C-121

COMPARISON OF PRIMARY CARE CODED PREVALENCE OF ATRIAL FIBRILLATION AND PRESCRIBING RATES FOR DRUGS INDICATED FOR ATRIAL FIBRILLATION IDENTIFIED USING A LARGE-LANGUAGE MODEL

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Summary

+ We used atrial fibrillation (AF) as an exemplar condition to assess whether prescribing rates derived from a large language model (LLM)-assisted medication-indication knowledge base and aggregated prescribing data align with recorded prevalence in primary care in England.

+ Proxy AF prescribing rates showed a moderately positive correlation with AF prevalence across the 42 health areas in England (R^2 = 0.52), with a median of 6.76 (IQR: 5.78, 6.93) AF medication items prescribed for each prevalent AF case in October – December 2024. Stable AF prescribing-to-prevalence ratios was observed over three years, suggesting consistency in patterns.

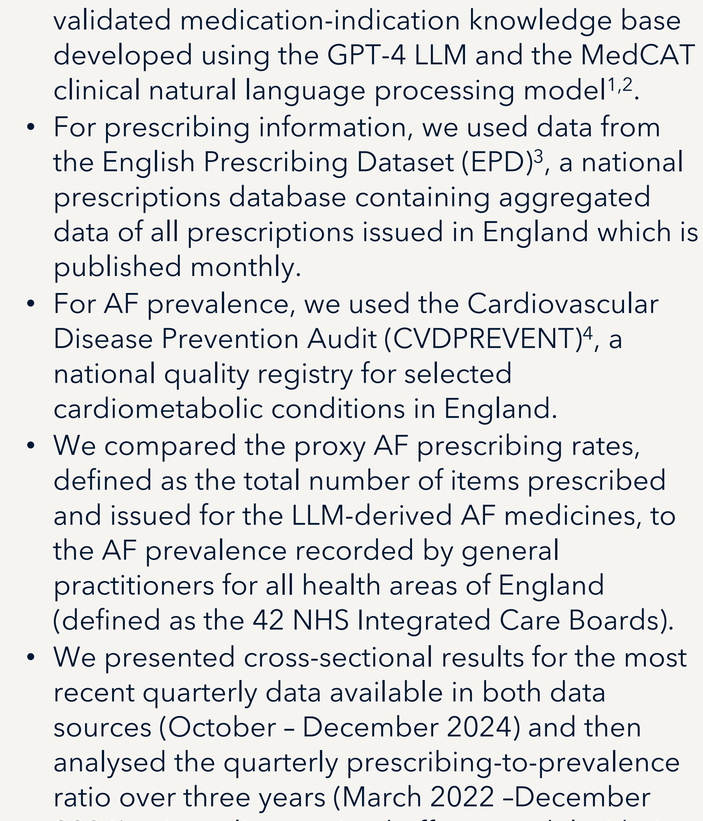
+ The ratio of the proxy prescribing rates to real-world prevalence showed a consistent trend, highlighting the potential of AI-enabled tools to support population-level pharmacoepidemiological research for other conditions.

Background +

- Information on indications is not routinely recorded in prescriptions or the prescribing process, hence is often absent in the prescribing data in electronic health records and in aggregated data.
- LLM-driven medication-indication knowledge bases may offer disease-specific insights from prescribing data.
- It is unclear whether LLM-assisted prescribing rates for specific indications are consistent with reported prevalence. As a proof of concept, we analysed the LLM-prescribing rates and prevalence of AF.

