The Networked Data Lab

Topic 5: Waiting Lists Final Report

NDL North West London

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Glossary

Acronym	Definition
A&E	Accident & Emergency: The department in hospitals where emergency cases are triaged and treated.
BNF	British National Formulary: A code system for medication prescribing in the NHS.
COVID-19	Coronoavirus-19: Viral disease pandemic which emerged in December 2019.
CTV3	Clinical Terms Version 3 codes: a medical code system used in the NHS.
DNA	Did Not Attend: Used to describe when a patient misses an appointment without canceling it.
eFI	electronic Frailty Index: A measure of patients current frailty status.
EMIS	Egton Medical Information Systems: A software system for healthcare data management used by many GP practices.
GDP	Gross Domestic Product: The total value of goods and services produced by a country over a period of time, used to adjust healthcare cost data.
GP	General Practitioner: A primary care physician who provides general health services.
HRG	Healthcare Resource Group: A system used in the UK for classifying healthcare resources and their associated costs.
ICB	Integrated Care Board: an NHS organization that plans health services for a local area.
ICD-10	International Classification of Diseases, 10th Edition: A system for coding diseases and health conditions.
ICHP	Imperial College Health Partners: The Health Innovation Network for North West London
ICS	Integrated Care System: Local systems that coordinate healthcare and social services.
ID	Identification : E.g. patient identification information
IQ	Interquartile Range: A measure of statistical spread, representing the range between the first and third quartiles of data.
IMD	Index of Multiple Deprivation: A measure of relative deprivation across various factors such as income, employment, and health.
LTC	Long-Term Condition: A health condition that impact individuals over a long period of time.

Med3	Med3 Certificate: Also known as a fit note or Statement of Fitness for Work, is a medical document that assesses a patient's fitness for work
MFF	Market Forces Factor: A geographical factor used to adjust the NHS funding formula.
NWL	North West London: The region with which this report is concerned.
OPCS4	Office of Population Censuses and Surveys Classification of Interventions and Procedures, 4th Edition: A coding system used for medical procedures in the UK.
ONS	Office for National Statistics: The UK's largest independent producer of official statistics.
NHS	National Health Service: Umbrella term for the publicly funded healthcare systems of the UK.
NHSE	National Health Service England: The public body which leads the National Health Service in England.
PSSRU	Personal Social Services Research Unit: A research unit that provides cost data for healthcare and social services.
READ	Read Codes: A medical coding system used within the NHS.
R&I	Research & Innovation: Activities related to advancing knowledge, research, and innovation in healthcare.
RTT	Referral-To-Treatment. Time it takes for patients on a care pathway to recieve consultant-led treatment.
SD	Standard Deviation: A statistical measure that quantifies the amount of variation or dispersion of a set of data values.
SE	Standard Error: Quantifies the variability between samples drawn from the same population.
SNOMED	Systematized Nomenclature of Medicine: : A clinical terminology used for electronic health records.
SUS	Secondary Uses Service: Repository for heathcare data in England.
SUS APC	Admitted Patient Care: The national data set for hospital admission within SUS
TRE	Trusted Research Environment: A secure platform for conducting research with sensitive or confidential data
WSIC	Whole Systems Integrated Care: A data integration system for linking healthcare information across various services.

Contents

1. Introduction

1.1 Background and context

Over the last decade the number of patients on consultant-led Referral-To-Treatment (RTT) pathways has increased steadily. This problem has been exacerbated during the COVID-19 pandemic, throughout which the number has increased at a higher rate. The backlog of patients after the COVID-19 pandemic includes variety of patients that could not be seen during the pandemic. This include those whose referrals or operations have been cancelled or postponed (Queen Mary University of London, 2021), or patients that avoided seeing a general practitioner (GP) due to fear of infection or to 'lessen the burden' on the NHS (The Health Foundation, 2020).

