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DESIGN OF AN AI SUPPORT FOR DIAGNOSIS OF DYSPNEIC ADULTS AT TIME OF TRIAGE IN THE EMERGENCY DEPARTMENT

Ellen Tolestam Heyman[1,2], Awais Ashfaq[3,4], Ulf Ekelund[2,5], Mattias Ohlsson[2,4], Jonas Björk[2], Ardavan Khoshnood[2,5#], Markus Lingman[1,4,6#]

[1]HALLAND HOSPITALS; [2]LUND UNIVERSITY; [3]REGION HALLAND; [4]HALMSTAD UNIVERSITY; [5]SKÅNE UNIVERSITY HOSPITAL; [6]UNIVERSITY OF GOTHENBURG #SHARED LAST AUTHORSHIP

LUND UNIVERSITY

Region Halland

Background

About half of dyspneic patients in the emergency department (ED) suffer from acute heart failure (AHF), chronic obstructive pulmonary disease exacerbation (eCOPD) and/or pneumonia, which are often misdiagnosed. Studies suggest that a third to a half of elderly patients with these conditions are mistreated during their ED stay. We aimed to design an artificially intelligent (AI) diagnostic support for adult dyspnea patients in ED triage. The support should display an interpretable graph for each individual patient visit, showing the AI´s underlying diagnostic decision basis.
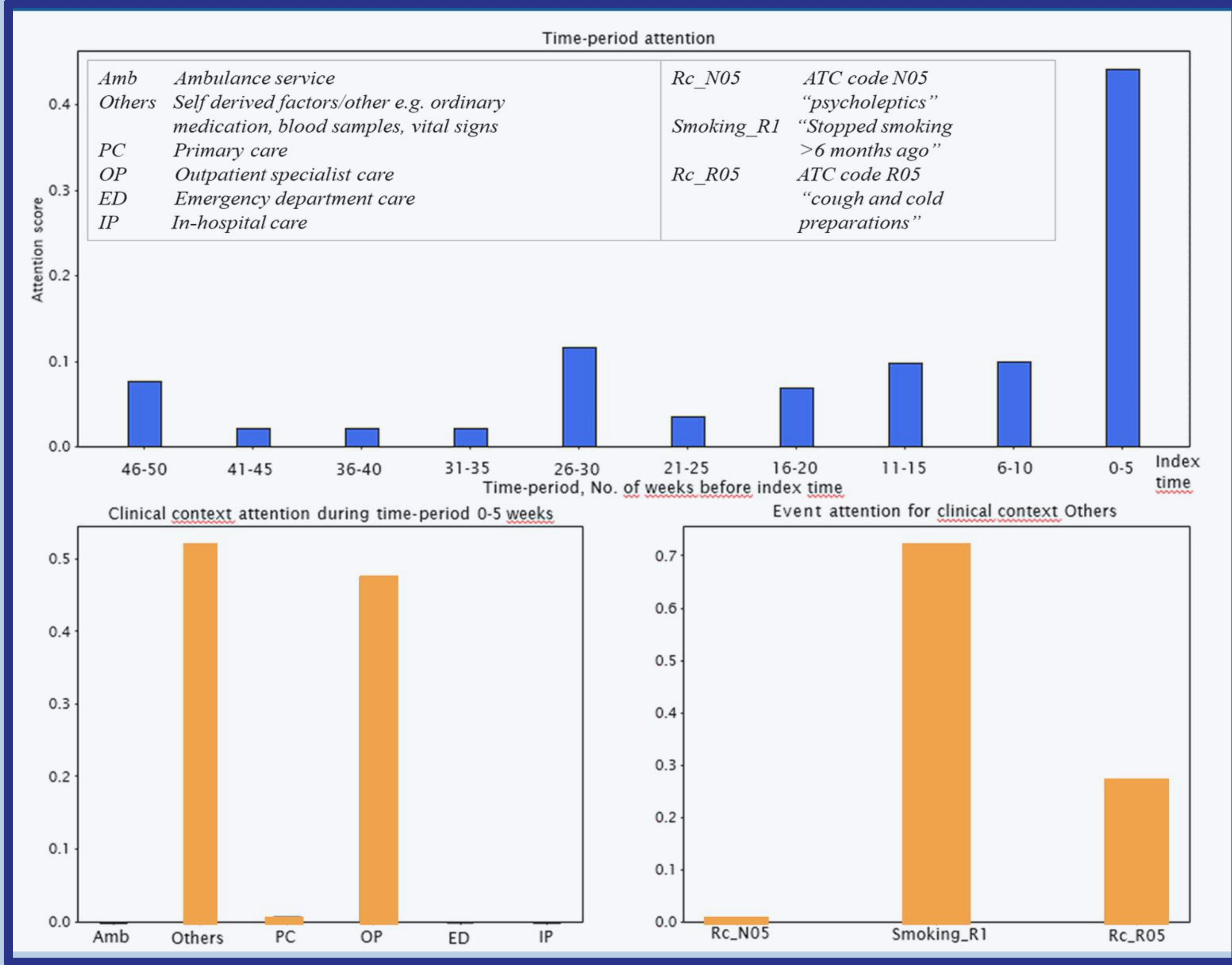
Conclusion

- We created an AI support for diagnosis in dyspneic adults at time of triage in the emergency department
- Complete data from an entire regional health care system was analyzed, to find AI-derived, unknown, important diagnostic predictors. Most important were prior diagnoses of heart failure or COPD, daily smoking, atrial fibrillation/flutter, life difficulties and maternal care
- Sensitivity for AHF, eCOPD and pneumonia was 75%, 93%, and 54%, respectively, with a specificity above 75%
- Each patient visit received an individual graph with the AI´s underlying decision basis

Results

In all, 10 315 patient visits were included. Most prevalent diagnoses were AHF (15.5%), eCOPD (14.0%) and pneumonia (13.3%). Diagnostic performance at time of triage had an area under the receiver operating characteristic curve (AUROC) of 87%. Most important diagnostic variables were found to be earlier heart failure diagnoses in primary care and earlier COPD diagnoses in ED or in-patient care. Diabetes type 1 was more important among women and smoking and atrial fibrillation among men. Each patient visit received a unique patient visit graph (see Figure).

Methods

This population-based register study was conducted in Region Halland, in south-western Sweden. We included all patient visits older than 17 years at any of the region's two EDs from July 1, 2017 to December 31, 2019. All collectable structured patient data from the visits´ previous five years was included, from the complete regional health care system. Median number of clinical events per patient visit was 1 095 (IQR 459 – 2 310). Diagnoses in the subsequent in-hospital or ED discharge notes were used as gold standard. Diagnostic accuracy in 1 070 patient visits discharged to home from the ED were reviewed, including data 30 days after the visit, by three emergency physician specialists. We developed a novel deep learning model, CareNet.

Stopped smoking more than six months ago and collected prescribed medication against cough and cold in the past five weeks. Those were the most diagnostic variables for a patient with pneumonia, shown as the AI tool´s decision basis in an individual patient visit graph.

Contact ellen.tolestam-heyman@regionhalland.se