Understanding patient flow within community healthcare - a novel mapping of sequences and patterns of referral

Ryan Palmer, Martin Utley

Clinical Operational Research Unit (CORU),
University College London (UCL), London
e-mail: ryan.palmer.14@ucl.ac.uk

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Context: Community healthcare and healthcare policy

In recent decades, an ambition of healthcare policy has been to deliver more care in the community sector [4].

- Diverse range of geographically dispersed health services
- Common for patients to use a range of services which they may re-use
- Considered to be crucial in meeting the current and future challenges that face modern health care services [3]

Challenge: how organise and deliver these services given: physical distribution, patients using multiple services, increased referrals, case mix, and long term care requirements [6].

North East London Foundation Trust

- Serve North East London (Waltham Forest, Redbridge, Barking and Dagenham, and Havering) serving a population of almost 2.5 million (including Essex)
- They have adopted a decentralised community based model of healthcare - in accordance to national developments and changes in policy [2]
  - NELFT Operational Plan states that this transition followed the trend to deliver more care out of hospital [5]
  - Includes: provision of care for patients with long term illness, mental health services and elderly care

Purpose of work

Working with services in Havering, we analysed community referral data for patients aged 65 and over to:

- Understand the dynamics of referrals in the large and complex system of care
- Help identify whether referrals may be streamlined or simplified
- Explore how patients used multiple services and whether common referral patterns occurred

NELFT are seeking to establish a single point of access (SPA) - they wanted these insights to shape their thoughts in designing the SPA.

Visualising referral data

From meetings, three characteristics of the community referrals stood out:

- **Theoretically:** possible for all physical health services to refer to each other - complete network of more than thirty services
- **Perception:** believed this would be seen in practice
- **Key characteristic:** potential for patients to re-use services multiple times

Seeking to understand these dynamics, we produced a network to represent their data using Gephi [1].

Key features of the network

Patient level routine data set - 1st April 2014 to 31st Aug 2016

Nodes: represent services - two types

- Specialties: services that are part of NELFT's community portfolio, to which patients are referred.
- External Sources: services that exist outside of NELFT's community portfolio, referring patients in i.e. acute care

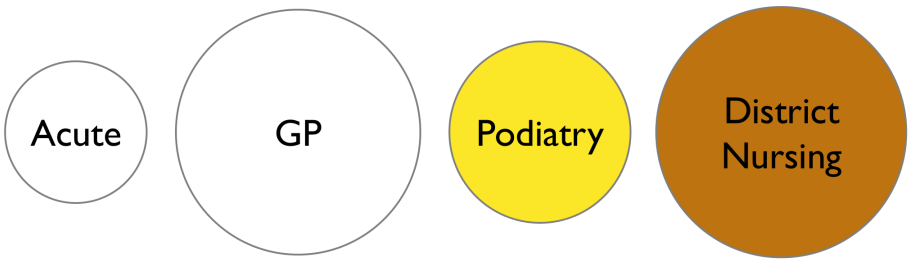
Edges: represent referrals

- Directed: always flowing from sources to referrals, indicated by arrows

Note: Some specialties may refer to other specialties

Key features of the network

- Size:
  - External Source: Number of referrals leaving
  - Specialty: Number of referrals received
- Colour:
  - External Source: White
  - Specialty: Light brown to dark
    - Indicates a measure for the service:
    - i.e. Average number of appointments per referral

