Readmission prediction model using OMOP-CDM and home health care notes

Sujin Gan [1], Chungsoo Kim [1], Byungjin Choi [2], Rae Woong Park [1,2]

[1] Department of Biomedical Sciences, Ajou University Graduate School of Medicine [2] Department of Biomedical Informatics, Ajou University School of Medicine

Background

- Hospital based home health care (HHC) is provided to patients who need post-discharge cares. Thus, the HHC document could be a useful data to identify risk factors for readmission.
- Prediction models can assist early detection of readmission risks, however, this area of study has not been explored in HHC settings.
- This study aims
  - to develop a readmission prediction model using predictors from structured clinical data and unstructured HHC documents and,
  - to determine the feasibility of implementing early warning systems in HHC using Natural Language Processing.

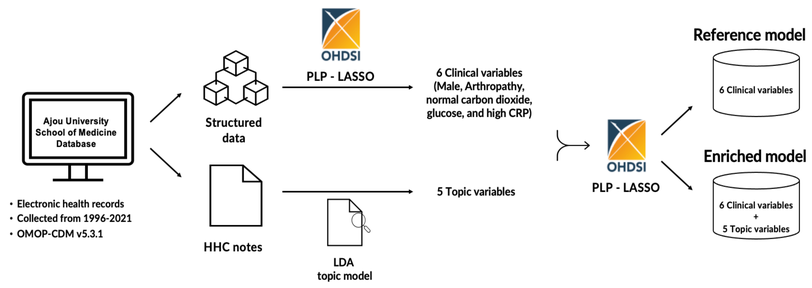
Methods

1. Data sources

- Target cohorts
  - Patients who had home health care (HHC) after discharge
- Outcome cohorts
  - Rehospitalization or emergency department (ED) visits from 2 days to 90 days after discharge

2. Model development

- Reference model and Enriched model
- LASSO logistic regression
  - Data split of 75:25 (train/test) set
  - 3-fold cross validation



2.1 Reference model

- 6 Clinical variables from the data recorded within 365 days prior to the index date
  - Included in domains of demographics, condition, observation, drug, measurement, and procedure

2.2 Enriched model

- Determination optimal numbers of the model by the degree of the coherence score
- The probabilities of being assigned to the topic as topic variables

3. Model evaluation

- Area under the receiver operating curve (AUROC) and Area Under Precision – Recall Curve (AUPRC)

4. Heatmap of topic variables

- The percentage of patients with a topic documented in the HHC document.
- Patients grouped by readmission outcomes, and duration to outcome event

Results

1. Topics and words in each topic

Five topics were selected by the degree of coherence scores.

Topic	Words
The postoperative care	항생제주사 (Antibiotic injection in Korean), 수술 (Operation in Korean), stapler, brade, 수술부위드레싱, wounddressingela, 아프고 (Pain), 수술상처부위 (Leision after surgery in Korean), band_dressing, op
Chemotherapy	수액요법chemoport, chemoport needle, 겨드랑이(axillary), 항암주사후 (After chemotherapy in Korean), 액와부(Axillary),항암제 (Anticancer drugs in Korean), 가래가 (Sputum in Korean),항암치료 (Chemotherapy in Korean)
Diabetes mellitus care	Edematous, 좌측발 (Left foot in Korean), 누르면 (As pressured in Korean), 통증은 (Pain in Korean), 발적등 (Rash in Korean), 두드러기 (Urticaria in Korean), 양측족부 (Bilateral foot in Korean), 발적없이(Without rash in Korean), 감염증상은 (Infection signs in Korean), 부종이 (Edema in Korean), 혈당이 (Blood sugar in Korean), 감염증상없이 양호함
Tube insertion care	Peg, 비위관교환 (Levin tube change in Korean), portex, cath_site, 비위관 (Levin tube in Korean), 기관지관 (Tracheostomy in Korean), peg_portex, tracheostomy tube, fixator 고정 (Fixation in Korean), 콧줄을 (Levin tube in Korean), 분비물이 (Discharge in Korean)
Stoma care	복부수술부위 (Abdominal operation site in Korean), skin, trace, black, 좌약 (Rectal suppository in Korean), colostomy, 테가덤 (Tegaderm), 식사는 (Diets), 상처소독(Disinfecting wounds in Korean), 치유됨 (Healed in Korean), Tolerable, remove, 발적분비물없이 (Without rash/discharge in Korean), 욕창 (Ulcer in Korean)

