

ECMO Referrals in the UK

A Descriptive Analysis Using Refer-a-Patient and Royal Brompton Hospital Data (2019–2025)

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Background

- Extracorporeal Membrane Oxygenation (ECMO) is a life-support modality functioning as an external heart and lung for patients in whom these organs are failing.
- In the UK, Adult ECMO is delivered by an 8-centre network (1) with catchment areas based on population density.
- Referrals are primarily sent via the national online portal, Refer-a-Patient (2).
- ECMO centres provide round-the-clock retrieval and clinical advice (3).

Aims

1. **Network-wide:** Quantify referral volumes, trend and seasonality (03/2020–06/2025).
2. **Royal Brompton Hospital (RBH):** visualise referral patterns to RBH (01/2019–06/2025)

Methods

Design:

Retrospective, descriptive study of referrals for all types of ECMO (VA, VV, V-AV).

Sources:

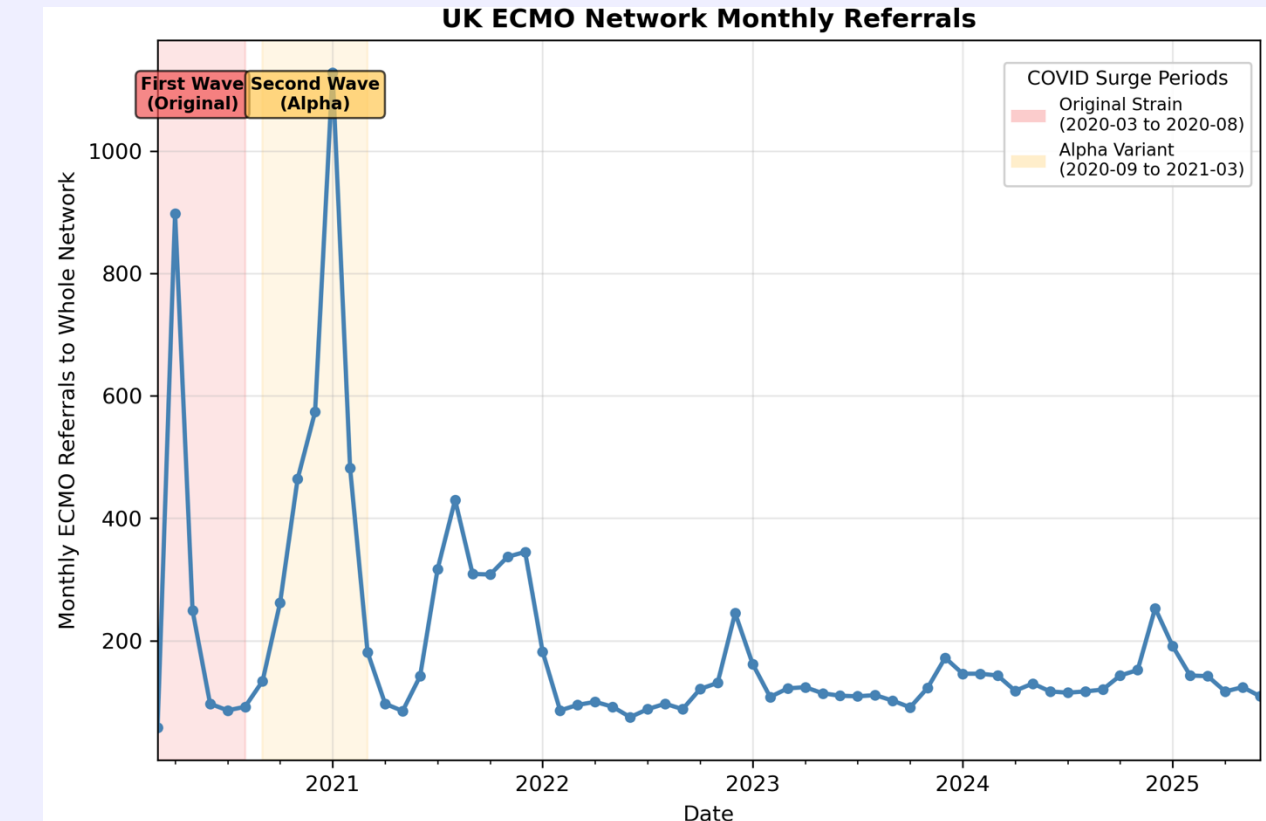
1. Refer-a-Patient (RaP; 03/2020–06/2025)
2. Royal Brompton Hospital (RBH) ECMO commissioning data (Tracker; 04/2019–06/2025)

