Version 4.0

Cheshire and Merseyside Networked Data Lab:

A review of Intermediate care services to prevent emergency readmission within Liverpool.

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1. Research rationale and objectives

Intermediate care (IC) provides support for a short time to help people recover and increase their independence following a hospital admission. It includes reablement, crisis response, home-based, and bed-based support. It is usually provided by a mix of health and social care professionals with a range of different skills including nurses, social workers, doctors, and a range of therapists. The goals are help patients remain at home when they start to find things more difficult, recover after a fall, an acute illness or an operation, avoid going into hospital unnecessarily, or return home more quickly after a hospital stay.

Intermediate care in Cheshire & Merseyside

Within Mersey Care's Integrated Community Reablement and Assessment Service (ICRAS) there are inpatient Intermediate Care beds (Hub Rehabilitation Units across Liverpool), as well as community services across Liverpool and South Sefton.

At discharge from hospital, patients can be broadly categorised into one of 4 pathways:
0 – discharged home without IC
1 – Discharged home with IC
2 – Discharged to bed-based care with IC
3 – Discharged into a care home

We have opted to focus on the Liverpool area **(Liverpool Place**) due to data availability and existing engagement from Intermediate Care & Social Care services. The research will undertake a whole-system review within Liverpool across the discharge pathway aiming to understand whether the current system is sustainable and fit for purpose. Appendix 6 represents the current discharge pathway for Adults in Liverpool.

Liverpool Place Intermediate Care Summary

- The ICRAS team within Mersey Care manage the overall package of care
    - ICRAS team deliver the associated healthcare services
    - Liverpool City Council deliver the associated social care services
- Assessments happen in situ regarding discharge, carried out by the ICRAS team
- Initial video triage carried out by ImmediCare (data not available)
- Network of key decision makers mapped out for Liverpool Place IC services
- Three Intermediate Care Facilities – Granby, Sedgemoor & Townsend (circa 30 beds each)

Aims and objectives

The aim of this project is to link routinely collected health and social care data for Liverpool in order to better understand who is using IC, what is being delivered as IC (and to whom), and what the impact of IC is on patient outcomes.

Objective 1. Establish linkage between health (NHS) and social care (local authority) datasets and use this to identify individuals on alternative pathways of care.

Objective 2. Describe and explore the demographic and health characteristics of people on the alternative pathways of care.

Objective 3. Describe different forms of IC services received and explore how the intensity of support received is related to individual level of need.

Objective 4. Compare the characteristics of patients receiving home-based or bed-based IC support and those without an assigned pathway.

Objective 5. Evaluate the impact of IC by comparing the health outcomes of those who received it with (clinically/demographically) similar people who did not receive it.

2. Data and data linkages

Data on IC services will be linked with routinely collected electronic health record (EHR) data sources available for the population of Cheshire and Merseyside. Linkage is only possible for individuals with an NHS number which currently stands at 98% in Cheshire & Merseyside.

Datasets below will be linked using a pseudonymised key.

NHS

- Primary care data
- Prescribing data
- Secondary care data (SUS; inpatient and outpatient)
- CSDS (Community Services Data Set) inc. ICRAS
- ECDS (Emergency Care Data Set)
- Criteria to reside (in Acute)
- NWAS 111/999
- Johns Hopkins Risk Model

Local Authority Adult Social Care

- ASCD (Adult Social Care Dataset)
- People assessed for carers support

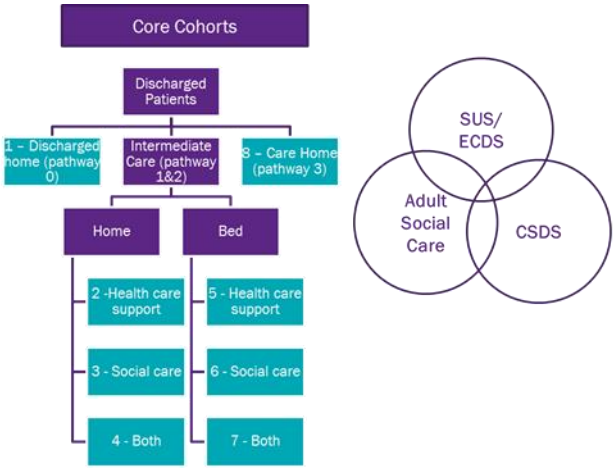
Open data – linked to LSOAs

- Indices of deprivation

Objective 1. Establish linkage between health (NHS) and social care (local authority) datasets and use this to identify individuals on alternative pathways of care.

