Understanding patient flow within community healthcare

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Novel methods for mapping sequences and patterns of referrals

In recent decades, community services have been at the forefront of healthcare policy around the world [1], notably within the NHS Five Year Forward Plan [2]. A stand out challenge for this sector is how services may be organised to provide co-ordinated care given their physical distribution, patients using multiple services, increased volume of referrals and differing patient needs [3]. With a wealth of data available, accessible analysis and collaborative research are key in addressing this challenge.

We have worked alongside the North East London Foundation Trust (NELFT) to understand the dynamics of community referrals through novel visualisations of referral data. These methods help researchers and service managers to investigate questions that are otherwise difficult to answer from raw data.

The aims of this work were to: understand this complex system, explore concurrent uses of multiple services, and identify common patterns of referrals.

Each map focuses on a different aspect of community referrals. Applying these methods to NELFT services, we helped inform their thinking towards the design of a single point of access (SPA) - a service for streamlining referral processes in NELFT community services. We present a selection of these maps here.

Methods and Results

Network Map

Motivated by the complexity of referral data and volume of services, we developed a network map. Nodes (circles) represent services and edges (lines) represent referrals between them. There are two types of node – external sources and specialties. The former exist outside of NELFT's community provision, with their size indicating number of referrals out. Specialties form NELFT's community provision, their size indicating number of referrals received. Colouring conveys patient activity and edge widths signify the volume of referrals between services.

- Two levels of activity were identified: large number of low activity referral edges vs the few high activity referral edges that form the bulk of referrals.

- Metrics were calculated to understand the structure of the network, for example we identified groups of services which commonly refer to each other.
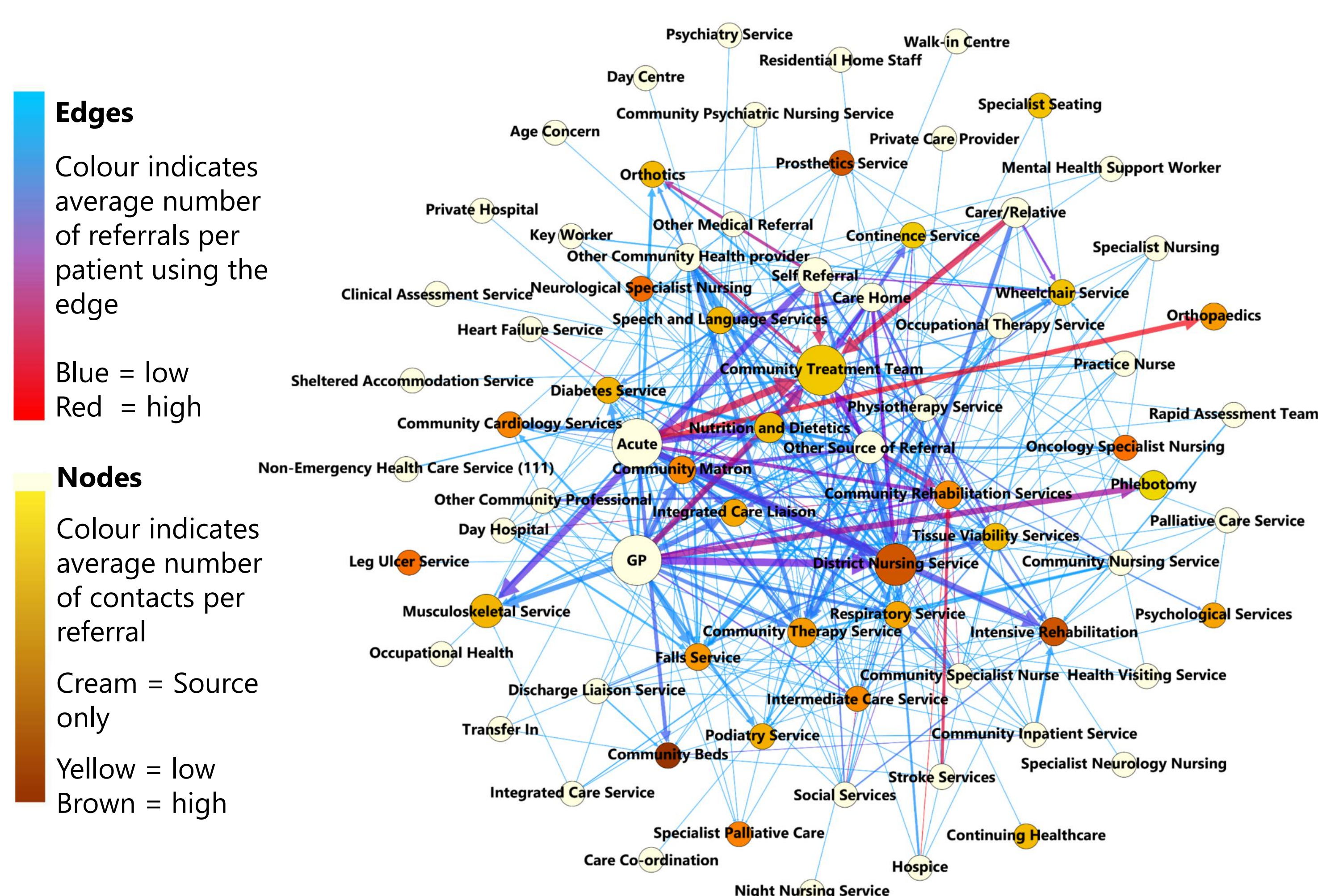
Concurrent uses of service

We plotted the time distribution of concurrent uses of multiple services since the start of each patient's first referral in the dataset.