Techniques:

Volumes, temporal trend, seasonality using STL (Seasonal-Trend decomposition using LOESS) and geospatial flows to RBH were analysed using python.

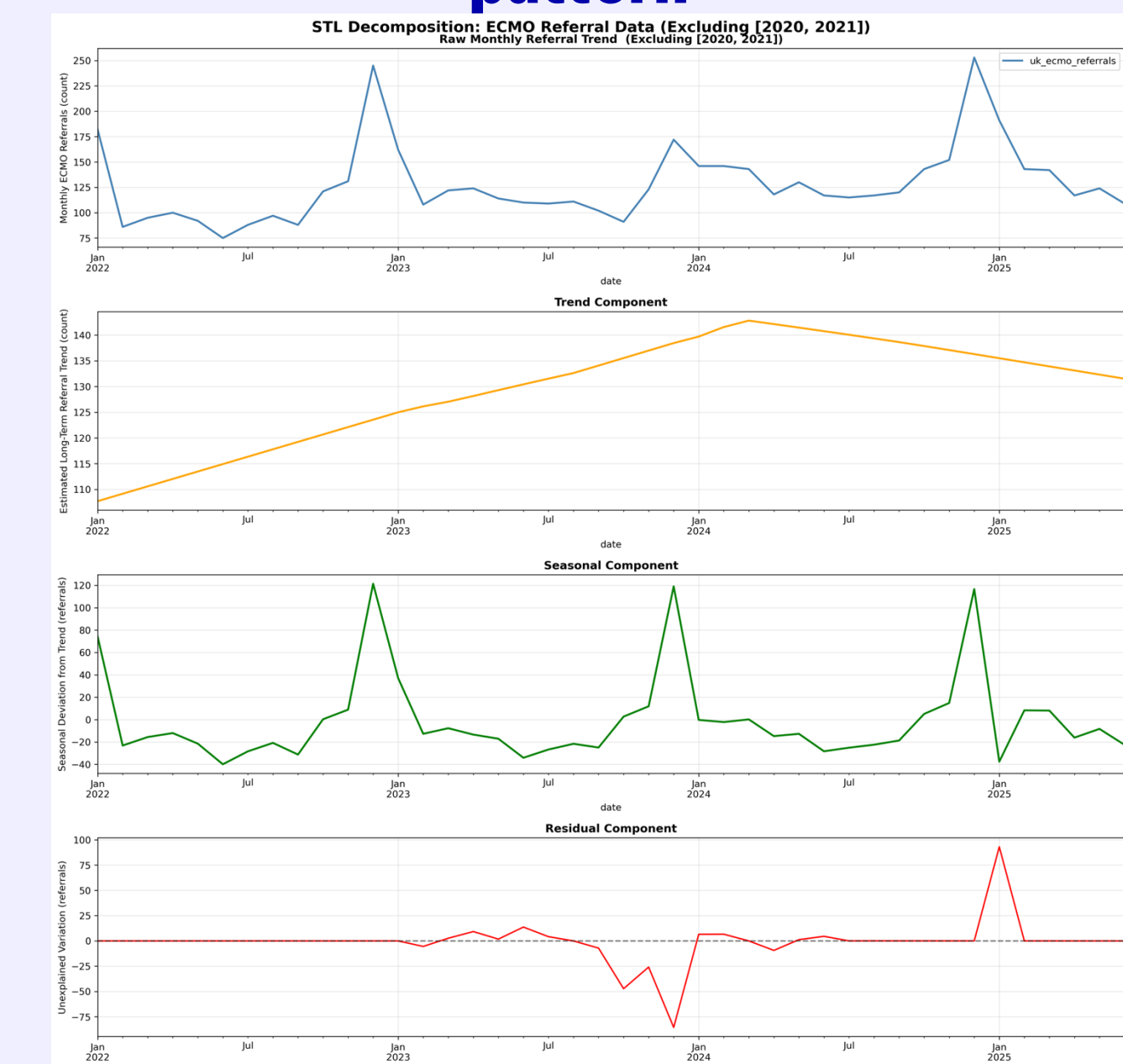
Results

1) COVID increased total number of referrals for ECMO across the network



- Referrals spiked during COVID-19 waves