We first plan to create our intermediate care 'core cohorts' (shown below). To do this we plan to join Acute data (SUS) with the community and social care data to understand, of those discharged from Acute setting, which patients engaged in IC via health and/or social care services.

Cohort identification logic outlined below (CSDS & ASCD coding validation in progress).



#	Cohort	Data definition
1	Discharged home (pathway 0) no PoC	SUS discharge code = X No activity in CSDS or Social Care within X months
2	Intermediate Care (pathway 1&2) Home w. Health care support	SUS discharge code = X CSDS activity within X months
3	Intermediate Care (pathway 1&2) Home w. social care support	SUS discharge code = X Social care activity within X months
4	Intermediate Care (pathway 1&2) Home w. Health & Social care support	SUS discharge code = X CSDS and Social care activity within X months
5	Intermediate Care (pathway 1&2) Bed w. Health care support	SUS discharge code = Y CSDS activity within X months
6	Intermediate Care (pathway 1&2) Bed w. social care support	SUS discharge code = Y Social care activity within X months
7	Intermediate Care (pathway 1&2) Bed w. Health & Social care support	SUS discharge code = Y CSDS and Social care activity within X months

3. Statistical methods

3.1 Study design

This will be a retrospective cohort study centralised around quantitative analysis of electronic health record data that is underpinned by qualitative insights from IC patients, clinical staff and managerial staff across IC services within Mersey Care.

3.2 Study period

The study will include data from patients discharged from hospital during a 2-year period of April 2021- March 2023 inclusive. The outcome variables (see Section 3.4) will include the period up to June 2023 so that we can explore at least 3-month outcomes for all patients. Patients with more than one record of hospital discharge will only be included once in the cohort, any event after the first recorded discharge will only be investigated as an outcome. We have restricted the study period to predominantly post-COVID (the second national lockdown ended in July 2021) so that we can better understand the current state-of-play for IC services.

3.3 Study population

The study will be focussed upon patients aged 18 years and above who have been discharged from an adult secondary care service. There are circa 430k adults registered in GP Practices within Liverpool. The patient cohorts we will examine are aligned with the IC pathways described above:

0 –Discharged home without IC

1 – Discharged home with IC

2 – Discharged to bed-based IC

3 – Discharged into a care home

4 – Not enough information to assign pathway

<u>Discharged to home without IC (Pathway 0)</u>

This includes patients that have been discharged to their usual place of residence and have not been referred to/accessed IC. The inclusion criteria for this cohort are:

- Discharged from hospital between April 2021 and December 2022.
- Secondary care records (SUS) indicate discharge to usual residence.
- No record of accessing IC in community care (CSDS) or social care (ASC) records within 7 days of discharge.

<u>Discharged to home or to bed-based care with IC (Pathways 1 & 2)</u>

This includes patients who have accessed IC following hospital discharge. IC delivered in usual place of residence or bed-based care is included. The inclusion criteria for this cohort are:

- Discharged from hospital between April 2021 and December 2022.
- Secondary care records (SUS) indicate discharge to usual residence or alternative short-term facility (i.e. not a care home).
- Record of accessing IC in community care (CSDS) or social care (ASC) records within 7 days of discharge. Patient's access to CSDS care defined as a referral that occurs within 7 days following patient's discharge, and this referral must result in a care contact where the

patient is present for the scheduled appointment. Appendix 2 provides further details on the approach used for assigning pathways to each patient with available IC information in APCS, CSDS and ASC datasets.

Discharged into a care home (Pathway 3)

This includes patients that have been discharged to a residential care home. They have not referred for IC because they already have long-term care provision established. The inclusion criteria for this cohort are:

- Discharged from hospital between April 2021 and December 2022.
- Secondary care records (SUS) indicate discharge to a residential care home.

Not enough information to assign pathway (Pathway 4)

This refers to patients who were discharged from the hospital, but the destination code was not sufficient for assigning a specific pathway. Integration with CSDS and ASC data was not successfully performed for these patients. The inclusion criteria for this cohort are:

- Discharged from hospital between April 2021 and December 2022.
- Secondary care records (SUS) where discharge destination could not indicate a specific pathway (e.g. discharge destination not coded)
- No record of accessing IC in community care (CSDS) or social care (ASC) records within 7 days of discharge.

