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Impact of crowding on return visits in the emergency department

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Introduction

- Overcrowding in the emergency department (ED) occurs when the demand for services in ED exceeds the capacity of ED to provide quality care in a timely manner.
- We hypothesized that crowding is associated with increased risk of return visits (RV).

Data source and cohort

- Used the provided subset of a deidentified population-based administrative ED visit database from Alberta for the period from January 1, 2018 to January 5, 2021.
- Excluded ED visits with an unknown disposition group (labeled as “Active”) and restricted the data to the pre-COVID pandemic period in Alberta (before March 13, 2020).

Data enrichment

- The exact timing of an ED visit was not provided in the provided database.
- Simulated a time down to the minute using an iterative simulation-based approach in which we drew a random time in the day uniformly such that it would not cause any conflict with subsequent visits (if any) of the same patient.

Exposure: crowding

- Determined the capacity of each hospital’s ED as the maximum number of patients present in the ED at any time during the study period.
- **Initial crowding:** the number of patients at the beginning of the ED visit divided by the corresponding capacity
- **Average crowding:** the average number of patients during the ED visit divided by the capacity.

Conceptual map

- Built on the existing ‘input-throughput-output’ conceptual map of ED crowding with cause of ED revisit classified into three categories (***Figure 1***).

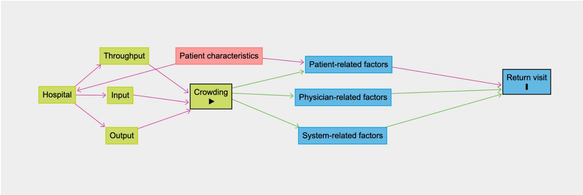

Figure 1. Simplified conceptual map of emergency department crowding (A. D. McRae et al., 2022, Can J Emerg Med; Sartini et al., 2022, Healthcare; M. Alshahrani et al., 2020, JMDH).

Descriptive analysis

- Compared the cumulative incidence curves using the gap time scale for different levels of crowding across triage codes (Emergent=1,2; Urgent=3; Non-urgent=4,5) and hospital type.
- No differential effect of crowding was found for emergent cases and cases at teaching and urban ambulatory hospitals (***Figures 2 and 3***).
- However, there was a positive association between crowding and cumulative incidence of RV for non-emergent cases and cases at urban and rural hospitals.

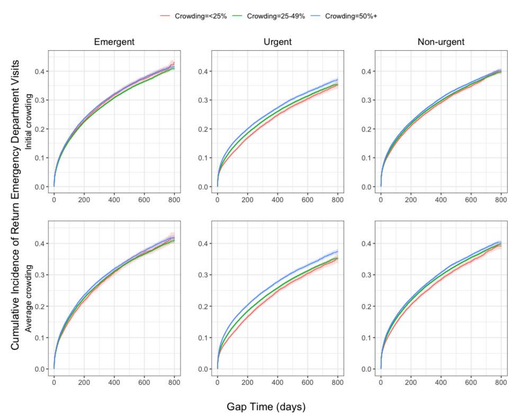

Figure 2. Cumulative incidence curves of return emergency department visits under the gap time scale across triage codes (Emergent=1,2; Urgent=3; Non-urgent=4,5) using two measures of crowding (top: initial; bottom=average).

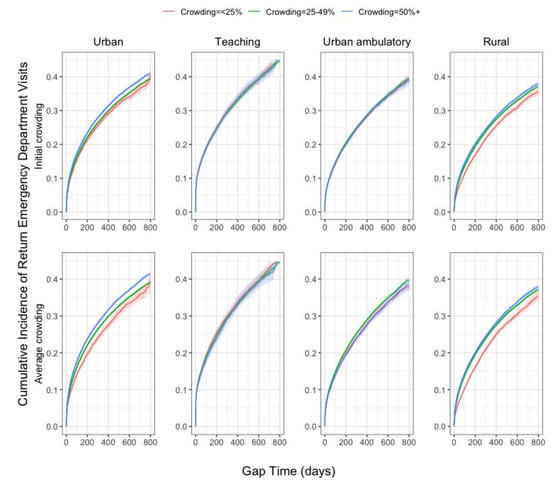

Figure 3. Cumulative incidence curves of return emergency department visits under the gap time scale across the hospital type using two measures of crowding (top: initial; bottom=average).

Regression analysis

- A maximum of four revisits per subject were included in the analysis due to small strata size limitations. Our final sample consists of 424,828 subjects (***Table 1***).

Number of RV	0	1	2	3	4	Total
Patient Count (%)	331,317 (78.0%)	63,804 (15.0%)	17,399 (4.1%)	6,154 (1.4%)	6,154 (1.4%)	424,828 (100.0%)

Table 1. Distribution of the number of RV of patients in the final sample

- Two time-scales: calendar time (CP) and gap time (GT).
- The recurrent events analyses were conducted using three models:
  - Andersen-Gill (AG)
  - Prentice-Williams-Peterson (PWP) models
    - PWP-CP and PWP-GT
- Adjusted for age group, gender, neighbourhood median income, hospitalization history, acuity level, hospital type, disposition group and waiting times.
- Interaction effects of crowding with hospital type and acuity level (triage code).
- Robust inference using cluster ID.

- **Figure 4** illustrates the difference between the three models. For PWP models, the survival probability of RV decreases in the number of RV.

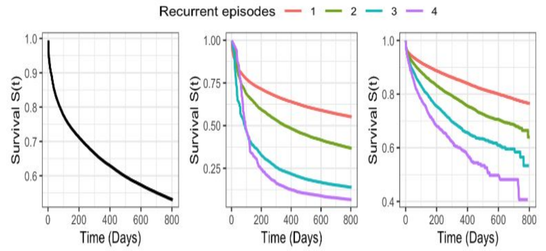

Figure 4. Survival functions estimated using the AG, PWP-CP, and PWP-GT models.

- The main effects of crowding were statistically insignificant at 0.05.
- However, the interaction effects of crowding and hospital type & acuity level were statistically significant (***Figure 5***).

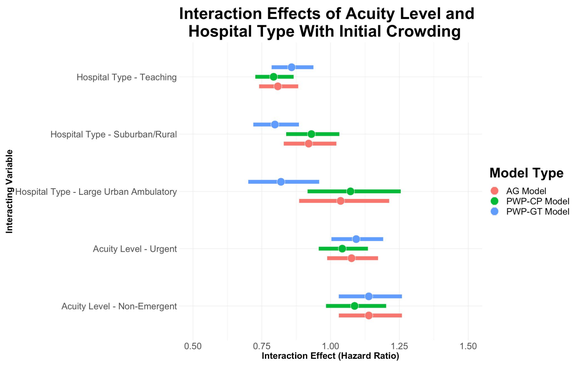

Figure 5. Estimated interaction effects with 95% confidence intervals of acuity level and hospital type with initial crowding in the AG, PWP-CP and PWP-GT models.

Discussion

- Given the scale of crowding, the effect of crowding seems practically insignificant.
- Interventions should be focused on other aspects, such as factors related to disposition group and hospital type.
- Scan the QR code for more results.