- Post-pandemic – relatively stable baseline with recurrent winter increases (late 2022 and 2023)
- Patterns consistent with seasonal change in respiratory pathologies causing SARF.

2) ECMO referrals follow a seasonal pattern



Analysis excludes COVID pandemic (01/2022–06/2025)

Trend (yellow):

Modest increase (+0.69/month) – flattens after early 2024

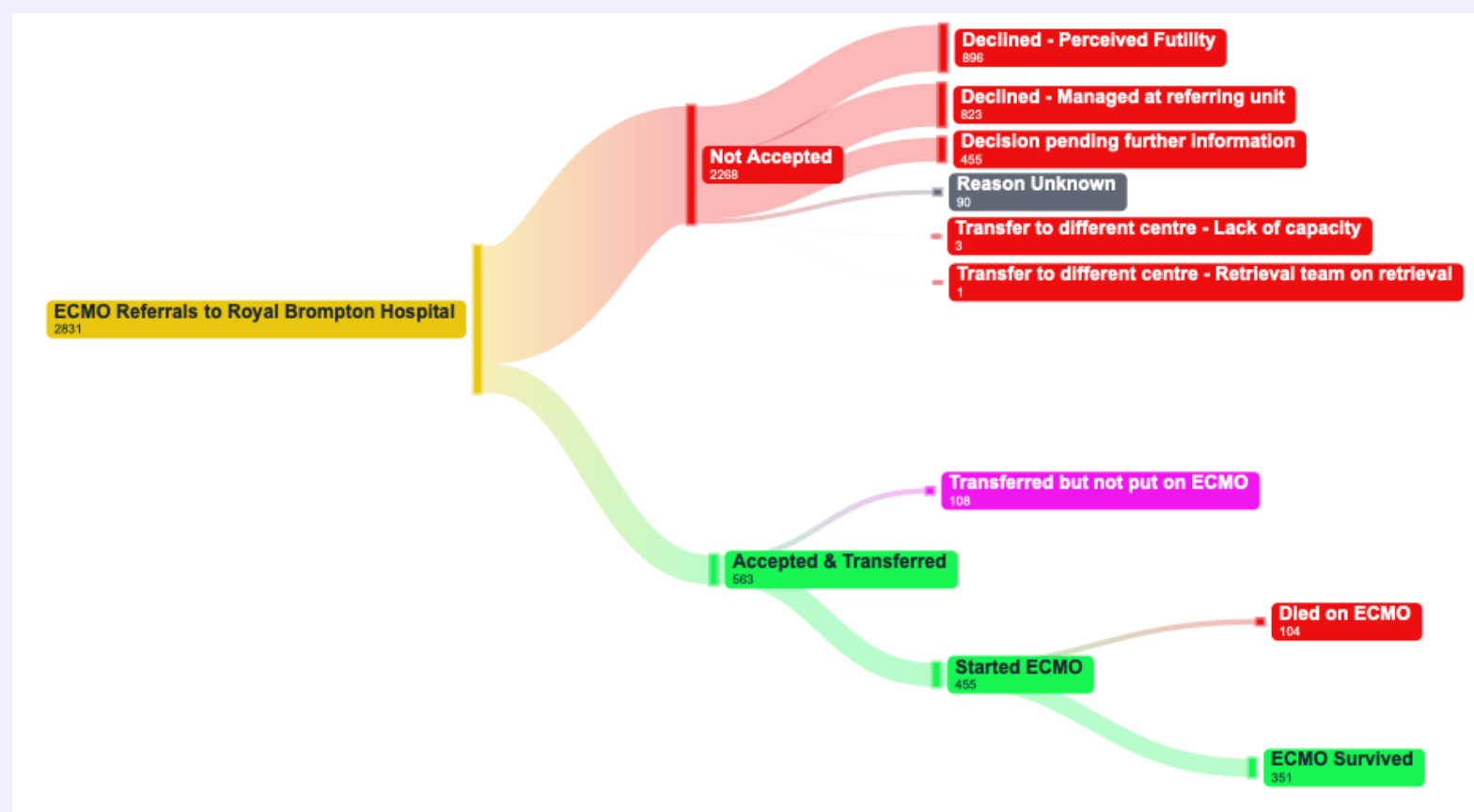
Seasonality (green):