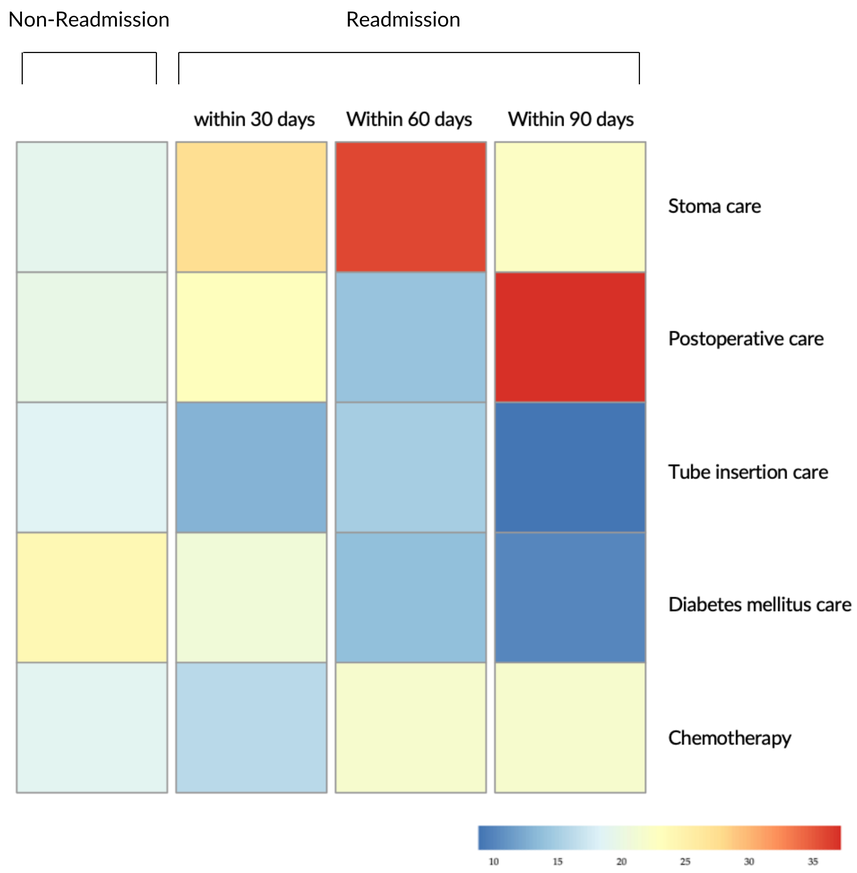
2. Model performance

- Enriched model had higher AUROC and AUPRC compared to the reference model.

	Reference model	Enriched model
AUROC	0.614	0.759
AUPRC	0.140	0.291

3. Percentage of patient's groups with a topic documented in a home health care note

- Topics for colostomy care and chemotherapy were frequently recorded across the readmission patient groups, compared to the non-readmission group.
- Topics of tube insertion, Diabetes mellitus care were more frequent in the non-readmission group.



Conclusions

- The differences of topics in each HHC document between readmission patients and non-readmission patients were observed.
- We documented potential applicability of the HHC document to identify risk factors for readmission.
- Further studies that include social determinants and environmental factors are suggested.

Acknowledgements

• This research was supported by a grant of the project for Infectious Disease Medical Safety, funded by the Ministry of Health, Republic of Korea (grant number: HG22C0024).

• This work was supported by the Bio Industrial Strategic Technology Development Program (20003883, 20005021) funded By the Ministry of Trade, Industry & Energy (MOTIE, Korea), and a grant from the Korea Health Technology R&D Project through the Korea Health Industry Development Institute, funded by the Ministry of Health & Welfare, Republic of Korea (grant number: HR16C0001).