Waiting times have consistently been a topic ranked as one of the public's main NHS concerns (NHS England, 2024). As of May 2024, there are 7.6 million patients on waiting lists in England and it's estimated that the median wait is 14.2 weeks (The King's Fund, 2023). The NHS states that patients have a right to start consultant-led treatment within 18 weeks of referral (or request an alternative provider who could offer them and earlier treatment option) (Department of Health and Social Care, 2012). Alongside this right is an aim to have at least 92% of patients treated within this timeframe (Office for National Statistics, 2024). However, as of May 2024, only 59.1% of patients were treated within 18 weeks (NHS England, 2024), and this goal has not been met since September 2015 (British Medical Association, 2024). This effect has been seen across all medical specialities (The King's Fund, 2023).

Our North West London (NWL) stakeholder and public engagement helped us identify that the waiting lists of greatest significance to our local area for the deep-dive analysis are hip replacements and cardiothoracic surgery. The focus on hip replacements was suggested due to it being one of the largest cohorts in England (The King's Fund, 2024), with patients reporting poor experiences while waiting, such as pain, risk of deconditioning, and reduced mobility. Cardiothoracic surgery was chosen because it represents a complex waiting list which is likely to cause considerable additional costs to healthcare providers. It is hypothesised that patients waiting for cardiothoracic surgery will have higher rates of GP appointments and/or visits to the Accident and Emergency (A&E) department due to high risk of adverse events.

Within NWL, the Networked Data Lab supports our larger Research & Innovation (R&I) strategy (North West London ICB, 2023). The NWL R&I Board is comprised of senior representatives from across all ICS organisations including academic institutions, and other R&I organisations. In 2023, it set out to drive greater impact from R&I by focussing on fewer priorities. This defined and deliberate portfolio of projects are known as the NWL Missions (Imperial College Health Partners, 2025). The current missions are:

- Mission 1: Optimising care of long-term conditions (starting with Cardiovascular Disease)
- Mission 2: Enabling more days at home (improving system flow)
- Mission 3: Supporting children and young people's mental health.

Analysis of waiting lists aligns to the objectives of optimising care of long-term conditions and enabling more days at home.

1.2 Key research questions

This report is focused on providing an analysis of the following overarching research questions:

- Who are those citizens on our NHS waiting lists? What are their demographics and health needs?
- What procedures are they waiting for and for how long?
- What happens to healthcare utilisation whilst people are waiting for treatment?

Specifically the analysis will generate:

(1) Descriptive wait lengths of 'referral to treatment' pathways for patients waiting for elective NHS care, and how they vary between specialties, demographic groups and patient health characteristics;
(2) Descriptive reasons patients are removed from the NHS elective care waiting list, and how they vary between specialties, demographic groups and patient health characteristics;
(3) Descriptive and comparative analysis of patients' primary and secondary healthcare use before and after waiting for elective treatment, by specialty and by patient demographic and health characteristics;
(4) Causal impact of waiting for longer periods of time on healthcare usage and costs for cardiothoracic surgery and hip replacement surgery

Our goal in this report is to provide a snapshot of the state of elective waiting lists in NWL, as well as provide local stakeholders with information regarding factors that affect patient experience both of waiting for surgery and post-surgical outcomes.

2. Methods

2.1 Public involvement and stakeholder engagement

System stakeholder engagement

When developing the priority areas for this analysis, we asked system stakeholders including the NW London Elective Care Forum and directors from local community healthcare trusts to feed into the procedures chosen for the causal analysis.

Public involvement

For this topic, we established a Patient and Carer Advisory Group made up of eight members, all with lived experience of waiting lists for elective care. Our approach was continuous engagement with this group throughout the life cycle of the project: research question development; statistical analysis plan review; interim results interpretation; and synthesis of final inferences for our discussion.

The group contributed to our research question development through the sharing of their own lived experience. For example, they discussed the strong link between physical and mental health while waiting; this helped inform our analytical plan, which will explore changes in primary care prescriptions for mental health before, during, and after waiting. The group also spoke about the lack of support for mental and financial wellbeing while waiting and were keen for us to provide evidence on the impact of waiting to make the case for more support in these areas. During the discussion, several members shared their frustration with COVID-19 being

used as an excuse for long waiting lists, and we acknowledged that the NHS was not reaching its waiting time target long before the pandemic started.

