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

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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.
  • 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

1. Topics and words in each topic
   Five topics were selected by the degree of coherence scores.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>The postoperative care</td>
<td>항생제주사 (Antibiotic injection in Korean), 수술 (Operation in Korean), 스테이저 (stapler, brace), 수술부위례대부상, wounddressing, 고혈압 (Pain), 수술상처부위 (Lesion after surgery in Korean), band, dressing, op</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>추위요법, chemoprot, chemoprot needle, 거드랑이 (axillary), 항암주사환 (After chemotherapy in Korean), 약외구 (Axillary), 항암제 (Anticancer drugs in Korean), 가래가 (Sputum in Korean), 항암치료 (Chemotherapy in Korean)</td>
</tr>
<tr>
<td>Diabetes mellitus care</td>
<td>Edematous, 체중감소 (Weight loss in Korean), 두프진 (Hypertension in Korean), 발적등 (Edema in Korean), 혈당이 (Blood sugar in Korean), 감염증상없이 (Infection signs in Korean)</td>
</tr>
<tr>
<td>Tube insertion care</td>
<td>Peg, 부위관교환 (Levin tube change in Korean), portex, cath_site, 비위관 (Levin tube in Korean), 기관지관 (Tracheostomy in Korean), 정문 (Fixation in Korean), 수술 (Discharge in Korean)</td>
</tr>
<tr>
<td>Stoma care</td>
<td>복부수술부위 (Abdominal operation site in Korean), 치유됨 (Healed in Korean), Tolerable, remove, 발적분비물없이 (Without rash/discharge in Korean), 특장 (Ulcer in Korean)</td>
</tr>
</tbody>
</table>

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.

Results

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.

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