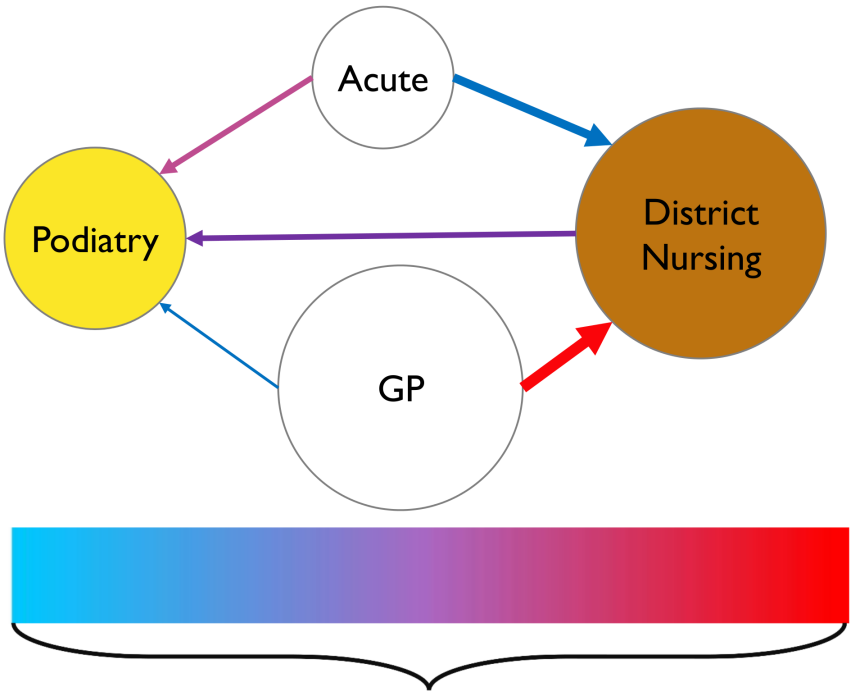


Source size: 1 - 12,586 Specialty size: 1 - 12,598

1-22: Average number of appointments per referral

Key features of the network

- Width:
  - Number of referrals: 1 - 5810
- Colour:
  - Blue to red
  - Indicates a measure for the service:
    - i.e. Average number of referrals per patient



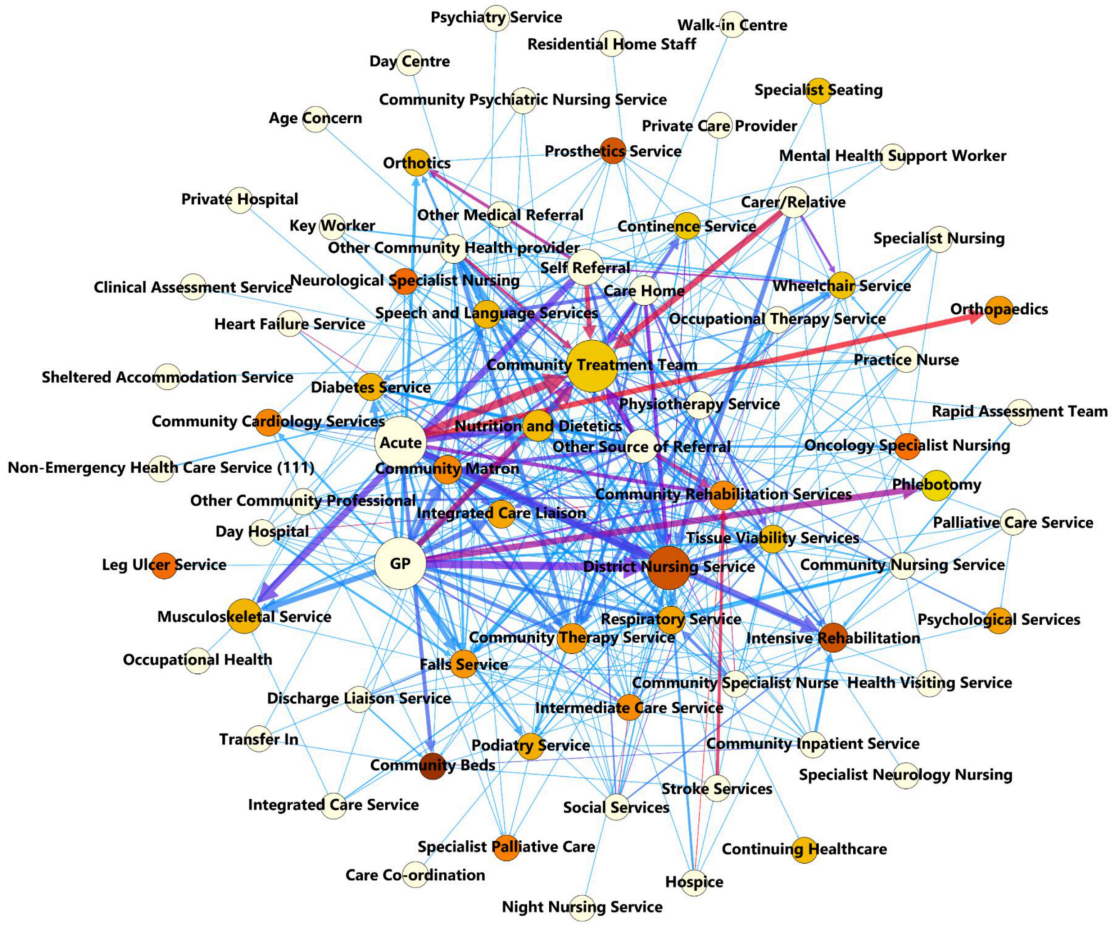
1-2: Average number of referrals per patient who uses edge