We met again with the group to review our initial statistical analysis plan and identify limitations. The group told us that the referral to treatment clock may not align with patients' perceptions of their wait times due to 'hidden waits'. Many patients had to interact with their GP multiple times before a referral was made, and since the NHS starts the referral to treatment clock only once a patient has been referred to a consultant-led service, these interactions with GPs are not reflected in the recorded waiting times. Additionally, patients may delay seeking care if they know the system is overwhelmed. The group also noted that we would not be analysing the holistic impacts of waiting, including impact on social care, private care, and employment and felt that these were all important areas for policymakers to consider.

We also presented our interim results to the Patient and Carer Advisory Group to help us understand the trends in the data, including discussions about anything that resonated with them, surprised them, or required further exploration. Prior to this presentation, we met with two members of the group who helped review our slides and figures for clarity and ease of interpretation. Their input led to valuable improvements, including embedding storytelling into the presentation and removing text to focus on the figures themselves. When discussing with the wider group, we gained several insights which helped inform our subsequent analysis.

They also felt our analysis would benefit from taking a more intersectional view, which we addressed by conducting a cross-tabulation analysis. After revisiting our analysis, we noted that there are greater disparities across demographics when looking at median wait length, rather than when looking at the proportion of pathways seen within 18 weeks. Given the contributions from our Advisory Group, we have included both median wait length and proportion completed within 18 weeks in this report.

Following the casual analysis, we conducted additional interviews with patients and carers on a waiting list for a hip replacement or cardiothoracic surgery with the aim of reviewing and understanding how the findings of the causal analysis resonate with patients' lived experience. The discussion guide for these interviews was developed with members of our Patient and Carer Advisory Group.

Clinical Leads

We recruited a Clinical Lead for each of the speciality areas who had experience in one of the specialties chosen and had a background in using data for healthcare transformation and improvement. For the cardiothoracic surgery Clinical Lead, we appointed Dr Sadia Khan, a consultant cardiologist who is the Service Director for Cardiology and Respiratory Medicine at Chelsea and Westminster Hospital NHS Foundation Trust and an honorary clinical senior lecturer at Imperial College's National Heart and Lung Institute as well as other regional leadership roles. For the hip replacement Clinical Lead, we appointed Dr Chris Russell, formerly the Associate Director for Data for Research & Development at NHSE with a background as a medical doctor in anaesthetics and national roles in health innovation and analytics. The Clinical Leads reviewed the specialty code lists and identified comorbidities and other variables that are likely to affect outcomes for patients either waiting for or recovering from surgery. They also assisted with the interpretation of findings and the synthesis of the discussion.

2.2 Data extraction & processing

This study was conducted using the Discover database (the deidentified version of the Whole Systems Integrated Care (WSIC) database). Discover is one of the largest depersonalised

linked health data sets in Europe, accessible via Discover-NOW Health Data Research Hub for Real World Evidence (Discover-NOW, 2025). It is hosted by Imperial College Health Partners (ICHP) and is made available for research in a Trusted Research Environment (TRE). Discover provides linked coded primary care, acute, mental health, community health and social care records for over 2.7 million patients who are registered with a GP in NWL. This database is fed by data from over 400 provider organisations including 350+ GP practices, two mental health and two community trusts and all acute providers attended by NWL patients. Primary care is from a variety of GP systems including EMIS and SystmOne. The underlying coding structure are READ and SNOMED for primary care data and ICD-10, OPCS4 and the NHS data dictionary for secondary acute and mental health.

2.3 Data analysis

Descriptive Analyses

Objective 1: Describe wait lengths of 'referral to treatment' pathways for patients waiting for elective NHS care, and how they vary between specialties, demographic groups and patient health characteristics

Output no.	***Research Questions***	***Analytical Output***
1.1	*How many patients are waiting for <=18 weeks, >18 weeks, >36 weeks and >52 weeks for elective NHS care?*	*Counts and proportions of all patient pathways stratified by wait length*
1.2	*What specialties have people waiting for <=18 weeks, >18 weeks, >36 weeks and >52 weeks been referred to?*	*Counts and proportions of all patient pathways stratified by wait length and specialty*
1.3	*What are the demographic characteristics of patients waiting <=18 weeks, >18 weeks, >36 weeks and >52 weeks?*	*Counts and proportions of all patient pathways stratified by wait length and demographic variables*
1.4	*What are the health characteristics of patients waiting <=18 weeks, >18 weeks, >36 weeks and >52 weeks?*	*Counts and proportions of all patient pathways stratified by wait length and health characteristics*
1.5	*How does mean and median length of wait differ between specialties, demographic groups and health characteristics?*	*Mean, median, SD and IQRs of completed patient pathways lengths stratified by specialty and patient demographic and health characteristics*

