Decision Support for Crisis Emergency Response in Nursing (DiSCERN)

A/Prof Sean Lam[1], Esther Fan[2], Ronald Cheong[1], Brandon Wong[3], Gregory Koh[3], Xaver Tan[3], Fazila Aloweni[2], A/Prof Ang Shin Yuh[2]

1. SingHealth Health Services Research Centre, 2. Singapore General Hospital, 3. Ngee Ann Polytechnic School of InfoComm Technology

Background

- As the flagship emergency service of Singapore, Singapore General Hospital (SGH) has been involved in providing medical care for civil disasters of the nation from our early days as a nation (Singapore General Hospital, 2020). Examples are the Sino-Malay riots in 1964 and collapse of Hotel New World in 1986 among other disasters.
- Today, SGH continues to provide medical care during civil emergencies (CE) and there are detailed plans and routine CE exercises to ensure that SGH is prepared to provide the medical care required.
- During a CE, the nursing management is responsible for hospital bed management.
- The current **manual** process of having to refer to the civil emergency (CE) plan to make plans for bed management is **very time-consuming**.
- During a CE activation, the nursing management is required to **react swiftly to multiple situations**.
- **Automating** the manual process of reviewing the CE plans will **greatly reduce the time taken** in deciding the **best approach to bed management.**

Aim

To develop a web-based application driven by a rule-based model to advise decision makers on bed management and augment the response against future infectious disease outbreaks or mass casualty circumstances.

Methodology

1. **Design Thinking**
   The design concept was wireframed based on user personas of nurse managers and planners. Functionality and design were refined continuously based on iterative user feedback.
2. **Collaboration**
   Regular Sprint meetings were conducted, either physical or virtual, to engage project stakeholders to understand the concepts and gather feedback on the deliverables.
3. **Agile Development**
   Regular stand-up meetings were conducted for the development team to share progress and impediments. Product and Sprint backlogs were used to track work progress, with well-defined Sprint goals to deliver product increments.
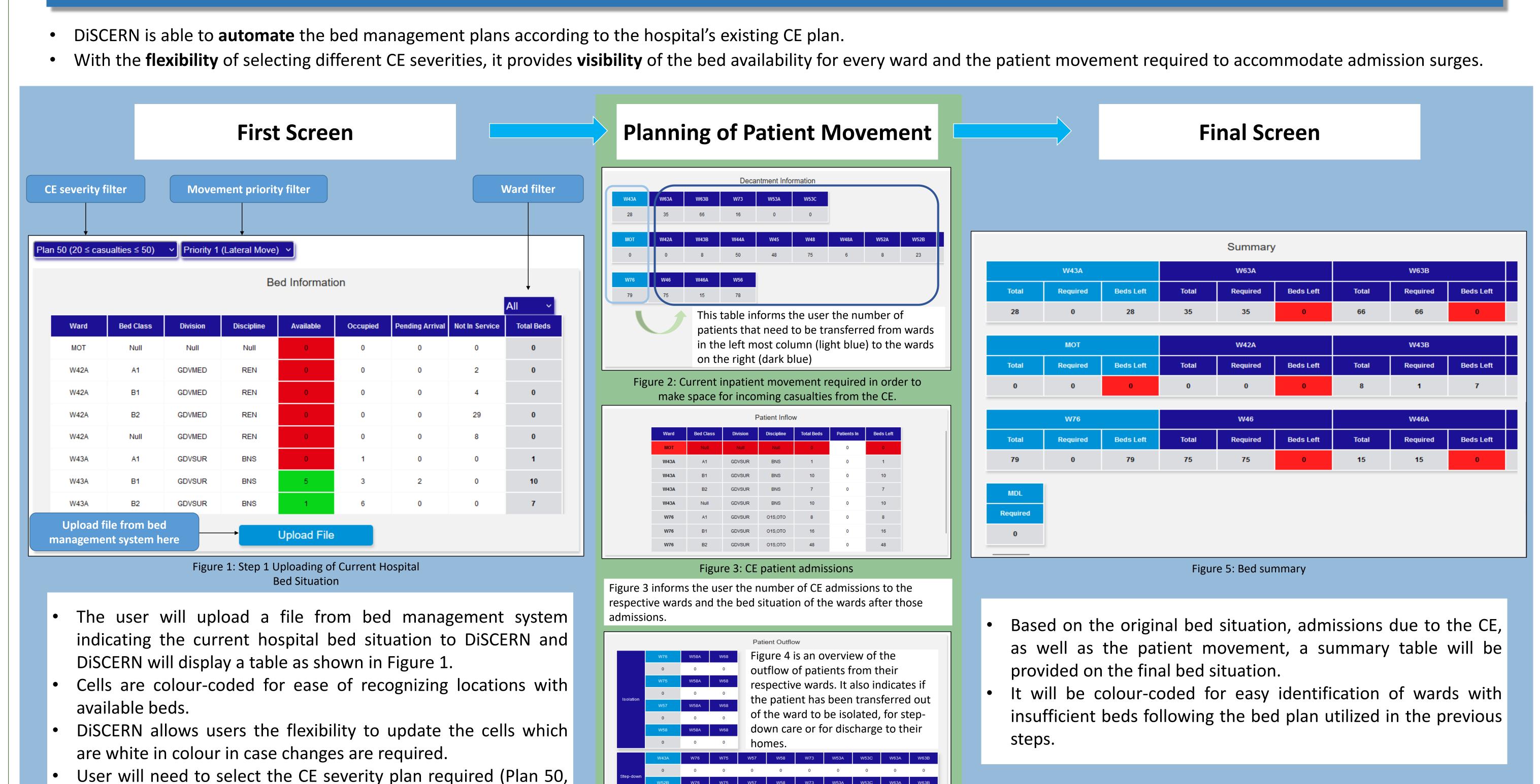4. **Technology Stack**
   Django, a full-stack Python web framework, was used for the backend to serve responsive user interfaces (UI) using Bootstrap. A REST API was built using a Python Flask API framework to encapsulate the model and communicate with the UI. SQL and NoSQL in-memory databases were used to store user authentication details and generated results, respectively.
5. **Deployment**
   DiSCERN was designed to function in the cloud or on a standalone computer. As this is still a works-in-progress, DiSCERN is currently deployed in the nurse managers' systems.

