

Background

Hospital length of stay (LOS) is a key indicator of healthcare utilization and patient outcomes.

Understanding the factors that influence LOS can inform resource planning and targeted interventions.

We aim to identify and quantify the impact of age, health condition, and their interactions on LOS using regularized regression models, with a focus on comorbidity dynamics.

Materials and Methods

Data source:

We used all inpatient records from the Hong Kong Hospital Authority (HA) between 2014 and 2023.

The Hospital Authority is the main provider of public inpatient healthcare services in Hong Kong, and its administrative database contains comprehensive hospitalization records, including patient demographics, admission information, diagnoses, and other clinical characteristics.

Materials and Methods

Methods

- We used four regression models to predict LOS. Each model was run using LASSO regression with H2O's GLM tool.
- The predictors included age categories, grouped condition indicators (such as mental, respiratory, and cardiovascular), and combinations of these variables to capture interaction effects.
- The resulting coefficients show how much each factor is estimated to change LOS, assuming all other factors stay the same.

Main Results

Age was consistently associated with LOS, with older groups predicting longer stays.

Mental health burden was the strongest predictor across models (+14.29 to +18.82). Other conditions such as respiratory (+2.93), infections (+1.84), and cardiovascular (+1.52) also contributed positively.

Interaction terms revealed complex comorbidity effects, with notable negative synergies (e.g., Maternal and neonatal disorders + Mental disorders: -14.42, Injury + Mental disorders: -10.49).

Year indicators were consistently excluded or negligible, suggesting stable LOS patterns over time.

Discussion

- **Age and condition burden were major determinants of LOS.** We found that older age was consistently associated with longer hospital stays. Among grouped conditions, mental health burden showed the strongest association with LOS, followed by respiratory, infection-related, and cardiovascular conditions. This suggests that both ageing and disease complexity are important drivers of healthcare utilization.
- **Comorbidity effects were not purely additive.** The interaction terms showed that the combined effects of multiple conditions on LOS could differ from the sum of their individual effects. Several interactions were negative, indicating that coexisting conditions may not always proportionally increase LOS. This highlights the importance of modelling comorbidity interactions to better capture the complexity of inpatient care.
- **The findings have implications for hospital planning and resource allocation.** The relatively small effect of year indicators suggests that LOS patterns were broadly stable over time after accounting for age and conditions. Identifying patient groups at higher risk of prolonged stays may help improve bed management, discharge planning, and targeted interventions, particularly for older patients and those with mental health comorbidities.

Policy Implication

- **Integrate mental health into care planning.** Mental disorders were the strongest driver of prolonged LOS, supporting policies that embed mental health screening and liaison services within general hospital care.
- **Adopt interaction-aware risk stratification for resource allocation** Non-linear comorbidity effects indicate that LOS cannot be accurately estimated by condition counts alone, highlighting the need for more nuanced case-mix and reimbursement models.
- **Prepare health systems for ageing-related LOS pressure** The consistent association between older age and longer LOS underscores the importance of geriatric-focused care pathways and strengthened post-discharge support.

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