Smart Bin
Safer, Reliable and Accurate!

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SingHealth

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BACKGROUND

Singapore General Hospital (SGH) Outpatient Pharmacy at Bowyer Block fills around 6000 prescriptions comprising more than 20,000 drug items per month. With this high item load, the potential risk of medication errors, especially wrong drug picked, can be significant. Medication errors have the potential to cause harm to patients.

The Smart Bin system was conceptualized to eliminate wrong drug picking errors and enhance patient safety. We collaborated with internal and external partners to implement this system, which offers a novel approach to handling high item loads safely.

METHODOLOGY

We conducted an extensive and targeted review of the drug picking workflow using a **Flowchart**. Through **Gemba Walk**, we observed the actual drug picking process and gathered feedback from pharmacy staff. The **Ishikawa Cause and Effect Diagram** was used to brainstorm root causes for incidence of wrong drug picking errors. To determine the final root causes, a **Pareto Chart** was constructed through multi-voting based on impact, frequency and prevalence for each of the root causes identified.

We brainstormed for solutions to eliminate wrong drug picking errors using a **Driver Diagram**. Final solutions were selected using a **Prioritization Matrix** through multi-voting based on the following criteria: effectiveness, ease of implementation, sustainability, and time/resources required. The Smart Bin system was designed to incorporate these final solutions.

Implementation of the Smart Bin system was done in two phases using **PDSA (Plan-Do-Study-Act)**, with the project timeline plotted in a **Gantt Chart**. A **Run Chart** was used to monitor the number of near miss involving wrong drug picked from Smart Bin per month over the project duration.

RESULTS*

Comparative analysis of medication near misses due to wrong drug picked was conducted before and after implementation of the Smart Bin system. Pre-implementation analysis from Aug 2015 to Mar 2016 showed that the number of medication near misses due to wrong drug picked was 4.8 per 10,000 items picked. After the Smart Bin system implementation, the number decreased to 0.3 per 10,000 items picked (93.8% reduction).