- This shows how patients use multiple community services, with a significant number using more than one service at the same time, especially within the first 100 days of the start of their first referral.
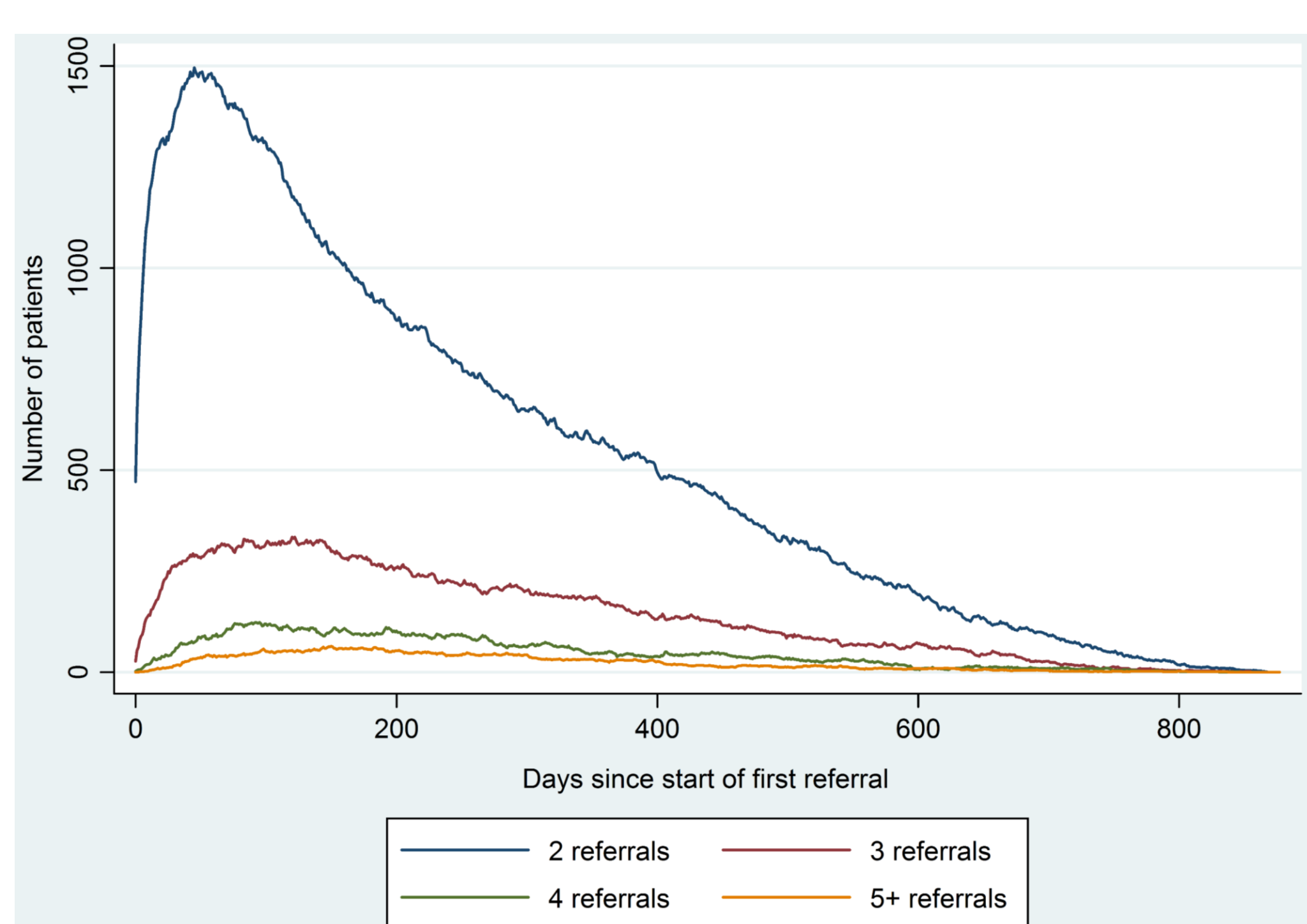
Chains of referrals

Using a flow diagram, we analysed the volume of patients who were referred from one NELFT service to another. Each chain is coloured according to the first specialty referred to. The original source is also captured, with chains flowing left to right.

