



**Singapore Healthcare Management 2024**

# Robots to augment the care team at the Emergency Department (ED)

Ho Wan Qi, Azfar Bin Jalil, Megan Wong, Vivienne Ho  
Changi General Hospital



Changi General Hospital  
SingHealth

## BACKGROUND

Being the second busiest ED nationwide, CGH's ED serves an average of more than 350 outpatients daily, on top of lodging inpatients. Increasing manpower or multi-tasking to cope with increasing workload were not viable in the long run, and manpower should be deployed to maximise the direct impact to patient care.

Three areas for improvement where autonomous mobile robots (AMRs) could potentially increase efficiency and productivity and enhance experience for patients and visitors were identified:

### 1. Wayfinding assistance:

- As a bi-level ED, where triaging first occurs at the lower floor and the bulk of P2 and P3 patients are directed to the upper floor for consultation and assessments after, majority of the patients would require to navigate to the lift to shuttle between floors.
- Due to bed capacity issues, a significant proportion of admitted patients will lodge in multiple inpatient lodging areas in ED while waiting for a bed to be available, and visitors would require assistance to visit their loved ones.

### 2. Blanket distribution:

As patients and visitors could get cold while waiting for consultation and tests, staff are deployed to distribute blankets in the waiting area, which remove them from other important duties.

### 3. Medication delivery:

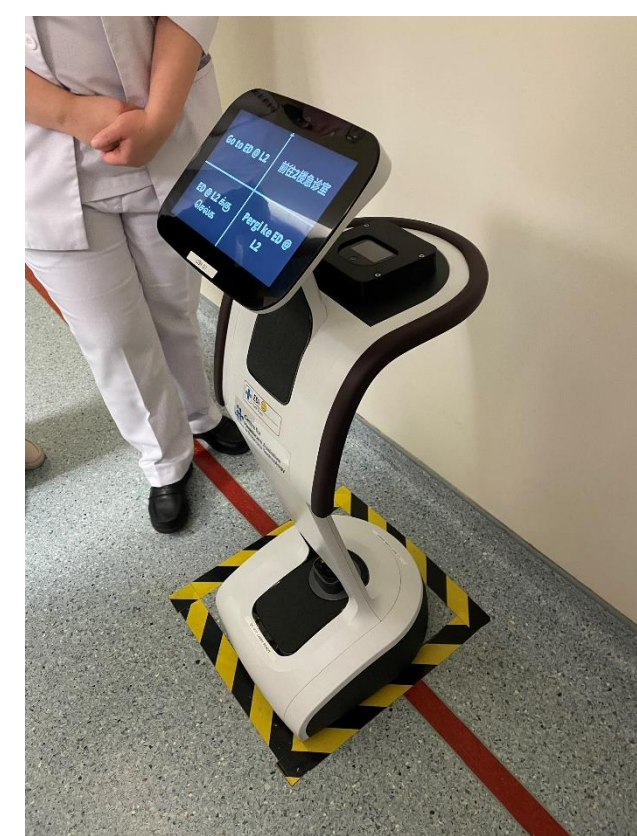
Certain medication may not be readily available in ED and staff will need to seek support from the pharmacy store to deliver medication, which takes time.

## METHODOLOGY

The project was mooted in April 2023 as an in-house collaboration with Centre for Healthcare Assistive & Robotics Technology (CHART), ED Operations, Nursing, Pharmacy and Facility Development (FD) and subsequently completed and deployed on August 2023.

The ability of AMRs to move through crowds and obstacles independently, as well as follow pre-set routes to perform tasks, made it an ideal solution for addressing the areas for improvement above. The AMRs are also capable of interactions with users and navigation of multiple scenarios, enhancing the patient experience both directly and indirectly.

Four of these AMRs, 1 to 1.3m in height, were planned for deployment at ED to augment manpower in the three functions identified.



### EDi: Robotic Patient Navigator

Deployed at two areas within the ED to aid patients and their visiting next-of-kin, two EDi robots usher them to their intended destinations, communicating in four languages with a smile, through its user-interface touchscreen.

### MEDi: Robotic Medication Delivery

Controlled via a tablet on either starting or ending locations of its route, MEDi has an in-built storage system that can transport up to four baskets of medication in four separate compartments, thereby serving four different areas in the ED in each trip it makes before it needs to be restocked.



