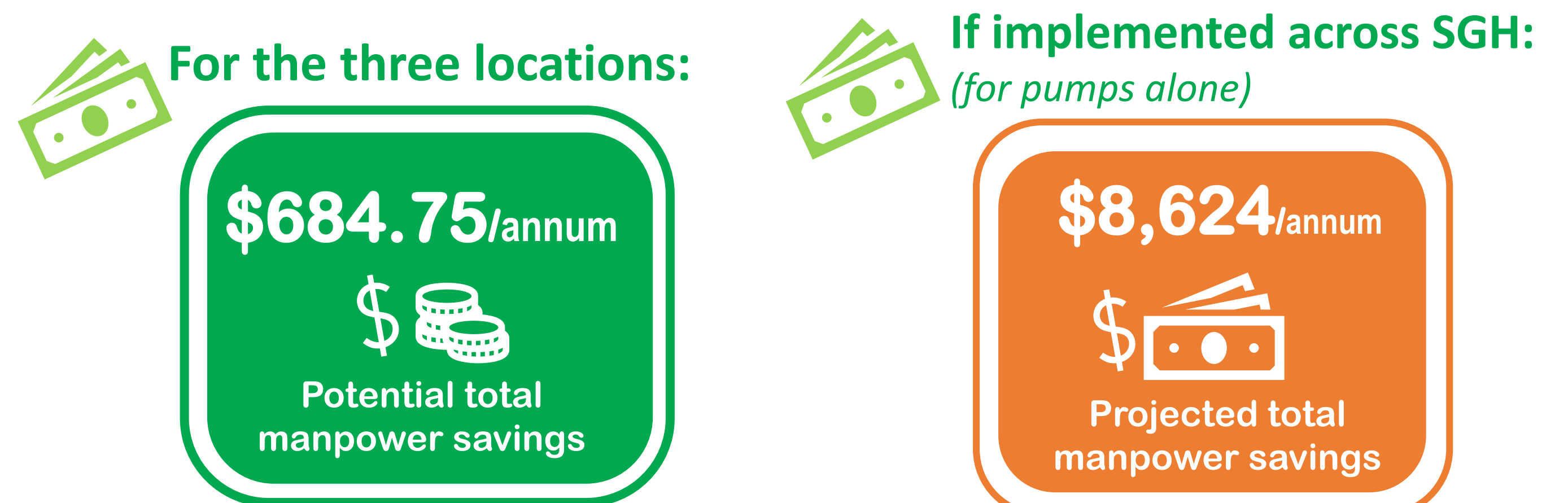
Figure 6. Features of the sticker

Figure 7. Picture of new stickers pasted on pumps inside the housing

Results

There was a huge improvement in the average time taken after post-implementation (total 187 samples) of at least 65% in all the 3 different locations *(Table 1)*. The team also performed a T-test comparing the pre-intervention and post-intervention data, obtaining a p-value of < 0.05, which is statistically significant.

Location	Average time taken pre-implementation (s)	Average time taken post-implementation(s)	Average time difference (s)	% Difference
W48	01:52	00:38	01:14	**66%**
W45	01:26	00:16	01:10	**81%**
BME	00:29	00:10	00:19	**65%**

Table 1. A comparison between pre-and post-implementation data and calculated percentage difference among the three locations

For the three locations:
$684.75/annum
Potential total manpower savings

If implemented across SGH:
(for pumps alone)
$8,624/annum
Projected total manpower savings

The solution was unanimously well-received by the nurses and BME technical staff, consequently improving their confidence in pumps identification. In addition to the positive feedback from the nurses, the solution also complements the RTLS in resolving the difficulty in identifying the stacked pumps.

Future works and Sustainability Plan

The team plans to scale up this new identification system by implementing across all the inpatient wards in SGH. The first stage will be targeted towards those that meets these three criterias:

☐ **High in quantity**
☐ **Portable or compact**
☐ **High usage**

This includes all B.Braun pumps, Welch Allyn monitors, transport ventilators and ECG machine. The total number of units is estimated to be around 3600 and expenditure for this implementation has been budgeted under BME Opex. After successfully completion, BME will continue to implement it for other types of medical equipment at SGH and also at other locations such as Emergency Department and Specialised Outpatient Clinics (SOC). As this solution eliminates the use of finding by ECN, it further streamlines the process of identification of equipment, improving workflow efficiency and manpower savings for the users as well as for BME.