The Leeds Networked Data Lab: Analysis plan for Topic 4: Intermediate Care

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Contents

1. Research rationale and objectives

Rationale:

The Leeds Health and Care Partnership (LHCP) commissioned an external review of intermediate care by Newton-Europe (NE) to identify opportunities to improve the health outcomes for people using these services in Leeds. Their analysis used existing local data flows of Leeds Community Health (LCH) data and focussed on health outcomes following intermediate care, which were provided after a hospital discharge - as illustrated in Appendix A. IC activity was summarised by demographic characteristics, and electronic frailty score, and compared with the overall Leeds population. Health outcomes were defined as the Length of Stay (LOS) in intermediate care and (re)admission rate for Acute Hospital Care (A&E attendance or non-elective admission). Readmissions within 30 days of discharge from IC were identified by linking intermediate care data to acute (secondary) data at an individual level. The review showed there were approximately 41,371 total users of IC in Leeds between March 2020 and March 2023 with average age of 81. Neighbourhood Teams comprised 87% of Intermediate Care users in Leeds.

Key findings included:

- 85% of IC users have a frailty score greater than 5.
- The proportion of males using IC is significantly lower than the proportion of males living with Frailty (41% compared to 39%)
- The average LOS for NT, RA and CCB is 89, 20, and 35 days respectively.
- The average hospital (re)admission rate (AE and Non-elective care) within 30 days of discharge from IC is approximately 12-14%
- A user living in the most deprived decile is typically more frail and younger than users from less deprived areas.

The review found too many people were spending more time in hospital than they needed to; short-term care was provided across many different services; outcomes depend on when, where, and how care was delivered; a high use of bed-based care; and that many older people could reduce or avoid deconditioning were services redesigned. It identified multiple opportunities to improve intermediate care services in Leeds with potential to decrease the length of stay in community care and reduce hospital readmissions from NTs, CCBs and RA. These findings have informed a significant programme of work to change how intermediate care is delivered in Leeds, the HomeFirst programme.[1] Nationally, the picture of increasing delays to discharge provides important context into which this local analysis could feed, providing further evidence to inform national policy debate and response.[2]

The Newton Europe analysis did not differentiate whether IC was to prevent hospital admission or provide support for a patient upon hospital discharge, the nature of any hospital admission, whether patients were receiving other care (GP, Elective, Community services) in addition to intermediate care, and consequently any possible association that care has with health outcomes. NICE has defined several Discharge to Assess (D2A) pathways which provide increasing levels of support from home-based care to significant / complex bed-based care. In this study, Leeds will examine health outcomes for intermediate care received on pathways 1 (Home support provided by

[1] HomeFirst - Leeds Health and Care Partnership (healthandcareleeds.org)
[2] Why are delayed discharges from hospital increasing? Seeing the bigger picture - The Health Foundation (Mar 2023)

Neighbourhood Teams (NT),[3] and Reablement services (RA)) and pathway 2 (Community Care Beds (CCB)), following a hospital discharge. This analysis will expand on analysis from Newton-Europe to build a complete descriptive picture of Intermediate Care before (to prevent) and following Hospital Admission.

NDL Leeds is a part of the Leeds Office of Data Analytics (ODA) which supports Leeds City Council and the Leeds Office of the West Yorkshire Integrated Care Board (WYICB). An important ODA function is the data engineering of new data assets. To prepare and validate them for operational reporting and provide robust, reliable data to executive decision makers. An exploratory analysis of NHS Digital's Community Services Data Set (CSDS) will be undertaken to validate the accuracy and quality of CSDS data and determine whether it is feasible to replace existing LCH data flows with CSDS for wider use. If this is unfeasible, recommendations for improving CSDS data quality will be made to decision makers. This will be an important NDL contribution to building local analytical capacity, sharing good practice, and implementing use the CSDS.

Conducting parallel analyses will serve as an assessment of CSDS Data quality by allowing direct comparison of existing data flows (extension of NE analysis) and CSDS data. Any differences will be investigated further and form recommendations for improvement.

Aims:

The aim(s) of this study are to:

1) Define the users of intermediate care in Leeds.
2) Determine the demographic factors associated with inequalities in intermediate care use and health outcomes.
3) Investigate associations between contact with elective and / or general practice services prior to acute hospital admission and subsequent intermediate care use.

