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Prediction models for readmission using home healthcare notes and OMOP-CDM

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Introduction

Readmission







- Lengths of stays
- Mortality
- Medical cost





Introduction

Readmission

- The quality of the medical treatment and high associations with poor clinical outcomes such as mortality, long lengths of stay
- Therefore, it is important to early identify patients at high risk





Introduction

Home healthcare

- A system provided to discharged patients, ultimately to help prevent readmissions
- Records of all post-discharge information on medical procedures, conditions, status, and complaints of patients
- Thus, the HHC documents could be useful data to find out hidden risk factors of readmissions



Objectives









Data sources

- An electronic health records (EHR) database of Ajou University School of Medicine in South Korea (AUSOM), from 1996 to 2021
 - Converted into Observational Medical Outcomes Partnership-Common Data Model (OMOP-CDM) version 5.3.1, constructed by the Observational Health Data Sciences and Informatics (OHDSI)
- The clinical data from AUSOM database was used as predictive variables



Study population

- Inclusion:
 - Aged over 18 years
 - Admitted more than a day in the hospital
- Exclusion:

1) having previous records prior to the first admission date 2) HHC notes within 90 days from the first discharge date

• Outcome of interest:

all-cause readmission including visits to an emergency department within 90 days after the first discharge date











Model development

- LASSO logistic regression
- Training/Testing (75:25) and 3-fold cross-validation

Model performance

- The area under a receiver operating characteristic curve (AUROC)
- The area under the precision-recall curve (AUPRC)







Latent Dirichlet Allocation (LDA) for topic extraction

- To generate topics from HHC documents
- The optimal number of topics were determined after calculating the perplexity scores, which estimates relative quality of statistical models
- The probabilities of each document to be assigned topics, hereafter referred to as the risk probability were added to the reference model as variables



Heatmap

- To visually compare the topics documented across the patient groups categorized by readmission status
 - Readmission after 0-30 days, 30-60 days, 60-90 days
 - Non-readmission within 90 days after discharge
- The percentages of documents to be recorded in the topics were calculated for each readmission status





Result

Structured variables

- Male
- Age group of 65-69
- Immunocytochemical procedure
- Leision of lung
- Drugs for cardiovascular system

Unstructured variables

- Orthopedic operation
- Chronic kidney diseases and diabetes
- Diabetes mellitus foot
- Gastro-intestinal tract
- Chemotherapy







Result

Topic clusters

Topic	Title	Words	
Topic 1	Orthopedic	External fixation, Cast, Granulation tissue, Postoperative scars, Wounds, A big toe, Edema, Top side of the foot,	
	operation	Blisters, Malleolus	
Topic 2	Chronic kidney	Cystostomy, Percutaneous nephrostomy, Foley_catheter, Operation, Edematose, Infrapatellar, Hemodialysis, Blood sugar	
	diseases and		
	diabetes		
тр	Diabetes mellitus	Tarsal, Opened skin, Postoperative, Postoperative scars, Dressing, Amputation site, On hemodialysis, Pheripheral,	
נ מסוכ	foot	Diet, amputation, Malleolus, Redness	
Topic 4	Gastro-intestinal	Nasogastric tube, Pin_site, Enema, TPN (Total Parenteral Nutrition), Constipation medicine, Diet, Remove heparin,	
	tract	Colostomy	
Topic 5	Chemotherapy	Axillary, Needle for chemotherapy, Aspiration, Fluid_Chemoport, Needle, Rounds, Energy, Axillary, Chemotherapy,	
		Chemo_tx (Chemo_treatment), Diarrhea, Soft stools, Pain, Urticaria	



Result

Model performance

	Reference model	Enriched model
AUROC	0.614	0.759
AUPRC	0.140	0.291







Color Key



Orthopedic operation

Chronic Kidney and diabetes

Diabetes

Gastrointestinal tract

Chemotherapy

Result





Discussion

- Developed readmission prediction models using predictors extracted from unstructured HHC notes
- The five topics from HHC notes improved prediction performance compared to the reference model developed using only structured variables
- We could discover risk factors for readmission, which patients have after their discharge, and observed how the topics are related to the readmission status





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