For all of the cohorts the following **exclusion criteria** apply:

- Subsequent hospital admissions after an individual's index admission will be excluded from the data, other than as an outcome measure (readmissions)

3.4 Definitions of outcomes and exposures

We have defined exposures and outcomes in the table below. Patient characteristics will reflect individuals at the time of hospital discharge and so will correspond to the latest measurement taken **before discharge**.

Outcome/exposure variables	Definition criteria	Dataset(s) from which the variable is
Demographic and Health characteristics		
Age	Age	SUS-APCS
Sex	Sex	SUS-APCS
Ethnicity	Ethnicity	SUS-APCS
Living Alone	Living Alone (binary)	Primary Care
Living with Under 18	Living with Under 18 (binary)	Primary Care
Total people in Household	Number of people living in Household	Primary Care
Date of Death	Date of Death (within 30, 60 and 90 days of hospital	Primary Care
Geography	LSOA 2011	SUS-APCS
Deprivation IMD	Deprivation IMD 2019	SUS-APCS

Length of index hospital admission	Number of days between admission and discharge of first admission in the study period	SUS-APCS
Frailty	Frailty score (Score, 4 levels of frailty: Fit, Mild frailty, Moderate frailty, Severely frail)	Primary Care
LTCs	Long Term conditions (binary)	Primary Care
Health Conditions	Hypertension, Cancer, Diabetes, CVD, Heart failure, CKD, Asthma, COPD, Depression (binary)	Primary Care
Outcomes		
Readmission	Readmission to Acute setting within 30, 60 and 90 days of hospital discharge	SUS-APCS
Time to readmission	Readmission to acute setting following index admission	SUS-APCS
Engagement with Primary Care within 30 days after discharge	Count of GP events	Primary Care
Attendance at A&E within 30 days after discharge	Count of attendances	SUS-ECDS
Engagement with 111 call service within 30 days after discharge	Count of 111 calls	NWAS
Time between discharge and initiation of IC	Time between discharge and initiation of IC	SUS-APCS, CSDS, ASC
Length of engagement with service	Length of engagement with service: Time between first and last contact/event	CSDS, ASC
Patients requiring >91 days of support at home	Patients requiring >91 days of support at home	CSDS, ASC

3.5 Statistical approaches

All analysis will be carried out within the SDE using R and RStudio.

Objective 2. Describe and explore the demographic and health characteristics of people on the alternative pathways of care.
We will summarise the demographic and health characteristics of IC service users within the different cohorts (cohort 1 and 2). Depending on there being sufficient numbers of patients to conduct robust analyses, we will identify and describe potential sub-cohorts which will then also be explored in Objectives 3-5. Potential sub-cohorts include:

- Number of LTCs
- Geography
- Deprivation
- Frailty
- Engagement with Primary Care
- Engagement with 111
- Age
- Living alone

Objective 3. Describe different forms of IC services received and explore how the intensity of support received is related to individual level of need.

We developed an operational definition for level of need based on the duration of index hospital admission and frailty to explore IC received at different levels of need.

Levels of Need

- Low: Patients with short hospital stays (less than 21 days, (NHS England, 2024)) and low frailty scores (Fit, Mild frailty).
- Moderate: Patients with longer hospital stays (over 21 days) and moderate frailty scores.
- High: Patients with longer hospital stays (over 21 days) and severe frailty scores.

To analyse the intensity of support received, descriptive statistics (mean, median) have been generated for the length of engagement with IC services and the proportion of patients requiring extended support (>91 days) has been calculated. Subgroup analyses were conducted to compare these metrics across the different levels of need and within the different IC pathways.

Correlation analysis have been used to explore the relationship between the frailty score and the number of engagement points with health services post-discharge (e.g., GP contact, A&E attendance , call to 111 service).

[Scheduled for completion by the end of April]

Objective 4. Compare the characteristics of patients receiving home-based or bed-based IC support and those without an assigned pathway.

It is possible that the patients who could not be assigned to an IC pathway due to insufficient data are not random and actually represent a distinct subgroup of the population. This objective aims to explore similarities and differences between those with no assigned IC pathway (pathway 4) and those who received IC (pathway 1 and 2). We compared proportions (for demographic variables) and means or medians (for continuous variables like length of stay in IC setting) to identify significant trends and differences. We used levels of need (see Objective 3) to explore whether patients of pathway 4 have similar characteristic to patients who received home-based or bed-based IC support.