Output 1

Output 1a will identify users of IC in Leeds following a hospital admission between 1st April 2022 and 31st March 2023, using existing Leeds Community Health (LCH) data. Health outcomes will be the length of stay in Intermediate Care services and whether a service-user was re-admitted to Acute Care within 30 days following discharge from IC services.

The number of service users, referrals and contacts for Neighbourhood Teams, Community Care Beds and Reablement will be summarised by demographic characteristics (age, gender, deprivation, ethnicity), level of frailty, and health outcomes. Additional variables are listed in Section 3.4 and include geographical information of the service-user.

Output 1b will develop Extract, Transform and Load (ETL) protocols for Community Services Data Set (CSDS) and map the existing LCH definition of intermediate care to CSDS. For example, it is currently unknown whether "Neighbourhood Teams" have an equivalent in CSDS, or whether the service type has been disaggregated further.

Output 1 will provide an important foundation for this analysis. It will

- Confirm that existing NE findings hold for the April 2022 – April 2023 study period.

[3] LCH Neighbourhood Teams (leedscommunityhealthcare.nhs.uk)

- Develop ETL protocols for CSDS using the SQL programming language.
- Derive working definitions for Intermediate Care according to CSDS fields.
- Compare summarised data from Output 1a and 1b and identify the source of any discrepancies.
- Validate whether CSDS is appropriate for wider operational reporting within the WYICB.

This analysis will proceed with LCH as the source of Intermediate Care data, but maybe supplemented by additional information from CSDS if appropriate.

Output 2

Newton Europe's analysis was focused on Intermediate Care provided between March 2020 and March 2022, following a hospital admission. However, users can also receive intermediate care to prevent hospital admissions alongside other parallel forms of care (See Appendix A for an illustration of how these Outputs relate NE analysis, the care pathway and one another).

Output 2 will provide a wider picture of the Intermediate Care pathway and describe other services received 6 months prior to hospital admission. Intermediate care data will be linked to acute care, primary care, and other community care data to determine number of GP appointments and other activity prior to Hospital Admission, through a common NHS pseudonym.

Hospital Admissions will be described using referral source, discharge destination, primary diagnosis, treatment code and procedure codes for attendances at AE, elective and non-elective spells, outpatient appointments and other hospital activity. Additional variables are listed in Section 3.4 and include Length of (last) Hospital Stay.

GP appointments will be described by consultation type, and intermediate care prior to Hospital Admission will be categorised by service type as in Output 1a. It is unclear whether users receive any parallel community care whilst being supported by intermediate care services, and this requires further investigation. Linked data will initially be aggregated to patient-level to count hospital spells, GP attendances and number of community contacts 6 months prior to Intermediate Care, and 1 month following the end of IC support. Patient-level data will be further summarised according to demographics (age, gender, index of multiple deprivation and ethnicity), frailty-score and Intermediate Care service type (NT, RA, CCB) following Hospital Admission (as identified in Output1).

Output 3

Output 3 will investigate health inequalities in intermediate care and determine whether patients who receive elective services, or GP support, within 6 months prior to hospital admission have better health outcomes following intermediate care support.

A logistic regression model will quantify the association between demographic variables and healthcare activity prior to hospital admission (Elective care and GP appointments), and the probability of Acute Care re-admission within 30 days following Intermediate Care support ending.

NE analysis described in Section 1 found a 14-16% acute care readmission rate at 30 days amongst 41,371 Intermediate Care patients in Leeds. 82% were supported by Neighbourhood Teams, 6% from Community Care Beds and 7% from Reablement.

Table 1 shows that re-admission rates vary between 7% and 15% depending on IC service. It is noted that a combination of small sample sizes and substantial class imbalance may present difficulties in determining associations between outcome and regressors for CCBs and the reablement service. Exploratory data analysis from Output 1 and 2 will provide an understanding of sample bias and relationships between variables which will inform modelling decisions. Furthermore, potential outliers can be identified and removed if there is suitable justification.

