Fall Prediction and Prevention in Inpatient Open-Cubicle Wards

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ST. ANDREW'S COMMUNITY HOSPITAL

Introduction/Background

- St. Andrew's Community Hospital (SACH) is a service under the St. Andrew's Mission Hospital group. In addition to inpatient rehabilitation, subacute and palliative care, SACH also operates home care and home palliative care; centre-based day and rehabilitative care; and outpatient and migrant worker clinics.

- SACH Ward 66 provides subacute stroke. The patients are mostly elderly, have cognitive impairment and poor safety awareness, and have gait imbalance and muscle weakness. They often try to get out of bed and walk without calling for assistance, thus resulting in falls. The fall rate was at 1.20 per 1,000 bed days in 2022.

Goal/Objective

- To achieve the following objectives by the end of 2023:

  1. Fall detection rate of >=80%^ for bed-exit prediction for 8-bedder open cubicle ward.

  2. 67%* saving in manpower hours.

  3. 34%* reduction in falls rate in SACH Integrated Building Ward 66 (Stroke Rehabilitation) open-cubicle ward.

^: TTSH's target detection rate was at 100% for single rooms. SACH moderated it to 80% for 8-bedder open cubicle wards
*: Reference targets from TTSH's PreSAGE pilot for single rooms

Problem Analysis

- SACH conducted a **FMEA workshop** to prevent fall incidents and has been actively instituting measures to try and reduce fall incidents, and has a dedicated committee overseeing the issue. Though there has been a reduction in the fall rate, we believe that it can come down further, and that **the gains must be through technology** rather than manual methods or through increasing manpower.

- With the successful implementation of PreSAGE®# at TTSH in all their single-bed and isolation rooms, SACH explored the feasibility of adopting the solution in the inpatient subsidized open-cubicle wards.

- PreSAGE, Provider B and the SACH existing pressure-based system were tested for reliability. Ten different scenarios (with each repeated 3 times) were done to determine reliability and repeatability. The results, in Table 1, show that PreSAGE had on the whole come out on top.

Considerations	Criteria	SACH Existing bed-exit sensor	PreSAGE	Provider B
Ease/ Time to set-up		Easy/ 2-3 mins	Very Easy/ <1min	No provision
Detection Rate	>=80%	40%	80%	60%
False Alarm Rate	<=5%	4%	0%	13%
Reliability/ Repeatability	<=95%	87%	100%	40%
Time to trigger alarm (median)	<=3 sec	3.6 sec (18 alarms)	2.7 sec (36 alarms)	Unable to measure

Table 1. Comparison of performances of SACH existing bed-exit sensors, PreSAGE and Provider B

Implementation Plan

- SACH adopted the PreSAGE®# bed-exit sensor and installed 20 units at the open cubicles and 2 units at the Isolation Rooms in one of our sub-acute wards from Apr 2023.

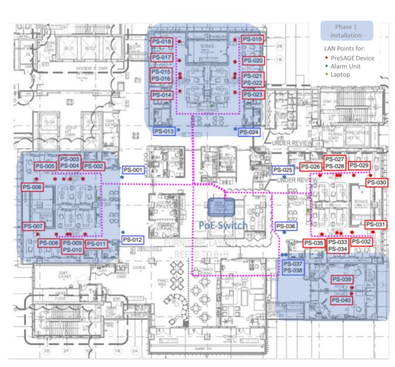

Figure 1. PreSAGE® sensor units installed at Sub-acute Ward 66.

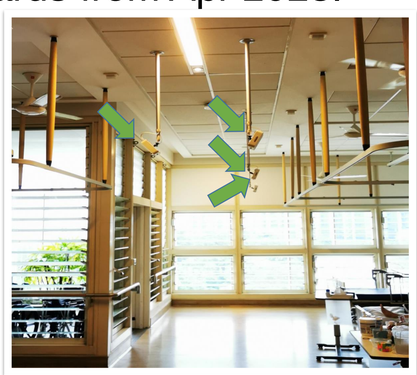

Figure 2. Alarm units on the ceiling

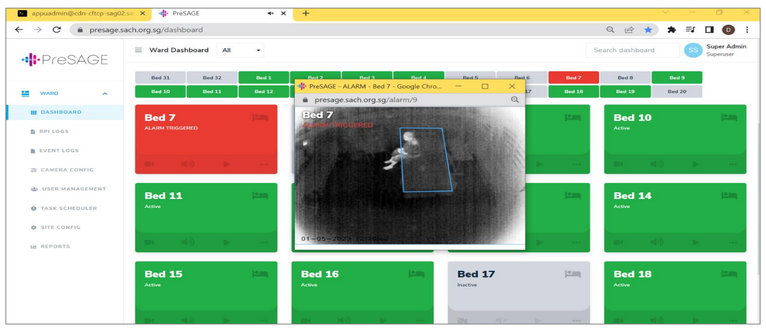

Figure 3. Live dashboard enables staff to continuously monitor patients remotely and automatically

Benefits/Results

- Analysis of 3-day (72 hours) data in Sep 2023,
  - **True Positives (Correct alarm triggers): 78%**
  - False Positives (False Alarm triggers): 22%
  - False Negative (Potential Fall without alarm activation): 0%

- Achieved **96% saving in man-hours** which is equivalent to approximately one nursing FTE avoided on setting up and performing functional check for bed-exit sensors.

	Time to setup and perform function check for 20 beds for 3 shifts (hours/ year)	Remarks
Existing Bed Exit System	2,190	6 mins per bed
PreSAGE	73	12 sec per bed
Time-saved	**2,117**	

Table 2 Time-saved in setting up bed-exit sensor by application of PreSAGE®

- **Fall rates reduced by 44%** in the open cubicles of Ward 66. (Refer to Figure 4)

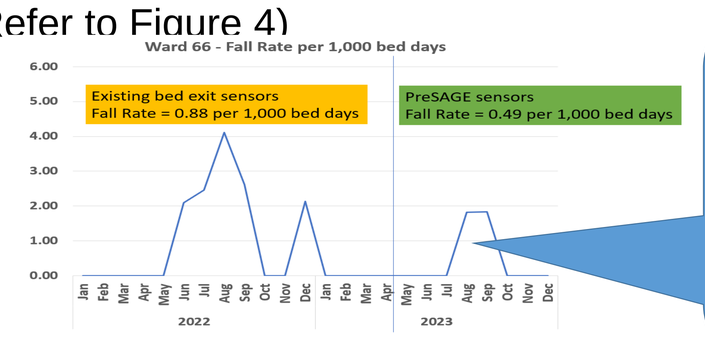

Figure 4. Ward 66 Fall Rates per 1,000 bed days between 2022 and 2023

Sustainability & Reflections

- Technical aspects:
  - False alarms are mostly due to patients extending one leg out of the bed or family member leaning towards the patients on the bed. Optimization and AI learning helped to address the issues.
  - Lack of visual cue (or display) indicating the bed number when PreSAGE alarm is triggered, a structural issue that can be overcomes.
- Resources:
  - Lack of manpower attending to PreSAGE® alarm triggered by possible fall incident remains a challenge. It is therefore important to involve all care staff and family members/ caregivers to work together to prevent falls in the wards.

#: PreSAGE® is based on a thermography sensor that generates thermal images to predict bed exits through the use of artificial intelligence (AI) software