- Seasonality strength (Fs) = 0.64 (range: 0-1)
- Signal-to-noise ratio (SNR) = 3.28
- Peak-trough range: 161.4 referrals
- Winter peaks: +121.4 above base-line
- Summer troughs: –39.9 below base-line

Limited residual variation: SD 21.8, outliers (–85.5 to +93) in Dec 2023 and Jan 2025

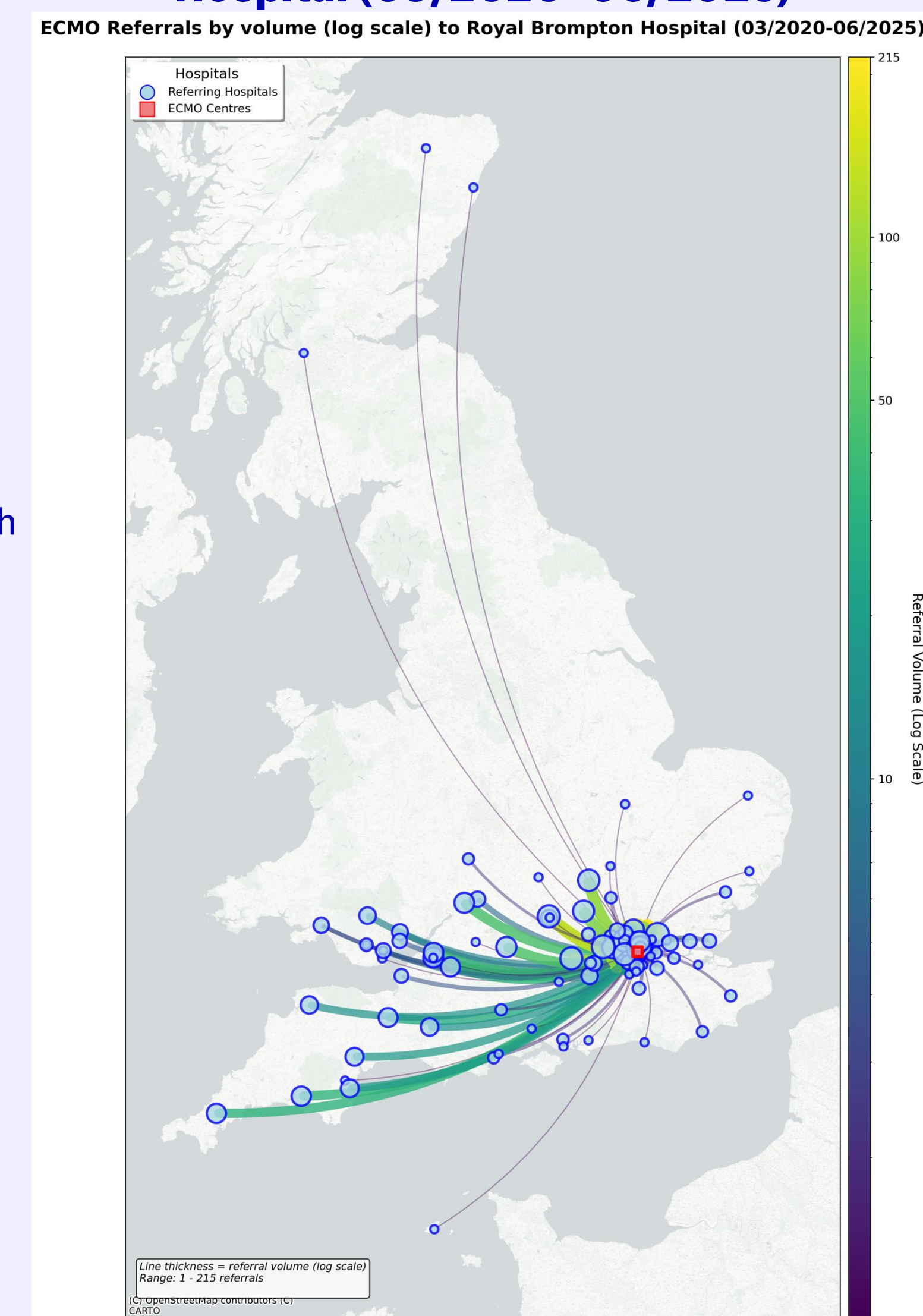
This indicates a winter-driven pattern of seasonality.