Methods +

- We identified medicines indicated for AF in a validated medication-indication knowledge base developed using the GPT-4 LLM and the MedCAT clinical natural language processing model[1,2].
- For prescribing information, we used data from the English Prescribing Dataset (EPD)[3], a national prescriptions database containing aggregated data of all prescriptions issued in England which is published monthly.
- For AF prevalence, we used the Cardiovascular Disease Prevention Audit (CVDPREVENT)[4], a national quality registry for selected cardiometabolic conditions in England.
- We compared the proxy AF prescribing rates, defined as the total number of items prescribed and issued for the LLM-derived AF medicines, to the AF prevalence recorded by general practitioners for all health areas of England (defined as the 42 NHS Integrated Care Boards).
- We presented cross-sectional results for the most recent quarterly data available in both data sources (October – December 2024) and then analysed the quarterly prescribing-to-prevalence ratio over three years (March 2022 –December 2024) using a linear mixed-effects model with time as the fixed effect and health area for the random intercept and random slope.



Results +

- The LLM-assisted knowledge base identified 20 medications as indicated for AF (with or without other indications). We extracted the relevant prescribing data from the EPD by mapping these medication names with the chemical substance names of the British National Formulary coding system.

Acenocoumarol	**Amiodarone**	**Apixaban**
Clopidogrel	**Digoxin**	**Diltiazem**
Disopyramide	**Dronedarone**	**Edoxaban**
Flecainide	**Heparin**	**INR blood testing reagents**
Phenindione	**Phenprocoumon**	**Propafenone**
Quinidine	**Rivaroxaban**	**Sotalol**
Verapamil	**Warfarin**	

Table 1. Medications indicated for AF, according to the LLM-driven medication indication knowledge base

- At a national level, AF prevalence was 25.8 per 1,000 population (95%CI: 25.8, 25.8), and the AF prescribing rate was 180.8 per quarter per 1,000 population (95%CI : 180.7, 180.9).
- Across 42 health areas, prevalence ranged from 11.1 (95%CI: 11.0, 11.3) to 38.0 (95%CI: 37.5, 38.5) per 1,000 population, while prescribing rates ranged from 114.9 (95%CI: 114.4, 115.3) to 274.2 (95%CI: 273.2, 275.2) per quarter per 1,000 population. The median prescribing-to-prevalence ratio was 6.76 (IQR: 5.78, 6.93).
- During October – December 2024, LLM-indicated AF prescribing and AF prevalence showed a non-linear, positive relationship across 42 health areas (R^2 = 0.52).

Key result 1: Cross-sectional comparison between AF prevalence and AF prescribing rate by geographical area shows a non-linear positive relationship

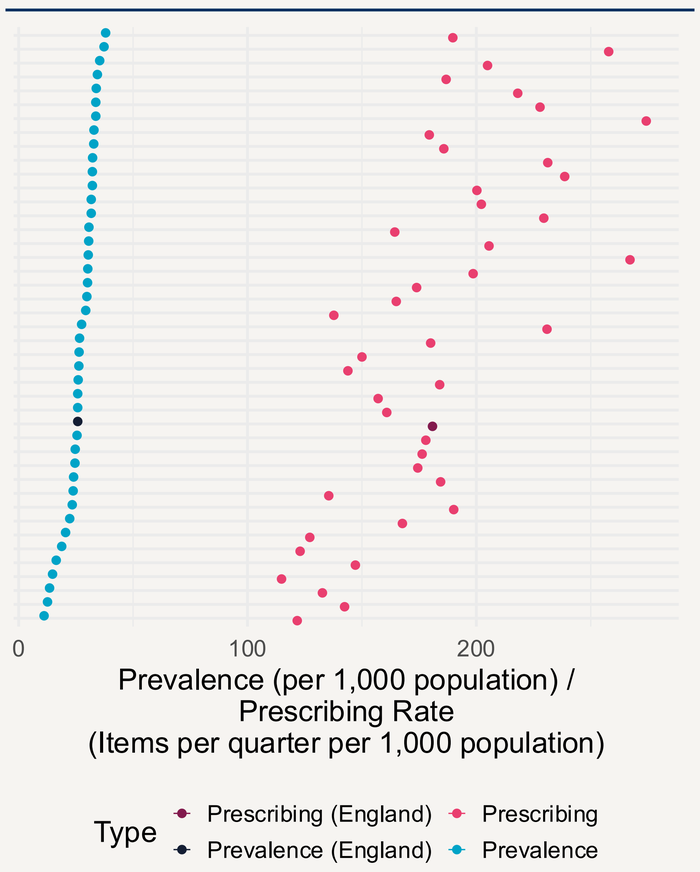


Figure 1. AF prevalence and prescribing rate based on LLM-identified indicated medications, England and its 42 NHS Integrated Care Board, October – December 2024