Complete network

75 nodes:

- 44 sources, 31 specialties
  - 11 refer to other specialties
- 45,506 referrals
- 386 referral paths (edges)

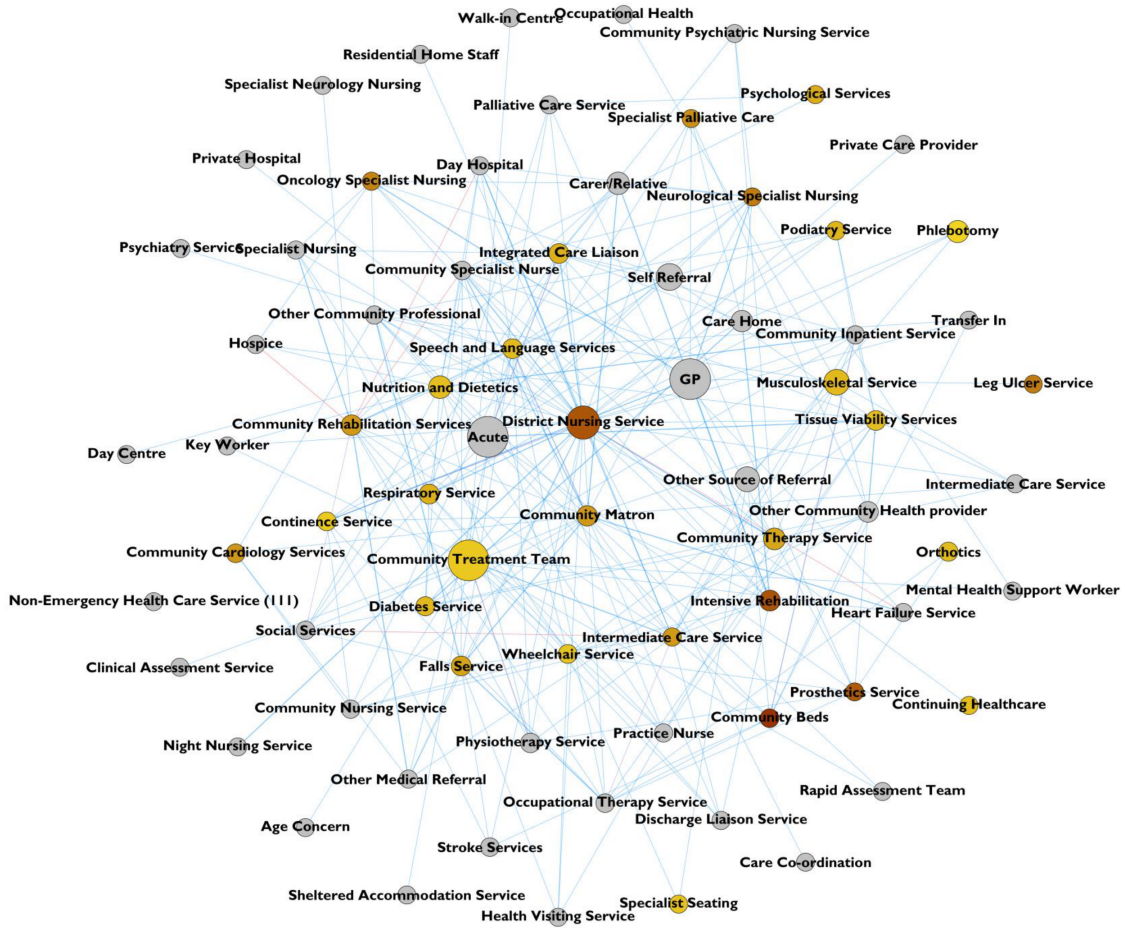
- Average number of edges connecting each node - 5.147