3) The majority of ECMO referrals to Royal Brompton Hospital do not result in ECMO initiation



- 16.1% (n=455) of referrals → ECMO initiation
- 80.0% (n=2264) of referrals → not transferred for ECMO
- 3.8% (n=108) of referrals → retrieved and transferred to RBH but not initiated on ECMO

4) ECMO referral flows to Royal Brompton Hospital (03/2020–06/2025)



109 hospitals sent 2,831 referrals via RaP to RBH (03/2020–06/2025).

- Geospatial analysis:
 - **Local hospitals** – higher referral volumes
 - **Peripheral hospitals** (outside of RBH catchment area) – smaller referral volumes

Discussion

Scope:

This study provides a description of national national ECMO referral volumes. While seasonality in SARF and VV-ECMO is recognised, this project quantified its impact at RBH and introduced geospatial mapping to enhance visualisation of referral patterns beyond traditional numerical reporting.

Implications on current research:

Until now the overall interest in ECMO research has been the ECMO patient group, yet in the studied time-period 83.9% (n=2376) of referrals to RBH did not result in ECMO initiation. Understanding this No-ECMO cohort is crucial to assess ECMO's equity in the UK.

Limitations:

- Limited post-pandemic timeframe restricts strength of seasonality conclusions.
- Descriptive design limits causal inferences.
- Single-centre focus may not fully represent national referral behaviour.

Future work:

- The next phase of this work will focus on how distribution of referrals and acceptance changed over the course of the pandemic and after the addition of new ECMO centres to the network. Subsequent steps will include:
- Linking referrals to patient-level characteristics and outcomes
 - Estimating per-capita referral and acceptance rates by region
 - Applying mixed-effects, case-mix-adjusted models to quantify centre- and geography-specific effects.
 - Auditing pathway frictions (time-to-decision, retrieval times/distance)

Together, this will enable rigorous evaluation of equity in ECMO access and inform targeted, evidence-based service planning.

Conclusions

- **Network volumes:** Referrals via RaP surged during COVID-19, then stabilised into a seasonal pattern with consistent winter peaks, aligning with seasonal drivers of severe acute respiratory failure (SARF).
- **Referral Outcomes:** 16.1% (n=455) of referrals progressed to ECMO cannulation; 3.8% (n=108) were accepted and transferred but not cannulated, highlighting the complexity of referral intent (ECMO initiation vs specialist input).
- **Referral Geography:** Proximity to Royal Brompton Hospital was associated with higher referral volumes, with additional cross-catchment referrals observed.

References

1. Signpost [Internet]. [cited 2025 Sep 24]. Signpost | ECMO | Highly Specialised Services. Available from: <https://www.signpost.healthcare/ecmo-referral-pathway>
2. Homepage [Internet]. [cited 2025 Sep 26]. Available from: <https://www.referapatient.org/refer-a-patient>
3. ECMO and severe respiratory failure service | Royal Brompton & Harefield hospitals [Internet]. [cited 2025 Sep 29]. Available from: https://www.rbht.nhs.uk/our-services/clinical_support/critical-care-and-anaesthesia/ecmo-and-severe-respiratory-failure-service