Cross-sectional satisfaction survey was administered among pharmacy staff. The survey showed that 82.8% of pharmacy staff agreed that the Smart Bin system was effective in reducing medication near misses due to wrong drug picked.
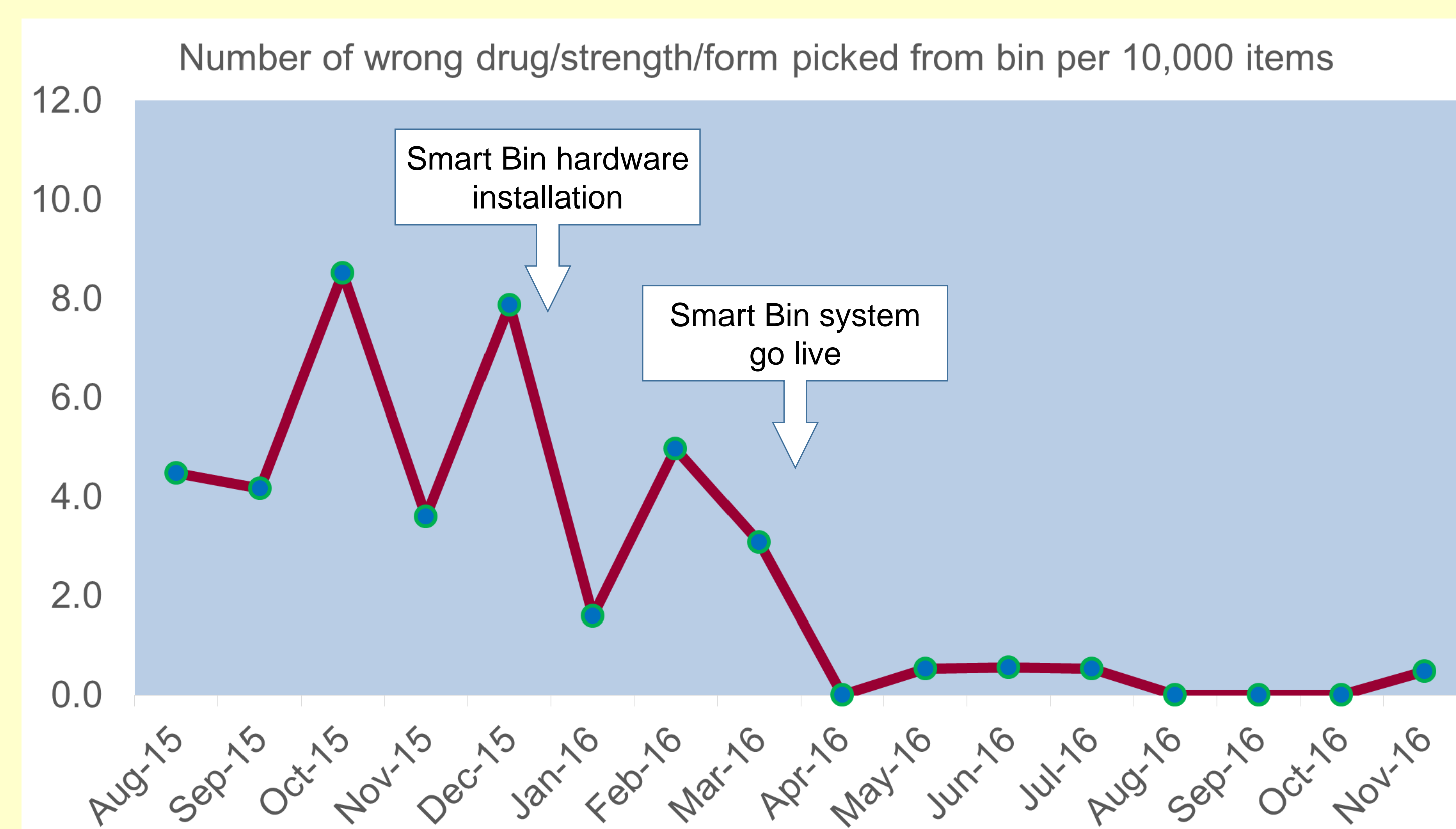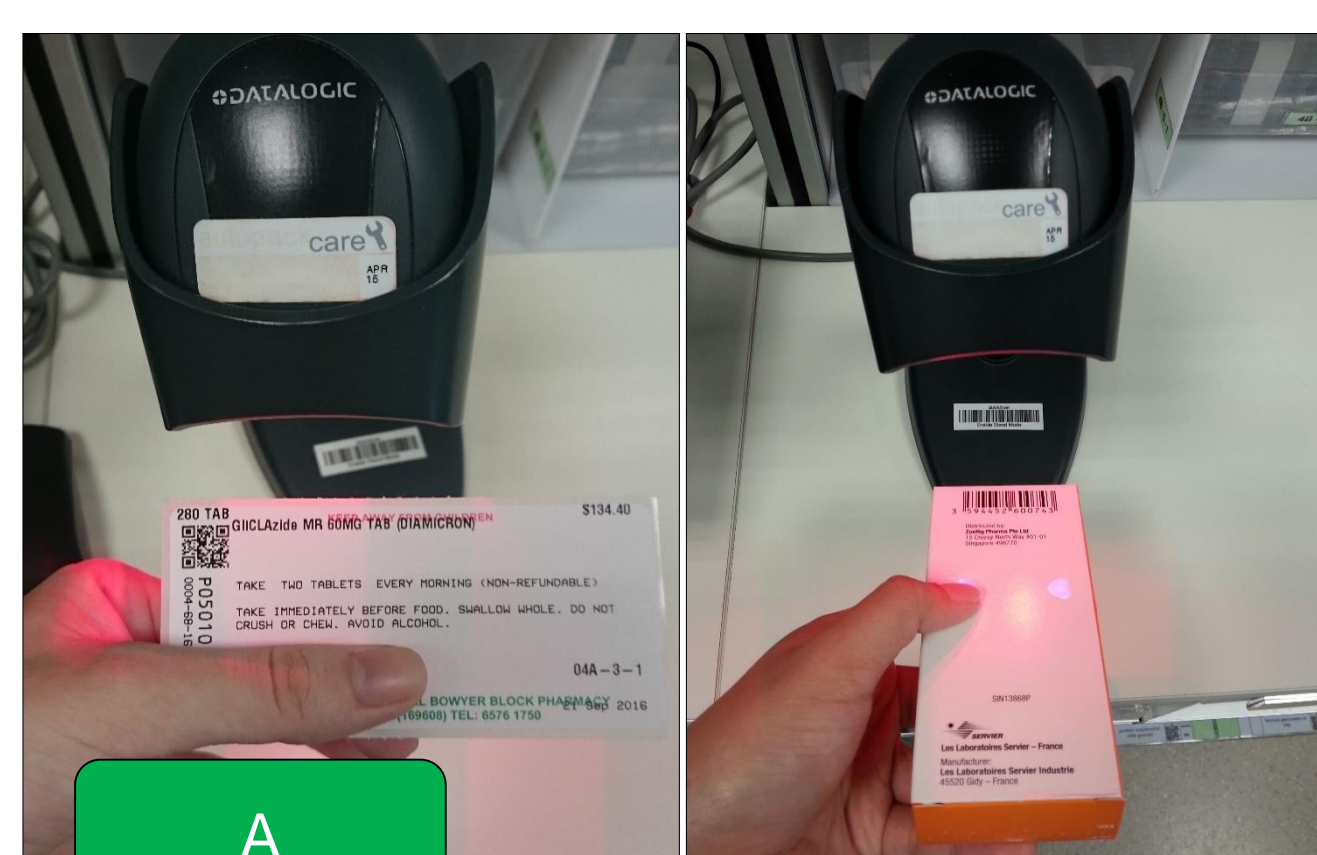

