**Augmenting inpatient ward operations with innovative technology in Public Healthcare Institutions (PHIs)**

**A. Problem Statement (Current State)**

The healthcare industry faces increasing demands and a growing shortage of healthcare professionals.[1,2] Healthcare professionals and practitioners can potentially boost efficiency, minimise cost, free up their time and focus on more critical work with the help of advanced technologies[3], features, and innovations (i.e., process redesign, automating or streamlining irrelevant/repetitive/time-consuming tasks, robotics). The inpatient ward setting presents numerous opportunities for innovation and creative solutions to ease the problems of manpower demands.

The following are the current challenges:

1. **Need for a more efficient delivery system of meals to patients in the inpatient ward:** The nursing team seeks innovative solutions to partially or fully automate the delivery of meals to patients in the inpatient ward setting. This will reduce the manpower requirements for what is undoubtedly a manual and labour-intensive process that occurs daily.

2. **Need for surveillance system to monitor patients during their stay:** The nursing team seeks a solution to monitor patients during their inpatient stay, particularly at night when manpower resources are at their leanest. Of interest is a system that can improve fall prevention and detection, detect aggressive behaviour, and detect patients who may need assistance but are unable to reach the call bell. Such patients might use other methods – e.g. to moan/groan/shout to get attention instead.

3. **Need for remote system to communicate with patients for non-urgent matters:** Sometimes, patients who require non-urgent medical attention will press the call bell incessantly to attract the attention of the nursing staff. Currently, in such situations, nurses have to go back and forth from the nursing counter to the patient's room, which may lead to additional effort that hinders their workflow. The nursing team is looking for a solution to better engage patients with non-urgent medical needs while minimising disruptions to the nurses' work.

4. **Need for automation of reminders and announcements at fixed intervals throughout the day or on-demand:** Visitors tend to stay beyond the visiting hours, and nurses have to constantly remind them to leave the wards so that the patients can have adequate rest. However, visitors who are overstaying may be unhappy to leave the wards and may express dissatisfaction with the staff. Therefore, a solution is required to remind visitors to leave at the end of visiting hours and to minimise or eliminate the need for nurses to be involved.

5. **Need for a solution to ensure ward corridors are free of congestion:** The corridors in the ward are to be kept open and free of congestion, so that patients can be moved

easily and quickly from one place to another, especially in the event of an emergency. A solution is needed to clear a congested thoroughfare on demand without involving ward staff.

## B. Challenge Statement

How might we improve inpatient ward processes to reduce manual operations and improve staff productivity and efficiency in the management of:

i.      Food delivery to patients during meal times (to also include delivery of small items, hot drinks and snacks on demand);
ii.     Patient surveillance during their stay, especially at night, to improve fall prevention and detection, detect aggressive behaviour as well as identify patients who might need assistance;
iii.    Communication with needy patients for non-urgent medical situations while allowing nurses to continue with their work with minimal disruptions;
iv.     Announcements to visitors at the end of visitation hours; and
v.      Congestion in the main corridor in the ward.

## C. What Are We Looking For? (To-Be State)

1. Join us in the search for technology-enabled solutions to achieve the desired state of:

a. **Enhanced productivity and efficiency** – reduce involvement of ward staff in delivering meals to their patients; minimised need for ward staff to walk to patient's bedside for non-urgent communication; automated announcements after visitation hours; and clearance of congested walkways.

b. **Predictive and analytics capabilities** – to anticipate when patients are about to fall and prevent it from occurring; detect unusual patient behaviour and initiate a timely response to ease the situation.

2. Overall performance requirements:

a. **Intuitive user experience:** All nurses and hospital operational staff must be able to quickly self-help with the solution(s) with minimal guidance.

b. **Scalable:** The proposed solutions must be easily scaled across Singapore's healthcare clusters and with potential roll-out to nursing homes within one to two years, following successful trials and refinements.

c. **Well-secured:** Any recommended solutions must undergo regular risk assessment and adhere to the cybersecurity standards to secure private health data and protected health information.

d. **Cost-effective:** The proposed solutions must be cost-effective to support the solution in scaling across hospitals and other potential healthcare settings.

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[1] Lee, B., & Lim, J. (2022, December 14). *Commentary: Singapore needs more doctors, but setting up a fourth medical school isn't the answer*. CNA. Retrieved February 6, 2023, from https://www.channelnewsasia.com/commentary/singapore-doctor-get-medical-school-healthcare-system-3138696

[2] RSM Chio Lim LLP. (2022, March 29). *Navigating workforce shortages in healthcare sector*. RSM Singapore. Retrieved February 6, 2023, from https://www.rsm.global/singapore/insights/our-expert-insights/navigating-workforce-shortages-healthcare-sector-0

[3] Haleem, A., Javaid, M., Pratap Singh, R., & Suman, R. (2022). Medical 4.0 technologies for healthcare: Features, capabilities, and applications. *Internet of Things and Cyber-Physical Systems*, *2*, 12–30. https://doi.org/10.1016/j.iotcps.2022.04.001