Objective 2: Describe the reasons patients are removed from the NHS elective care waiting list, and how they vary between specialties, demographic groups and patient health characteristics

Output no.	***Research Questions***	***Analytical Output***
2.1	*What are the reasons that people are removed from the NHS elective care waiting list?*	*Counts and proportions of completed patient pathways stratified by reason for clock stop*
2.2	*How do the reasons that people are removed from the NHS elective care waiting list vary between specialties?*	*Counts and proportions of completed patient pathways stratified by reason for clock stop and specialty*

2.3	*How do the reasons that people are removed from the NHS elective care waiting list vary between demographic groups?*	*Counts and proportions of completed patient pathways stratified by reason for clock stop and patient demographics*
2.4	*How do the reasons that people are removed from the NHS elective care waiting list vary by patient health characteristics?*	*Counts and proportions of completed patient pathways stratified by reason for clock stop and health characteristics*

Objective 3: Describe and compare patients' primary and secondary healthcare use before and after waiting for elective treatment

Output no.	***Research Questions***	***Analytical Output***
3.1	*How much healthcare do patients use before, during and after waiting?*	*Counts of healthcare use and cost by point of delivery in the three months prior to referral, over the waiting period, and in the three months after treatment*
3.2	*Does healthcare use before, during and after waiting vary between specialties?*	*Counts of healthcare use and cost by point of delivery in the three months prior to referral, over the waiting period, and in the three months after treatment stratified by specialty*
3.3	*Does healthcare use before, during and after waiting vary between demographic groups?*	*Counts of healthcare use and cost by point of delivery in the three months prior to referral, over the waiting period, and in the three months after treatment stratified by patient demographics*
3.4	*Does healthcare use before, during and after waiting vary by patient health characteristics?*	*Counts of healthcare use and cost by point of delivery in the three months prior to referral, over the waiting period, and in the three months after treatment stratified by patient health characteristics*

Causal Analysis

Objective 4: Assess the causal impact of waiting for longer periods of time on healthcare usage and costs

Output no.	**Research Questions**	**Analytical Output**
4.1	What is the effect of waiting for treatment for an additional [x] weeks for [y] procedure on healthcare use for [z] point of delivery?	Difference-in-difference analysis comparing the healthcare use of above-target waiters to target or below target waiters for [y] procedures and [z] points of delivery

4.2	What is the effect of waiting for treatment for an additional [x] weeks for [y] procedure on healthcare cost incurred for [z] point of delivery?	Cost-weighted results of the difference-in-difference analyses performed for output 4.1
4.3	What are the demographic and health characteristics of patients in the cohorts compared in output 4.1?	Descriptive statistics of patient demographic and health characteristics of the cohorts compared in the difference-in-difference analyses performed for output 4.1

2.4 Study design

The descriptive portions of this study (objectives 1-3) employ a retrospective cohort design to explore the wait lengths, pathway outcomes, and various health and demographic breakdowns of the elective care waiting list. The causal portion (objective 4) uses a difference-in-difference study design to assess the effect of waiting for longer than target periods of time on healthcare use and costs.

Study period

The patients referred to treatment between April 1st 2022 and March 31st 2024 were used to construct the study population. The outcome variables were obtained based on primary and secondary care records between the start and end date of the reference and intervention periods.

Patients found in more than one waiting list (those who are on waiting list for different medical specialties) has each pathway recorded in the cohort. Events after being placed in each waiting list are investigated as an outcome. A post-COVID-19 time period has been selected to ensure that the most recent record is examined.

Study population

The study population for this analysis is patients referred to the NHS elective care waiting list between 1 April 2022 and 31 March 2024, covering an additional pre-referral period of three months and a follow-up period until six months after the date of latest pathway end or 31 October 2024, whichever is sooner.