- Longitudinally, the linear mixed-effects model showed a mean AF prescribing-to-prevalence ratio of 6.99 (95% CI: 6.60 – 7.38).
- The fixed effect for time (per quarter) was -0.0028 (SE=0.0073), suggesting no evidence of an increasing or decreasing trend over the period. Random effects showed moderate variation in intercepts which indicate the baseline ratios across health areas (SD=1.28), but minimal variation in slopes which indicate their temporal trends (SD=0.046).

Key result 2: Stable AF prescribing-to-prevalence ratio over three years

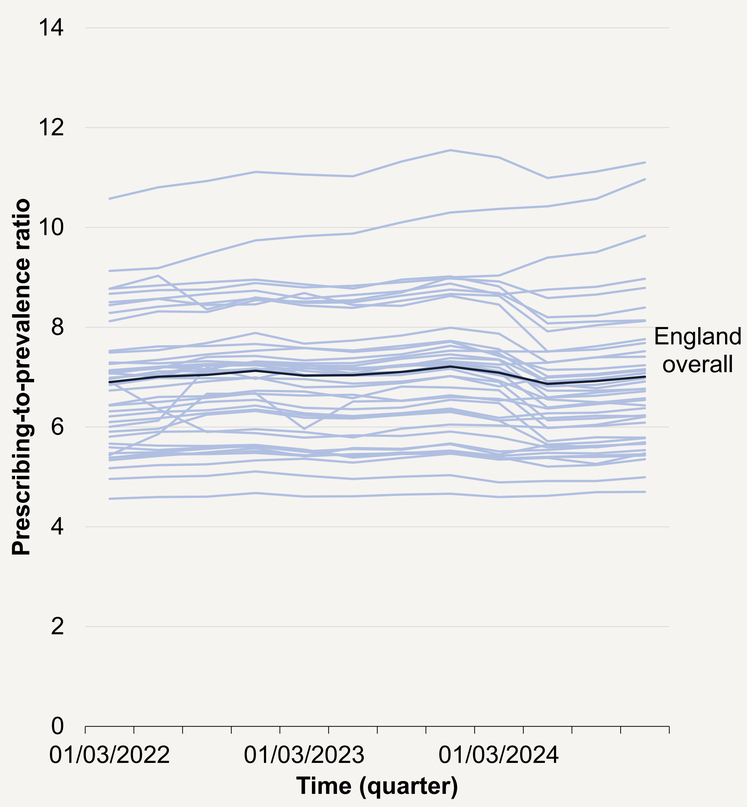


Figure 2. Number of AF-relevant items prescribed per quarter per prevalent AF case in England and its 42 NHS Integrated Care Board, March 2022 to December 2024

Conclusions +

- For AF, the ratios of the population-level prescribing rates to prevalence were broadly consistent across England over the study period.
- Indications identified by the LLM-assisted medication-indication knowledge base might differ from the actual clinical indication of a prescribed medication. This is especially complex with medications having multiple indications as well as polypharmacy.
- A limitation of this study is the use of aggregated data. More granularity could be achieved using prescribing data with reported indication information (including self-reported indications) or individual-level data where indications could be delineated using other medications in the same prescription.
- Future research should also consider other factors influencing prescribing, including underlying sociodemographic characteristics, local formularies and patient behaviour.
- An AI-driven approach to prescription analytics is potentially scalable for other diseases to detect and monitor population-level health trends.

References:
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