IC service	Number users	Avg age	Avg LOS	Readmission rate
CCBs	2336	84	35	0.19
NT	36008	77	71	0.07
Reablement	3027	81	20	0.15

Table 1 - Summary of health outcomes from review conducted by Newton Europe

(Potential Output 4 - Virtual Frailty Ward – remote monitoring)
An evaluation of the use of remote monitoring (as part of a Virtual Frailty Ward) is planned for early 2024. The Virtual Frailty Ward[4] in Leeds is categorised as a Neighbourhood Team in LCH data. The NDL and evaluation teams will stay in close contact as this evaluation develops to determine if a supplementary analysis of remote monitoring can be included in these analytical outputs.

2. Data and data linkages

The data source for these analyses is the Leeds Data Model. This data asset provides access to national data sets for NHS commissioned care in England, linked to local data sets on primary care data held in Leeds General Practices clinical systems, Leeds Community Care Trust data, and Adult Social Care activity provided by Leeds City Council. These data are restricted to Leeds GP registered patients who have not opted out of data sharing for secondary use (see section 4). Data linkage is by pseudonymised NHS number, as such where these data are not complete data is omitted. This is a restriction in linkage for adult social care data (historically approximately, 80-85% of ASC records hold an NHS number).

These data are hosted by North England Commission Support (NECS) and accessed through secure connection to a virtual data warehousing environment. A list of data sets for this study are listed below. Outcome and Exposure variables are listed in section 3.4.

Data sets

- Primary care data (from EMIS & TPP), featuring patient demographics, appointments, events, and prescriptions. Key clinical data relating to patient conditions, as well as demographic information and patient carer status is recorded via both Read code (EMIS: v2, TPP: v3) and SNOMED codes.

- Leeds Community Health Care data, community health care nursing and therapy activity data provided by local NHS provider.

[4] NHS England » Providing rapid care to people in their own home rather than going to hospital, through a frailty virtual ward in Leeds

- Adult social care data extracts (from CIS), featuring referrals, reviews, assessments, and service provisions. This data set is externally linkable via pseudonymised NHS number, and internally linked through unique ASC ID.

- Secondary Uses Service (SUS), containing inpatient attendances, outpatient appointments, Community Services Data Set (CSDS) and A&E visits.

In addition, further reference data may be required from the sources below:

- External open data sources and/or APIs including: Index of Multiple Deprivation (IMD) linked to patient record at Lower Super Output Area (LSOA) level where patient record holds LSOA of residence: clinical coding (Read/SNOMED lookups); and population data (ONS census and mid-year estimates, to LSOA level).

3. Statistical methods

3.1 Study design and statistical approaches

Output 1 and 2 will be descriptive analysis which provides an overview of the wider intermediate care pathway and will provide an exploratory analysis to inform modelling decisions. Output 3 will use explanatory models to investigate associations between health inequalities and intermediate health outcomes. Output 4 is to be determined.

3.2 Study period

The study cohort will consist of Intermediate Care users between 1st April 2022 and 31st March 2023. Healthcare activity up to 6 months prior to Hospital Admission will be included in the analysis, with October 2021 as the earliest point. Acute readmissions up to 30 days (1 month) will also be included up to April 31st 2023.

3.3 Study population

The study cohort is defined as Leeds GP registered patients in the Leeds Data Model with healthcare contact with LCH Neighbourhood Team, Community Care Bed, or Reablement Service. For Output 3, a subset of this population with a spell of acute care, and Frailty Score (eFI).

3.4 Definitions of outcomes and exposures

Please see table below for outcome and exposure variables. Successive outputs include variables stated for prior outputs.

Output	Type of variable (outcome or exposure)	Definition criteria	Dataset(s) from which the variable is derived
3,4	Outcome	AC readmittance	SUS
1	Exposure	IC LOS	LCH / CSDS
1	Exposure	Age	Multiple
1	Exposure	Age-band	Multiple
1	Exposure	Gender	Multiple[1]
1	Exposure	Ethnicity (census ethnic group)	Multiple[1]
1	Exposure	IMD 2019	Multiple[1]
1	Exposure	Frailty index (eFI) [3]	GP
1	Exposure	Dementia status[4]	GP
1	Exposure	IC LOS	LCH / CSDS
1	Exposure	Readmittance date	LCH / CSDS
1	Exposure	IC referrals	LCH / CSDS
1	Exposure	IC team type	LCH / CSDS
2	Exposure	Acute Care admissions	SUS
2	Exposure	Acute Care discharge	SUS
2	Exposure	Acute Care delayed discharge	SUS[2]
2	Exposure	Acute Care LOS	SUS
2	Exposure	OP attendances	SUS
2	Exposure	AE attendances	SUS
2	Exposure	GP contacts	GP
2	Exposure	LCH contacts (non-IC)	LCH
2	Exposure	Number of Comorbidities	LDM PHM cohort tables
All	Misc	Pseudo-NHS-number	All