There are three cohorts considered for the descriptive portion of this analysis:

(1) **Cohort 1:** All new referrals onto the elective waiting list (i.e., unique pathways with a patient pathway ID and clock start) between 1 April 2022 and 31 March 2024 with a definitive pathway end (i.e., completed pathways). Pathways without a clock stop (incomplete pathways) are reported separately in descriptive tables where available. This cohort is used to create outputs 1.1 - 1.5, and 2.1 – 2.4 as well as being the basis for all further cohorts.

(2) **Cohort 2:** Of cohort 1, all pathways ending in a definitive treatment (treatment status = 30, to filter out patients on active monitoring) and with patient-level linkage to local electronic health records. This cohort is used to create outputs 3.1 – 3.4.

(3) **Cohort 3:** Of cohort 2, all pathways for hip replacement and cardiothoracic procedures with a follow up period available of at least their wait time plus four weeks. This is the cohort created for the causal analysis i.e. outputs 4.1 – 4.3.

2.5 Definitions of outcomes and exposures

Table 1. Definitions of waiting lists variables

Variable	Details	Type of variable	Data Sources
Waiting list clock start	Time at which the patient was put on a waiting list	Date	Waiting List Clock Starts
Waiting list clock stop	Time at which the patient was taken out of the waiting list	Date	Waiting List Clock Stops
Reason for clock stop	Reason for which patient was taken out of the waiting list	Categorical	Waiting List Clock Stops
Patient treatment	OPCS code describing the treatment that the patient received	Categorical	Waiting List Clock Stops
Medical speciality	Medical speciality treating patients in waiting list	Categorical	Waiting List Clock Stops

Table 2. Definitions of demographic variables

Characteristic	Details	Type of variable	Data Sources
Age	Age at date of referral will be calculated from the month of birth recorded in patient index. Month of birth is used since the deidentified data doesn't hold exact dates.	Integer	Primary Care Events
Age group	Age group at date of referral	Categorical	Primary Care Events
Sex	Recorded as patient's gender; 'Female', 'Male', 'Other' or 'Unknown'	Categorical	Primary Care Events
Ethnic group	Patient's ethnicity, using ethnic group classification	Categorical	Primary Care Events
IMD decile	The Index of Multiple Deprivation decile of the LSOA of the patient's current residential address.	Categorical	Primary Care Events

Table 3. Definitions of comorbidities and common risk factors

Risk Factor	Details	Type of variable	Data Sources
Electronic Frailty Index (eFI)	Electronic Frailty Index, a measure of patients current frailty status, incorporates 36 deficits constructed using 2,171 CTV3 codes.	Continuous	Primary Care Events
Comorbidity status	Current status recorded as "Single LTC", "Comorbidity", "Multimorbidity", and "NA" for no record of long term conditions	Categorical	Primary Care Events

Table 4. Definitions of outcomes of interest

Outcome Name	Details	Type of variable	Data Sources

Emergency attendances	Major A&E attendances as primary outcome; also report by department type	Integer	SUS A&E
GP appointments	Measured as number of contacts. This is an estimated figure after filtering out administrative codes	Integer	Primary Care Events
Elective admissions	Number of spells with an admission method code beginning with '1'	Integer	SUS APC Spell
Emergency admissions	Number of spells with an admission method code beginning with '2'	Integer	SUS APC Spell
Prescriptions	Measured as number of unique drugs prescribed according to the BNF description during each time period	Integer	Primary Care Prescriptions
Sick notes	Measured as a a presence of a SNOMED code indicating a Med3 certificate has been issued. A maximum of one sick note per patient per time period can be counted	Binary	Primary Care Events

2.6 Statistical approaches

Descriptive analyses

Objective 1: Describe wait lengths of 'referral to treatment' pathways for patients waiting for elective NHS care, and how they vary between specialties, demographic groups and patient health characteristics

The wait lengths have been grouped into <18 weeks, >18 weeks, >36 weeks, and >52 weeks, which are subsets of each other and as such are not mutually exclusive – i.e., the >18 weeks group would be inclusive of people who waited for >36 weeks and >52 weeks. The groups are based on the standard cut offs measured in days, meaning that the <18 weeks group is defined as waiting between 0-126 days, the >18 week group is defined as waiting 127 days or more, the >36 week group is defined as waiting 253 days or more, and the >52 weeks group is defined as waiting 365 days or more.