- Identifying key chains and their volume of use helps to understand whether services have common associations, and how frequently they refer to each other.
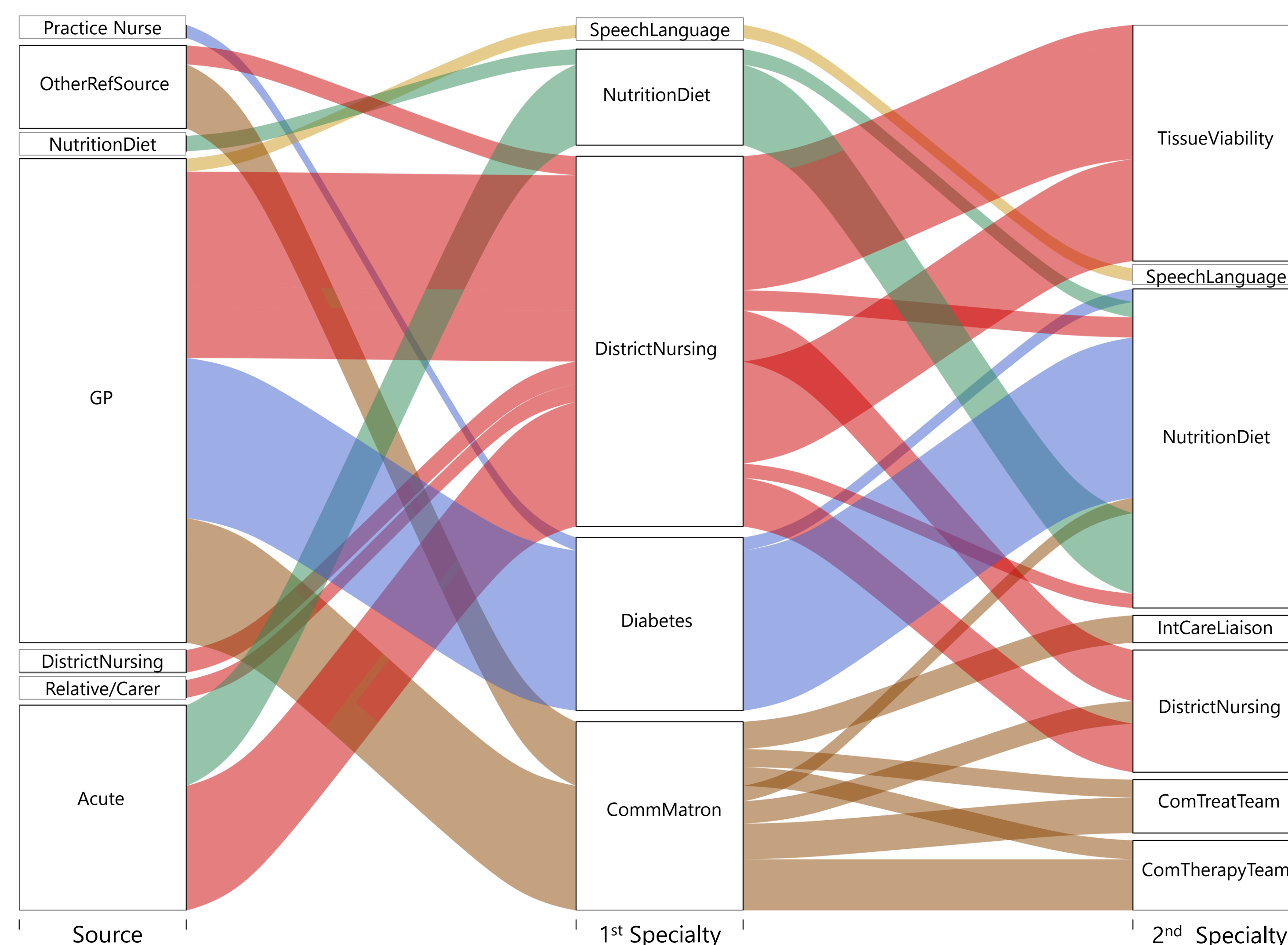
Implications

This work helped inform our collaborators thoughts around a SPA in several ways:

- Highlighted which services should be included depending on the level of activity or type of referrals they wanted to address i.e. external referrals only?

- Identified a large number of referring services, helping to think through how a SPA may help streamline referrals.

- Few NELFT services referred to each other, others were commonly used in conjunction. This knowledge can help inform referral practices within the SPA.

To aid the use of these methods in service, we held a workshop, training a variety of clinical leads in how to apply the network methods to their data and interpret them.

Limitations

Our data was left-truncated and right-censored i.e. not all referrals had finished by the end date of the data. As a result, the dataset may be biased, favouring shorter referrals. This may limit the insight gained by some of these methods.

- This is not an issue when implementing the methods with more data, or where data is easily accessed and updated – such as within the organisation or services.

- Survival curves/Kaplan-Meier plots may overcome missing end data. We will investigate this as future work.

Future work

Some questions that arose from this work, but were not directly addressed:

- Can regions in the system be identified where patients bounce back and forth between sources and specialties?

- Considering episode duration or time between referrals, can data visualisation help identify inappropriate referrals?

- What can be learned by applying these methods to a patient's total care, including services outside of physical community care?

References

[1] T Munton et al. (2011) Evidence: Getting out of hospital?, *Health Foundation*

[2] NHS England (2014), Five Year Forward View, *London: HM Government*

[3] R Palmer et al. (2017) A systematic literature review of operational research methods for modelling patient flow and outcomes within community healthcare and other settings, *Health Systems*

Acknowledgments