IDENTIFYING TRENDS IN NHS 111 AND GP REFERRALS TO A&E BETWEEN JANUARY 2023 TO MAY 2025: COMPREHENSIVE ANALYSIS WITH ML PREDICTIONS

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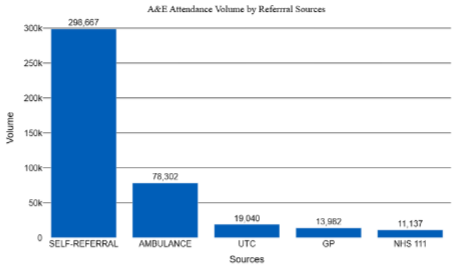
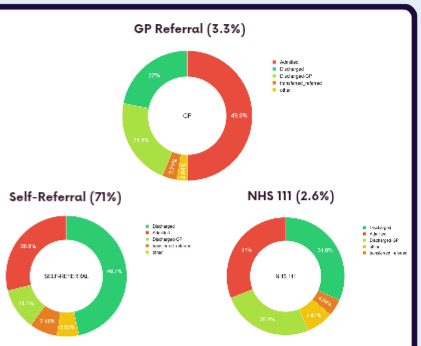
Context & Study Background

A&E departments face sustained increasing demand, with many attendances potentially avoidable through alternative care pathways. This comprehensive analysis examines referral patterns from NHS 111 and GPs into A&E visits, identifies high-volume and potentially avoidable attendances, and highlights opportunities to optimise patient pathways through data-driven insights and machine learning predictions. The study encompasses over 420,000 patients attendances across 15 months.

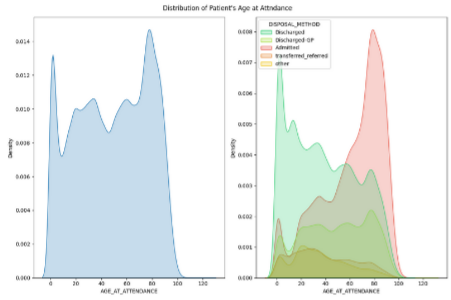
A&E Attendance Volume by Referral Source





Key Analysis:
Self-referrals dominate: 71% of attendances are self-referrals, indicating significant primary care access gaps and patient awareness issues about alternative care pathways.

Age Distribution & Clinical Impact



>60 years: Higher admission risk **<40 years:** Higher discharge rate

Multi-modal: Peaks at key demographics **Predictor:** Strongest admission factor

Age-Specific Care:
Age-appropriate protocols needed - fast-track for younger patients, comprehensive assessment for older adults.

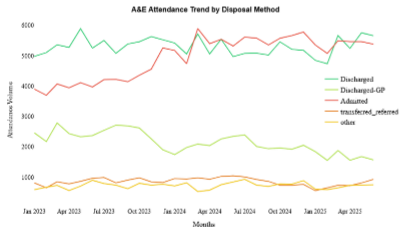
High Risk GP Practices Analysis

GP Practice	Location	Self-Ref Rate	GP Rate	Pop Avg
Practice A	Colchester	48%	59%	29%
Practice B	Colchester	47%	57%	29%
Practice C	Clacton	47%	54%	29%
Practice D	Walton	47%	55%	29%
Practice E	Bentley	45%	59%	29%

High-Risk Analysis:
Elevated rates: These practices show 43-48% admission rates for self-referred patients vs 29% population average.

Intervention Opportunity:
Targeted support through clinical decision tools and enhanced appointment availability could reduce unnecessary attendances.

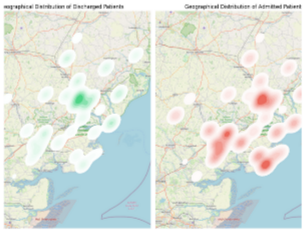
A&E Attendance Trend by Disposal Method



Critical Alert: 50% increase in monthly admissions from 4,000 to 6,000. Peak of 15k attendances in April 2024.

Trend Analysis:
Sustained growth: Consistent upward trajectory indicates systemic pressures requiring immediate strategic intervention.

Geographic Distribution Analysis

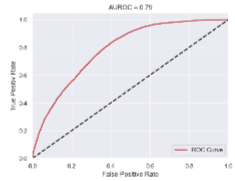


Site Performance Differences:
Geographic Inequalities:
Colchester: 47% admission rate with higher acuity. All ambulance patients originate from Colchester area.

Equity Issue:
22% difference in admission rates warrants investigation into resource allocation and service delivery patterns.

Machine Learning Predictive Model: Clinical Decision Support & Risk Stratification

ROC Curve Performance



Patient Embeddings

Clinical AI Implementation

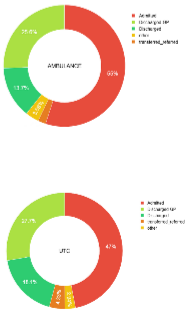
Model Performance: AUROC 0.79 demonstrates substantial predictive ability for early identification of admission-likely patients, enabling proactive resource allocation.
Patient Embeddings: Clear separation between admitted and discharged patients based on presenting complaints, revealing rich predictive information.
Clinical Impact: Real-time risk stratification enables prioritization, optimized care pathways, and improved departmental efficiency.

Key Clinical Findings & Evidence

- **Age strongest predictor:** Patients >60 have significantly higher admission likelihood requiring age-specific care pathways.
- **Self-referral opportunity:** 71% of attendances suggest substantial primary care access gaps requiring urgent intervention.
- **ML model validated:** 0.79 AUROC enables real-time risk stratification and proactive resource optimization.
- **Geographic inequalities:** Colchester 47% vs Ipswich 25% admission rates demand investigation into resource allocation and protocols.
- **Professional triage effective:** GP/ambulance referrals show appropriate 50-55% admission rates demonstrating excellent clinical judgment.
- **Capacity crisis:** 50% admission increase over 15 months requires immediate strategic response and planning.

Monthly A&E Attendance Trends

- There is an overall upward trend with fluctuations in A&E attendance between January 2023 to March 2024.
- Attendance spiked in April 2024 to its highest point of about 15k before entering a period of decline and variability.
- Small drops between consecutive months are likely linked to seasonal patterns or specific events, but the overall trend is upward.



Strategic Recommendations

- **Enhanced Primary Care:** Implement same-day appointments and digital consultations to address 71% self-referral burden.
- **High-Risk Practice Support:** Deploy specialized teams to assist Colchester practices with decision tools and training.
- **AI Implementation:** Integrate validated model into EHR systems for real-time risk stratification and workflow optimization.