Other comments (including external references)
[1] If not available in LCH / CSDS obtainable from other datasets
[2] If specific data item not well coded, use excess bed days to be tested.
[3] See Appendix for frailty deficits in electronic Frailty Index (eFI)
[4] Complete list of SNOMED codes for GP practice reported Dementia available here: Primary Care Domain Portal

3.5 Known limitations

Data for this study will be primarily derived from commissioning data sets. Some of which are known to have limited data on protected characteristics, where possible and required, data linkage to general practice data in the Leeds Data Model will be used to increase data completeness.

Longitudinal data is required for this study, the potential for confounding due the impact of Covid for instance in terms of reduced or deferred service use need quantifying.

4. Governance

4.1 Availability of data and materials

These data are available from the Leeds Data Model. A commonly pseudonymised ('linked') series of health and social care data sets. The Leeds Office of the West Yorkshire ICB is the data controller for this asset and has a legal basis to use these data for commissioning, planning and healthcare. The Leeds Networked Data Lab is part of this Office, with access to these data for this purpose. Access by and analysis of these data by the Networked Data Lab team (along with access for named individuals) is covered under existing data governance policies.

4.2 Ethics approval and participation consent

Ethical approval has been given for all data contained within the Leeds Data Model to be linked and used for the purposes set out within this plan, both through local data sharing agreements and DARS agreements for national data sets.

The legal basis for use of these data in the planning and provision of healthcare allows the use of these data without explicit consent. Though explicit consent is not required, it should be noted as part of the routine data processing of data provisioned for the Leeds Data Model, the data for any person choosing to opt out of allowing their data to be made available for secondary use are excluded.[5]

5. Impact, dissemination, and engagement

The output of these analyses will be presented at Health Foundation and Networked Data Lab fora, key stakeholder groups in the Leeds health and care system and to the wider West Yorkshire ICB. This includes dissemination to the Leeds HomeFirst Programme, Leeds Place Population Health Management Boards – (specifically People Living with Frailty, and Long-Term Conditions Boards); Leeds City Council Adult Social Care directorate executive team; and third sector organisations supporting older people and people living with Frailty. Further targeted dissemination of findings will be developed on recommendation from these groups and dependent on the evidence from this study of poorer health outcomes for specific population groups.

These analyses will provide stakeholders evidence to better understand the causes of differences in health outcomes by demographic characteristics and quantify the effect of these differences. This will enabling better targeting of support to more disadvantaged groups reducing health inequalities and service planning to improve health outcomes.

[5] National data opt-out - NHS Digital,
[MI] National Data Opt-out, May 2023 - NDRS (digital.nhs.uk), Leeds GP registered patients 3.7% opt out as at May 2023

6. Appendix

Electronic Frailty Index, Frailty deficits

Activity limitation	Hearing impairment	Polypharmacy
Anaemia and haematinic deficiency	Heart failure	Requirement for care
Arthritis	Heart valve disease	Respiratory disease
Atrial fibrillation	Housebound	Skin ulcer
Cerebrovascular disease	Hypertension	Sleep disturbance
Chronic kidney disease	Hypotension/syncope	Social vulnerability
Diabetes	Memory and cognitive problems	Thyroid disease
Dizziness	Mobility and transfer problems	Urinary incontinence
Dyspnoea	Osteoporosis	Urinary system disease
Falls	Parkinsonism and tremor	Visual impairment
Foot problems	Peptic ulcer	Weight loss and anorexia
Fragility fracture	Peripheral vascular disease	Ischaemic heart disease

Source: The Convergent Validity of the electronic Frailty Index (eFI) with the Clinical Frailty Scale (CFS) - PMC (nih.gov)

Appendix A

Newton Europe Analysis coverage of Intermediate Care in Leeds