For completed pathways (Cohort 1), the number and percentage of patient pathways by waiting time category are reported. Mean, median, standard deviation and inter-quartile ranges are supplied for waiting times in days. In both cases, these results are stratified by:

- Specialty
- Sex
- Age band
- Ethnic category (ONS categories)
- IMD quintile (national IMD with all components)
- Number of comorbidities
- Electronic frailty index categories
- Age band split by Sex
- Age band split by IMD decile
- Sex split by IMD decile

Objective 2: Describe the reasons patients are removed from the NHS elective care waiting list, and how they vary between specialties, demographic groups and patient health characteristics

Pathway outcome is defined by the stated reason for clock stop given in the RTT data. If no reason is available due to the clock stop being imputed during processing, cases are assigned to “Missing – imputed clock stop”).

For completed pathways (Cohort 1), the number of patient pathways falling into each clock stop category and the percentage they represent of the total cohort are reported and broken down by:

- Specialty
- Sex
- Age band
- Ethnic category (ONS categories)
- IMD quintile (national IMD with all components)
- Number of comorbidities
- Electronic frailty index categories

Objective 3: Describe and compare patients’ primary and secondary healthcare activity and costs before, during and after waiting for elective treatment

For completed pathways with a definitive treatment (Cohort 2) and patient-level linkage to local electronic health records, healthcare use and costs for each of the points of delivery described below are reported. Healthcare use is reported across three time periods: the three months prior to referral; across the total waiting period; and the three months following treatment. Patients for whom an insufficient follow up period is available are excluded. For these time periods, we report:

- Total healthcare use for each given point of delivery over that time period for the whole cohort
- The size of the cohort (in persons for the three months prior to referral and three months following treatment; in person-weeks for whilst waiting)
- Mean, median, SD and IQR of healthcare use for each given point of delivery (over the whole period for the three months prior to referral and three months following treatment; per week for whilst waiting)
- Mean number of events per 100 patient weeks is also reported for all three time periods

These results are in turn be stratified by the following patient pathway characteristics:

- Specialty
- Sex
- Age band
- Ethnic category (ONS categories)
- IMD quintile (national IMD with all components)
- Number of comorbidities
- Electronic frailty index categories
- Wait length (<18 weeks, 18-36 weeks, 36-52 weeks, >52 weeks).

Each incident of healthcare use is costed individually before being aggregated at the point of delivery level for presentation, with costs drawn from the following sources:

Table 5. Point of delivery outcomes

Point of delivery	Source
Emergency attendances	HRG-level costing with local MFF applied
GP appointments	PSSRU unit costs for a 10-minute GP attendance, split between nurse-led and GP-led appointments
Elective admissions	HRG-level costing with local MFF applied
Emergency admissions	HRG-level costing with local MFF applied

Costs are reported in 2023/24 prices, deflated where necessary using the GDP deflator. Prescriptions and sick notes, although included in the analysis of raw healthcare use, are not costed in this analysis.

Causal analysis

Objective 4: Assess the causal impact of waiting for longer periods of time on healthcare use and costs

Overview

To assess the impact of waiting for long periods of time on health care usage and costs, we carried out a set of difference-in-difference comparisons where a group who waited for a target amount of time (18 weeks or less for total RTT wait) were compared to a group who waited for longer than the target amount of time. These comparisons were conducted as difference-in-differences covering the entire period of waiting for each group and a follow-up period after waiting, with the period immediately after treatment removed. The follow-up period, where both groups have received their procedures, is the reference time (time = 0), while the period of waiting is the intervention period (time = 1).

To assess for the effects of having to wait for various ranges of time, the groups of above-target waiters are divided into several sub-groups based on their time of waiting. Each of these groupings is then separately compared to the control group (target-time waiters) in a series of difference-in-difference comparisons. From these comparisons, we can estimate the effect of having waited for various different periods of time beyond a given target on healthcare use and attendant costs.