[Scheduled for completion by the end of April]

Objective 5. Evaluate the impact of IC by comparing the health outcomes of those who received it with (clinically/demographically) similar people who did not receive it.

We investigated the impact of IC services on hospital readmission rates within 90 days post-discharge. First, we used a logistic regression model to estimate the probability of receiving IC based on patient characteristics, including age and health conditions. Patients are then assigned to different IC pathways, and their outcomes, particularly readmission rates, are examined through a weighted Cox proportional hazards model, adjusting for potential confounders using inverse probability of treatment weighting (IPTW). The primary objective is to assess how different IC services affect the risk of readmission, accounting for various patient characteristics and health conditions. Survival analysis, complemented by Kaplan-Meier curves and adjusted through propensity score weighting, offer us insights into the effectiveness of IC pathways in reducing readmissions.

We used statistical matching-based approaches to construct a cohort of people from pathway 0 who are similar to those who did receive IC (pathway 1 and 2) but did not receive it. We compared the outcomes for people who received IC to a cohort who did not receive IC to estimate the impact of receiving IC on the outcomes.

[Scheduled for completion by the end of April]

3.6 Known limitations

- We are establishing the feasibility of identifying users of IC based on the criteria we have defined above
- We cannot determine data quality/robustness until we have finalised our cohorts and outcomes
- We have limited our analysis to each individual's index hospital admission in order to differentiate between readmission as an outcome and as an opportunity for exposure to IC. However, it is likely to also be important to understand how IC can best serve the needs of people who have frequent hospital admissions
- Although we potentially have access to data across Cheshire and Merseyside, due to different arrangements for the commissioning of IC services, we are focussing only on Liverpool for this analysis which limits the sample size and also may make the results less generalisable to other geographic areas (i.e. not inner-city).
- We have restricted the study period to be largely post-COVID as the pandemic is likely to have had an impact on the provision, assessment, and delivery of IC and on our key outcome (hospital readmission). There are likely to still be some impact of the pandemic in our study period but it will not be possible to differentiate these from other effects in our analysis

4. Governance

Availability of data and materials

All patient/client-level data used in this project is pseudonymised prior to receipt by the ICB lab. All data arrives with the lab via one of three routes

4.1 Aggregate, open source or geographical data with no need for anonymisation/pseudonymisation

- NHS Digital data
- Indices of Deprivation

4.2 Data flowing via DSCRO

This is data extracted by or submitted directly to North West DSCRO, which is pseudonymised and released to Commissioners. This is managed by data sharing agreements between the commissioners and NHS Digital.

- SUS (Secondary Uses Service),
    - ECDS (Emergency Care Dataset),
    - APC (Admitted Patient Care),
- CSDS (Community Services Data Set)
- ASCD (Adult Social Care Dataset)
- Civil Registration Deaths

Other locally collected feeds (into CIPHA platform) to explore,

- Primary Care
- Social Care
- Community
- NWAS

4.3 Data flowing directly to commissioners

This is data that commissioners receive directly from the data controller, where the identifier has been removed by the data controller and replaced with a pseudonym (pseudo @ source). These are managed by agreements between those parties.

- Referral data into Telehealth /Telemedicine
- ImmediCare video assessments

Ethics approval and consent to participate

The project will be signed off by our data access & asset group. This group ensure that the right IG measures are in place to enable access to data. In C&M we have a direct care data sharing agreement (DSA) and a population health DSA. As such the scope of this project and required data are firmly covered under both of these data sharing agreements.