Figure 2: Analysis of number of drug items per 10,000 items picked erroneously picked from Smart Bin from Aug 2015 through Nov 2016

INTERVENTION

A: Scanning of quick response (QR) code on drug label or barcode on drug box triggers the Smart Bin system for picking from drug bin or loading / returning drugs to drug bin

The Smart Bin system uses light-emitting diode (LED)-guided pick coupled with locked bin concept. This system eliminates wrong drug picking errors arising from staff picking by memory or inadvertently from adjacent bin; and to track user ID to allow accountability and traceability.

The selected bin LED light ups and unlocks when staff scans either the patient drug label QR code for drug picking or the manufacturer's barcode on the drug carton for drug loading or returns (Figure 1).
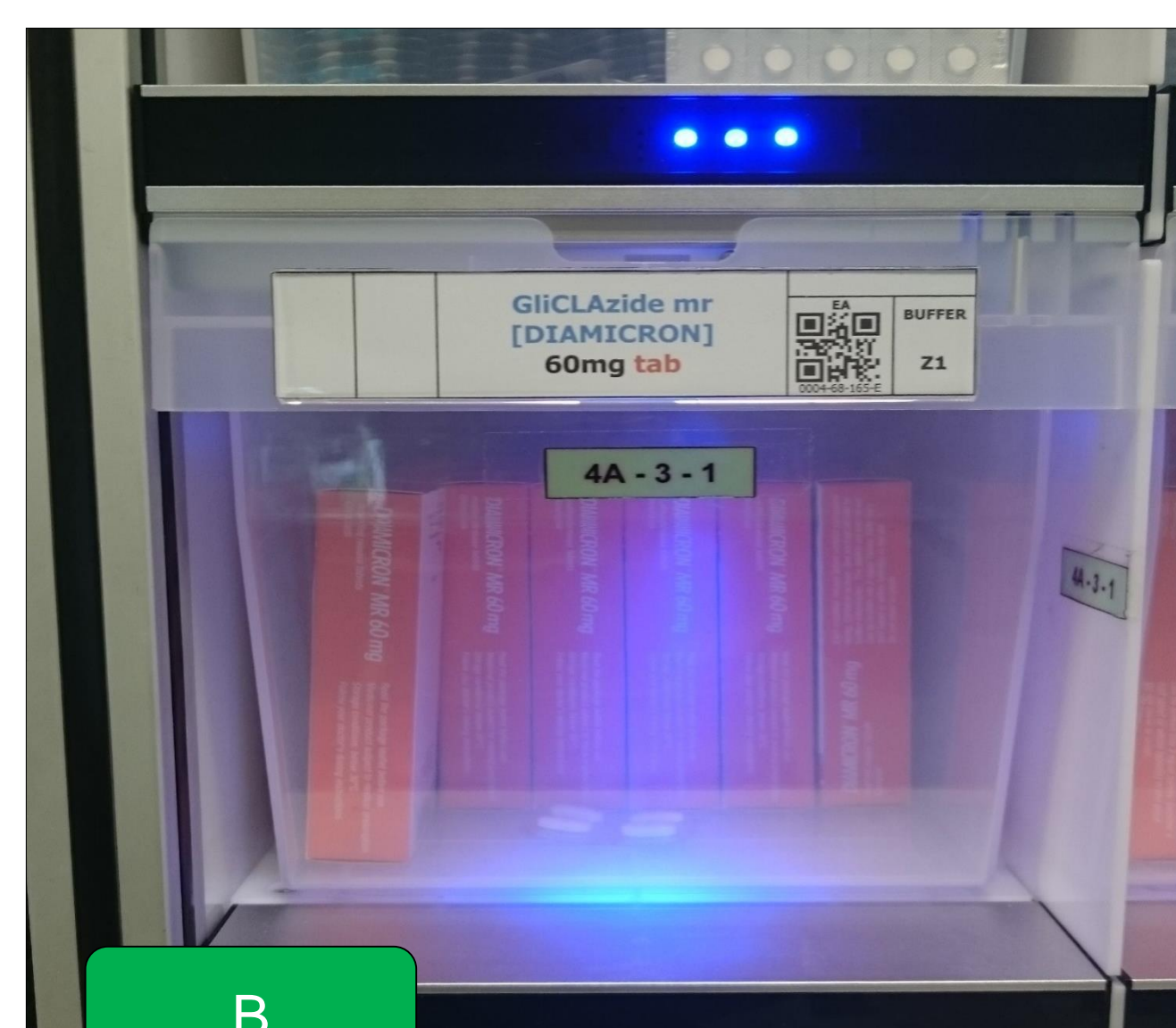
B: Light-Emitting Diode (LED) lights up, guiding staff to the correct drug bin

C: Locking mechanism unlocks, enabling staff to pick from drug bin or to load / return drugs to drug bin

Figure 1: Picking, loading, returns of drugs using the Smart Bin system

Improving patient outcomes

With higher picking accuracy (99.997%), medication near misses due to wrong drug picked from bin was reduced by 93.8%.

With assurance of correct medication prepared, dispensers are able to spend more quality contact time with patients, translating to better optimisation of drug therapy.

Optimizing manpower utilisation

With LED-guided pick, less time is needed to locate the correct drug bin, hence improving productivity.

Bins requiring top-ups are easily identified through generated reports or from blinking low-stock indicator lights.

Reducing healthcare cost

Accurate drug picks translates to cost avoidance from service recovery due to medication errors. These include, but is not limited to, manpower cost to conduct investigations and/or root cause analysis, cost of hospitalization and marred reputation/legal liabilities.

CONCLUSION

This Smart Bin system is highly suitable for pharmacies with space or budgetary constraints for setup of costlier and bulkier robotic picking system. To ensure that proper procedures are followed, we also used the **Failure Mode and Effects Analysis** to develop standard operating procedures for the Smart Bin system, addressing risks associated with human behaviour. We successfully incorporated the new system into our daily operations with sustained results since March 2016.

Using innovative technology to improve drug picking, this system has translated to better and quality service to our patients, in line with our hospital safety goal of "Target Zero Harm".