When describing the results of the causal analysis in the results and discussion paper, we use two terms:

- Excess healthcare utilisation, where the difference in utilisation is higher in the intervention period (i.e. time waiting for procedure) than the reference period i.e. the time post receiving the procedure
- Negative excess healthcare utilisation, where the difference in utilisation is higher in the reference period (i.e. time after the procedure) than the intervention period i.e. the time waiting for the procedure

This analysis is conducted on cohort 3. Demographic and health characteristics of the cohort for each procedure, split by wait time group, primary care usage (by average number of GP appointments per week) and emergency usage (by average number of emergency attendances per week) are reported. The latter splits are based on weekly usage to account for the differing length of observed periods for each waiting time group.

Outcome Measurement

For each group and time period, healthcare use by point of delivery is aggregated in two formats: as a total of healthcare use by each group in each period; and as the average healthcare use per person per week in each time period.

When examining group totals, excess healthcare use is then calculated as the difference between the two groups in the intervention period, minus the difference between the two groups in the reference period. Results are then be presented as group totals in each time-period, excess, and the number of person-weeks present in each group and time-period.

When calculating per person per week usage, results are derived using a fixed effects model.

Control and treatment groups

As described above, the control group for each comparison is the group of people who were treated for a given procedure within the NHS England target of 18 weeks. When creating this group, patients who were treated within the very early weeks of waiting (up to ~six weeks) are excluded as they may have been urgent cases with particularly high rates of healthcare use in the waiting period, possibly violating our assumption of parallel trends in that period.

The comparator group used are pathways that were over the treatment target of 18 weeks long.

Timeframe and periodisation

Following the classic form of difference-in-difference, our comparisons cover two time periods. For each waiter, these periods are: an intervention period, covering their full wait time from pathway start to treatment; and a reference period, consisting of a follow-up period after treatment of the same length as their wait time, minus an initial four-week recovery period after treatment (e.g., a 30-week waiter would require a follow-up of 34 weeks following their treatment, the first four of which would be excluded as the recovery period). This reference period is intended to correspond to the “normal” healthcare use of that individual over the stretch of time in question. The four-week period is excluded to account for follow-up healthcare use in the immediate aftermath of a procedure.

The intention of requiring a reference period equal to the wait time is to equalise the number of person-weeks present on each side of the comparison, enabling comparisons of total healthcare use along with per person-per week comparisons. This method also enables the direct comparison of multiple different groups of longer waiters to the same group of <= 18 week waiters. While there will naturally be a difference in the number of person-weeks present in the shorter waiting group compared to the longer waiting group, comparisons may still be made as each group would have an equal number of person-weeks observed in both time periods, with our key parameter of interest being variation in the difference between the healthcare use of the two groups in the two time periods.

Methods for addressing missing data

Pathways with missing clock stops have not been included in the causal analysis, due to the pathways having an unknown waiting time. In descriptive tables, the breakdown of pathways with a missing end date are reported separately.

Outcomes that have a zero or missing cost have been excluded from any cost analysis. These missing data have been interpreted as being commissioned or priced outside of SUS but are still legitimate activity and so are still included in any analysis involving counting of events.

3. Results

3.1 Descriptive analysis (Objectives 1-3)

Table 6. Overview of waiting list cohort by wait time, Cohort 1 (completed pathways)