5. Impact, dissemination and engagement

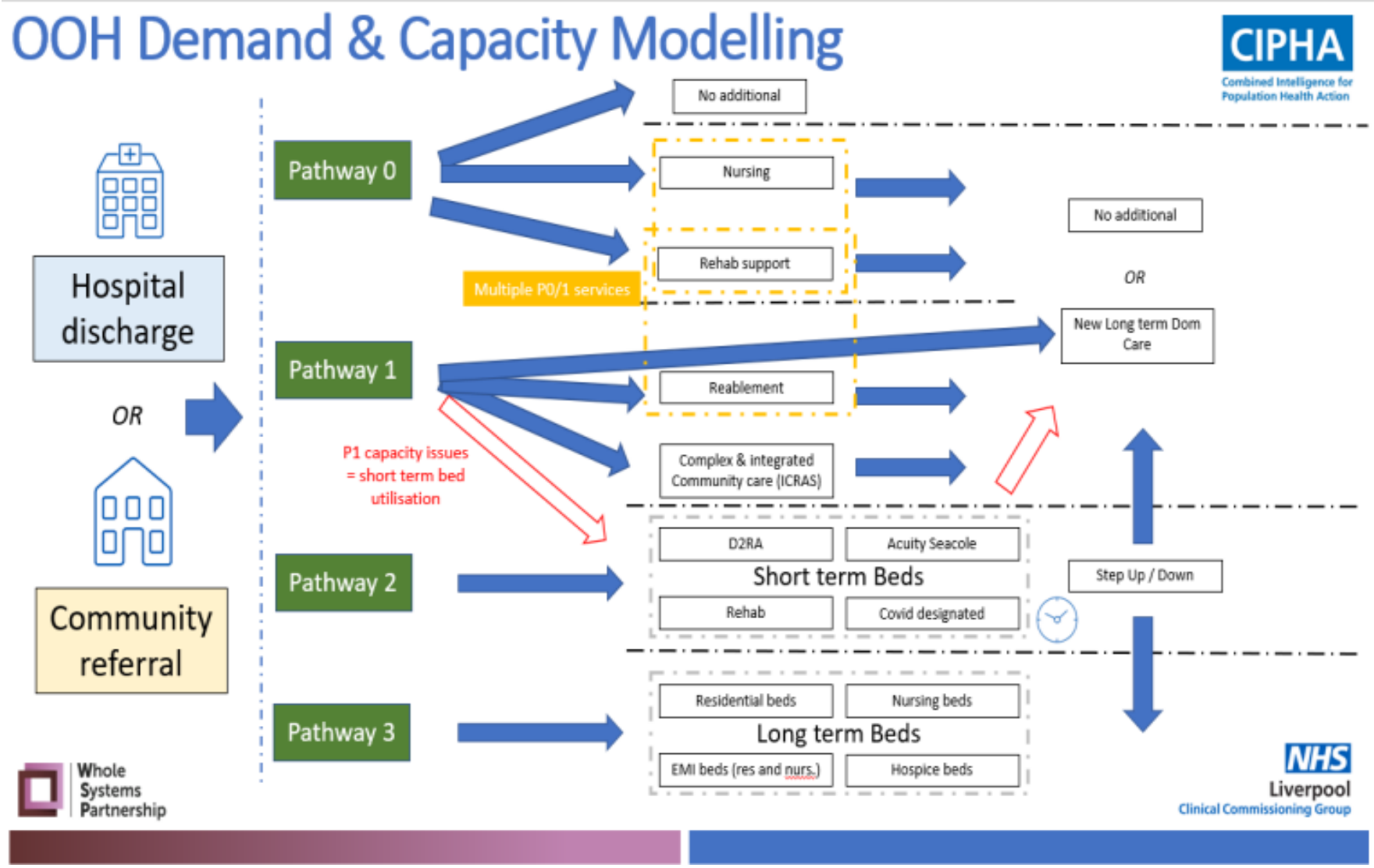
The research findings will potentially help in reviewing the Liverpool discharge model with a view of learning best practice across Cheshire and Merseyside and ensuring patients are discharged onto the optimum intermediate care pathway. In addition to Health Foundation led publications, the code for our analysis (SQL, R and RMarkdown files) will be made available on the Health Foundation GitHub: https://github.com/HFAnalyticsLab.

Initial list of key stakeholders includes,

- ICB IC transformation lead
- Liverpool Place IC Healthcare Commissioner
- Liverpool Place Head of Operations for Nursing
- Mersey Care Intermediate service care
- Mersey Care Head of Business Intelligence
- Liverpool city council Adult Social Care lead
- Liverpool city council facilities commissioner

The above stakeholders, along with intermediate care patients, are to be embedded in our PPIE strategy for this topic.

6. Appendix


OOH Demand & Capacity Modelling
CIPHA
Combined Intelligence for Population Health Action
Hospital discharge
OR
Community referral
Pathway 0
Pathway 1
Pathway 2
Pathway 3
No additional
Nursing
Rehab support
Multiple P0/1 services
Reablement
Complex & integrated Community care (ICRAS)
P1 capacity issues = short term bed utilisation
D2RA
Acuity Seacole
Short term Beds
Rehab
Covid designated
Residential beds
Nursing beds
Long term Beds
EMI beds (res and nurs.)
Hospice beds
No additional
OR
New Long term Dom Care
Step Up / Down
Whole Systems Partnership
NHS
Liverpool
Clinical Commissioning Group