Results

- DiSCERN is able to **automate** the bed management plans according to the hospital's existing CE plan.
- With the **flexibility** of selecting different CE severities, it provides **visibility** of the bed availability for every ward and the patient movement required to accommodate admission surges.

First Screen

Figure 1: Step 1 Uploading of Current Hospital Bed Situation

- The user will upload a file from bed management system indicating the current hospital bed situation to DiSCERN and DiSCERN will display a table as shown in Figure 1.
- Cells are colour-coded for ease of recognizing locations with available beds.
- DiSCERN allows users the flexibility to update the cells which are white in colour in case changes are required.
- User will need to select the CE severity plan required (Plan 50, Plan 100, Plan 260).
- User will also need to select the movement priority.

Planning of Patient Movement

This table informs the user the number of patients that need to be transferred from wards in the left most column (light blue) to the wards on the right (dark blue).
Figure 2: Current inpatient movement required in order to make space for incoming casualties from the CE.

Figure 3 informs the user the number of CE admissions to the respective wards and the bed situation of the wards after those admissions.

Figure 4 is an overview of the outflow of patients from their respective wards. It also indicates if the patient has been transferred out of the ward to be isolated, for step-down care or for discharge to their homes.

Figure 4: Patient outflow from the wards

Final Screen

Figure 5: Bed summary

- Based on the original bed situation, admissions due to the CE, as well as the patient movement, a summary table will be provided on the final bed situation.
- It will be colour-coded for easy identification of wards with insufficient beds following the bed plan utilized in the previous steps.

Conclusion

- DiSCERN **automatically** provides an overview of the bed situation based on the CE plan.
- This enables the nursing management to make **quick informed decisions** regarding the patient movement required to accommodate sudden increase in bed demand.
- Future work will focus on expanding the platform's capability to support **nursing manpower planning** required as a result of surges in bed demand.

Reference

Singapore General Hospital. (2020). Responding to Civil Emergencies. Retrieved on 27 June 2023 from https://www.sgh.com.sg/SGH200/Pages/Civil-Emergencies.aspx

Acknowledgements