### BLANKi: Robotic Blanket Distribution

A roaming robot that moves around the P2 waiting areas, BLANKi allows patients and visitors who may feel cold to retrieve blankets at their convenience, thus helping to enhance the overall comfort and well-being of individuals while awaiting further medical attention.

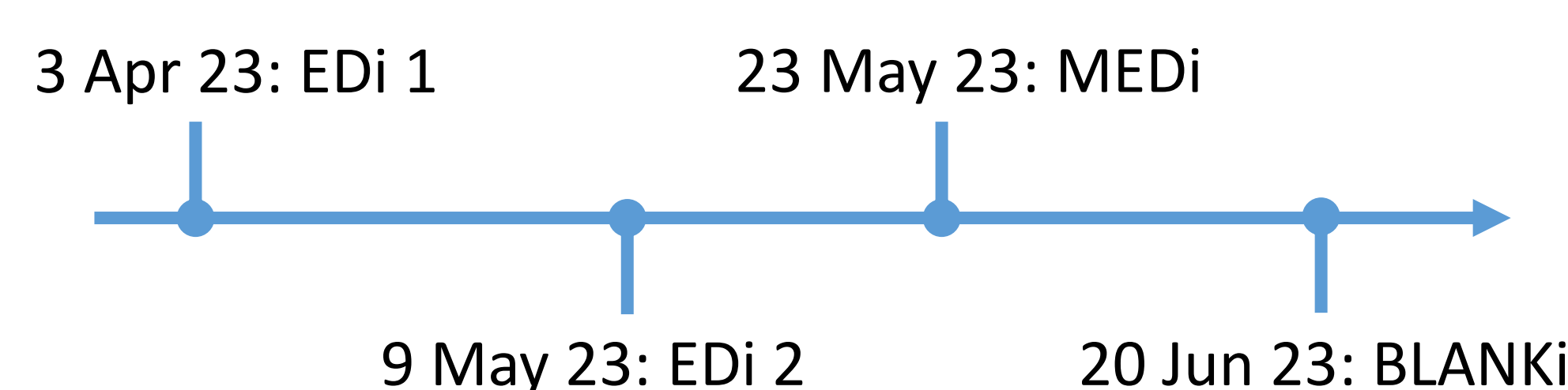


## IMPLEMENTATION

There were some shortcomings of AMRs, such as the inability to enter lifts or open doors and being operable at only one level. They would also have to be charged and there are some periods of downtime when human intervention is required. Evaluation of the scope that the robots would cover had to be performed.

After charging spaces were created and route maps were designed, the robots were deployed conveniently with minimal disruptions to day-to-day operations, as robots and humans were able to work together seamlessly.

### Timeline of progressive rollouts of the AMRs:



Further deployments of robots were rolled out to serve a bigger suite of functions and audience progressively. The robot trio are still being used in ED and has helped to channel manpower resources towards direct patient care, by alleviating the need for staff working in ED to perform lower-value repetitive tasks.

Adequate in-house support was also critical to ensure positive long-term user experience.

## RESULTS

### 1. Time Savings



### 2. Better focus on Emergency Care

The care team has more valuable contact time with patients to better serve patient needs, and manpower could be better deployed to areas where human intervention is necessary, especially when the hospitals face manpower constraints.



### 3. Improved Overall Patient Experience

BLANKi, being a self-help roaming robot, is able to extend its service to all patients at the waiting area, as opposed to a staff member who would be shuttling between functions, blanket distribution being only one of it.



### 4. No compromise to patient safety

The robots have served their functions reliably with no human intervention required, and without posing any risk to visitors.



## CONCLUSION

As workload continually grows with the ageing population in Singapore, hospitals would continue to face the perennial issue of manpower constraints. Other than improving workflows where possible, there should also be considerations to tap on mechanical resources, which had been progressively introduced since the COVID-19 pandemic, to relieve the burden on manpower resources.

The robot trio, EDi, MEDi and BLANKi, had helped save on manpower resources, which is now better deployed for other more important functions that require human interventions. With the presence of the robot trio, it has not only driven an efficient and better use of existing resources, but also created a novelty for patients and next-of-kin who wait in ED. The project had yielded promising results and it also underscored the importance of embracing technological solutions for sustainable healthcare.