Low activity filter

74 nodes:

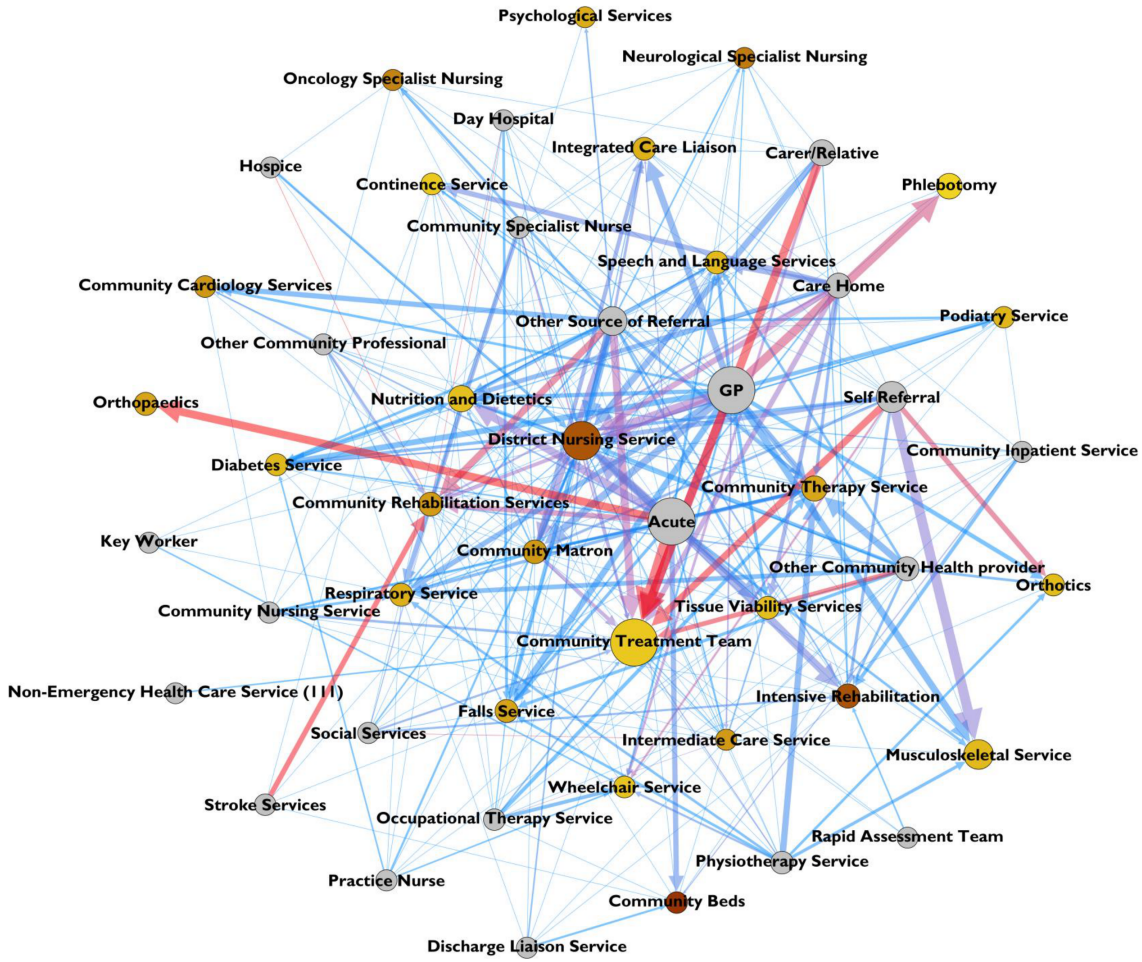
- 44 sources, 30 specialties
  - 10 refer to other specialties
- 293 referral paths (edges)
- Accounts for 6.8% of all referrals



High activity filter

39 nodes:

- 16 sources, 23 specialties
  - 9 refer to other specialties
- 93 referral paths (edges)
- Accounts for 93.2% of all referrals

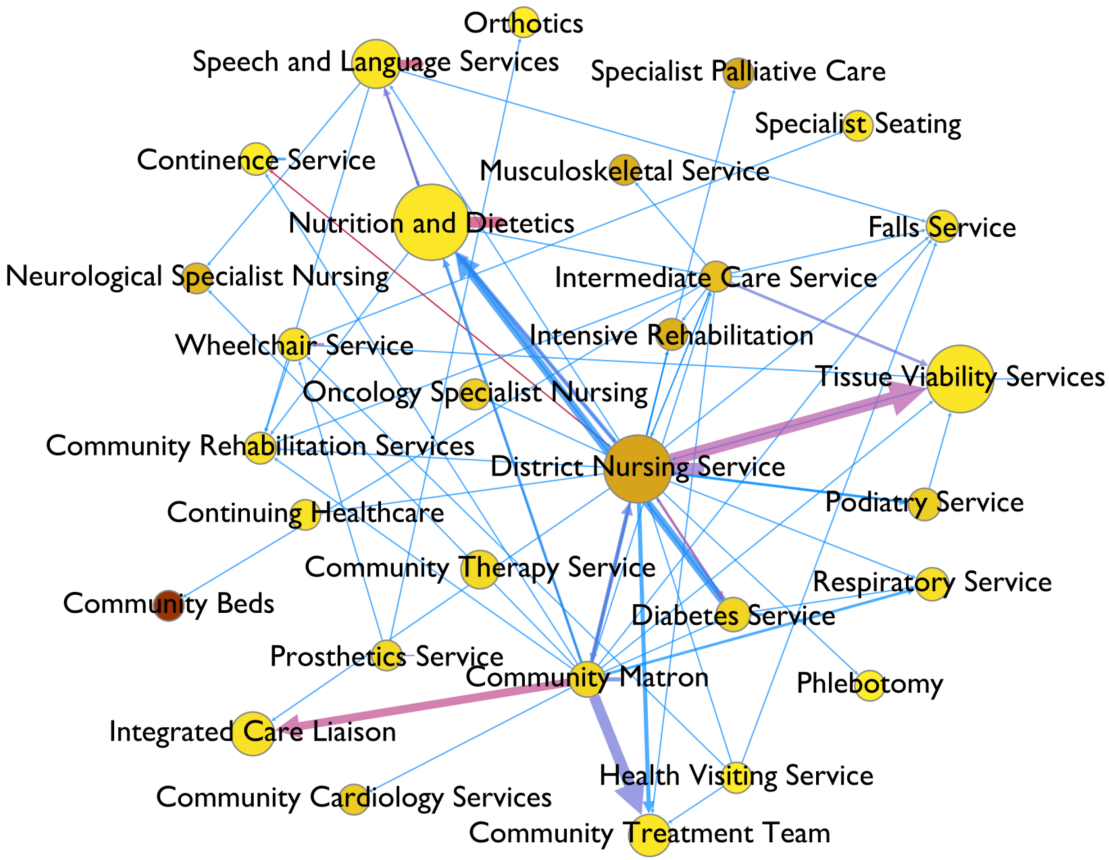


NELFT to NELFT

28 nodes:

- All specialties
  - 11 refer to other specialties
- 74 edges
- 2,919 accounting for 6.4% of all referrals

- Modularity – <0
  - No natural subgroups



Implications in design of SPA

- Is the high number of low activity referral pathways (edges) appropriate for these services?
  - Does this highlight a flaw in the system?
  - Or, is this a positive characteristic that patients may be referred into any service?
- How can should a SPA be designed to streamline referrals?

We ran a workshop with service leads to teach them how to apply these methods to their data, and interpret the results

- Service managers began to be identify possible services for inclusion within the SPA.
- Stimulated thought around whether only referrals from external sources should be included, or whether the SPA should cover NELFT to NELFT also.

Conclusions

Methods for visualising referral data are useful for the management and organisation of healthcare services.

These methods:

i. Visualise complex data which would otherwise be overwhelming and hard to understand.
ii. Analyse patient activity, identifying services that exhibit interesting characteristics.
iii. Stimulate conversation around analysis or information that is beneficial in managing these services

Future work with design of SPA

Questions raised but not investigated:

- Are there any regions in the system where patients bounce from one service to another and back?
- Can inappropriate referrals be identified i.e short episodes that get referred on elsewhere?
- Can these methods be used to describe a patient's total care by including services outside of physical community care i.e. acute care, social care and mental health?
- What insight may be gained by including more types of service?

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Thank you for your attention

Are there any questions?