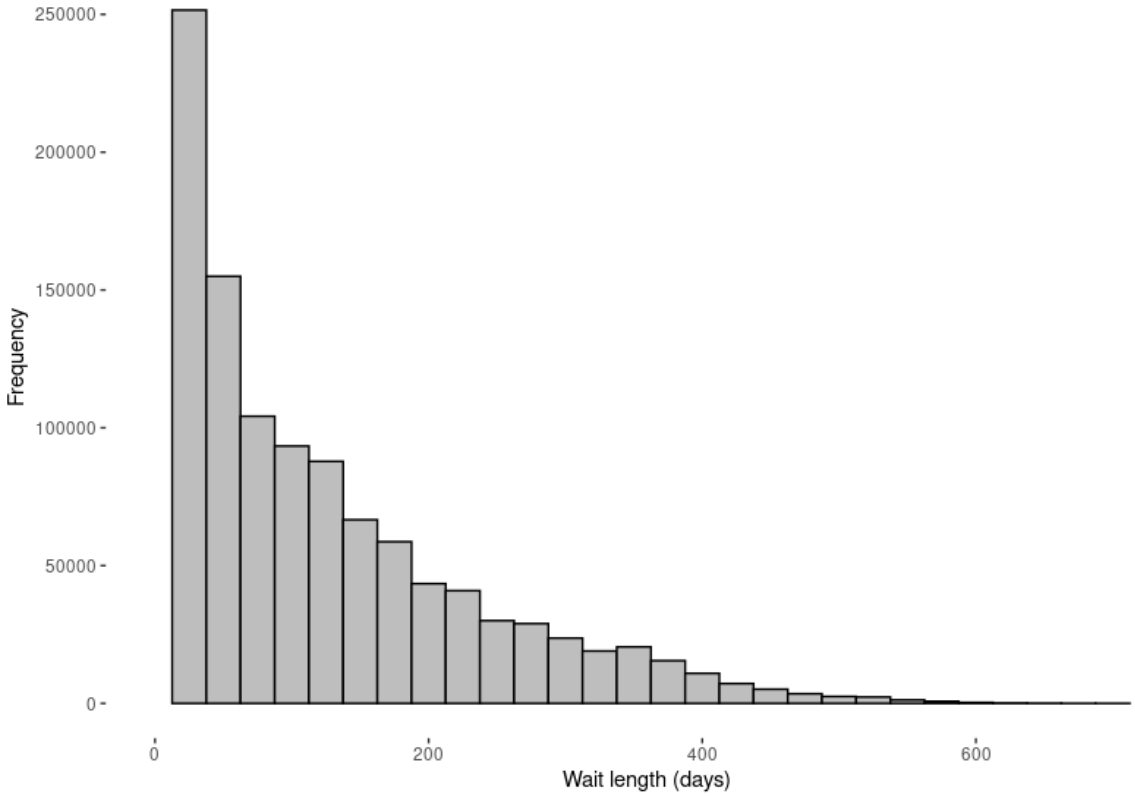
Total	0-3 weeks		4-6 weeks		7-9 weeks		10-12 weeks		13-15 weeks		16-18 weeks	
n	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*		*n*	*%*
1,279,344	321,396	17.3	174,439	9.4	117,065	6.3	93,296	5.0	79,468	4.3	74,003	4.0
	19-21 weeks		**22-24 weeks**		**25-27 weeks**		**28-30 weeks**		**31-33 weeks**		**34-36 weeks**	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
	68,468	3.7	51,888	2.8	46,404	2.5	37,899	2.0	33,523	1.8	28,121	1.5
	37-39 weeks		**40-42 weeks**		**43-45 weeks**		**46-48 weeks**		**49-51 weeks**		**52+ weeks**	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
	24,618	1.3	23,107	1.2	18,858	1.0	16,495	0.9	16,332	0.9	53,964	2.9

The dataset analysed included a total of 2,524,447 pathways, with 1,279,344 (49.3%) of these having an available end date. These pathways, representing completed cases, were incorporated into the descriptive analysis. Descriptive analysis was done on demographic variables including age, gender, Index of Multiple Deprivation (IMD), ethnicity, frailty and number of other long-term conditions. Analysis was also carried out on speciality area and healthcare use as described above.

The data showed variation in wait times, with 859,667 (67.2%) pathways completed within 18 weeks, and 419,677 (32.8%) exceeding this timeframe. A smaller proportion of pathways were significantly delayed, with 153,374 (12.0%) taking more than 36 weeks, and 48,409 (3.8%) extending beyond 52 weeks. The median wait time for all completed pathways was 69 days (Interquartile Range: 139 days), while the mean wait time was 108.0 days (Standard Deviation: 109.9).

There were 312,864 completed pathways resulting in treatment and with linkage to healthcare usage records, comprising 247,942 unique patients. 7.8% of all completed pathways result in a reason for clock stop of ‘Treatment – admitted’. 21.2% have a reason for clock stop of ‘Treatment – non admitted’. The remainder result in ‘Non-treatment’, including 17.3% having a clinical decision made not to treat, and 36.9% described as ‘Non-treatment – Other’. In 0.2% (2,875) of pathways, the patient dies while waiting.

Figure 1: Distribution of waiting length (days)



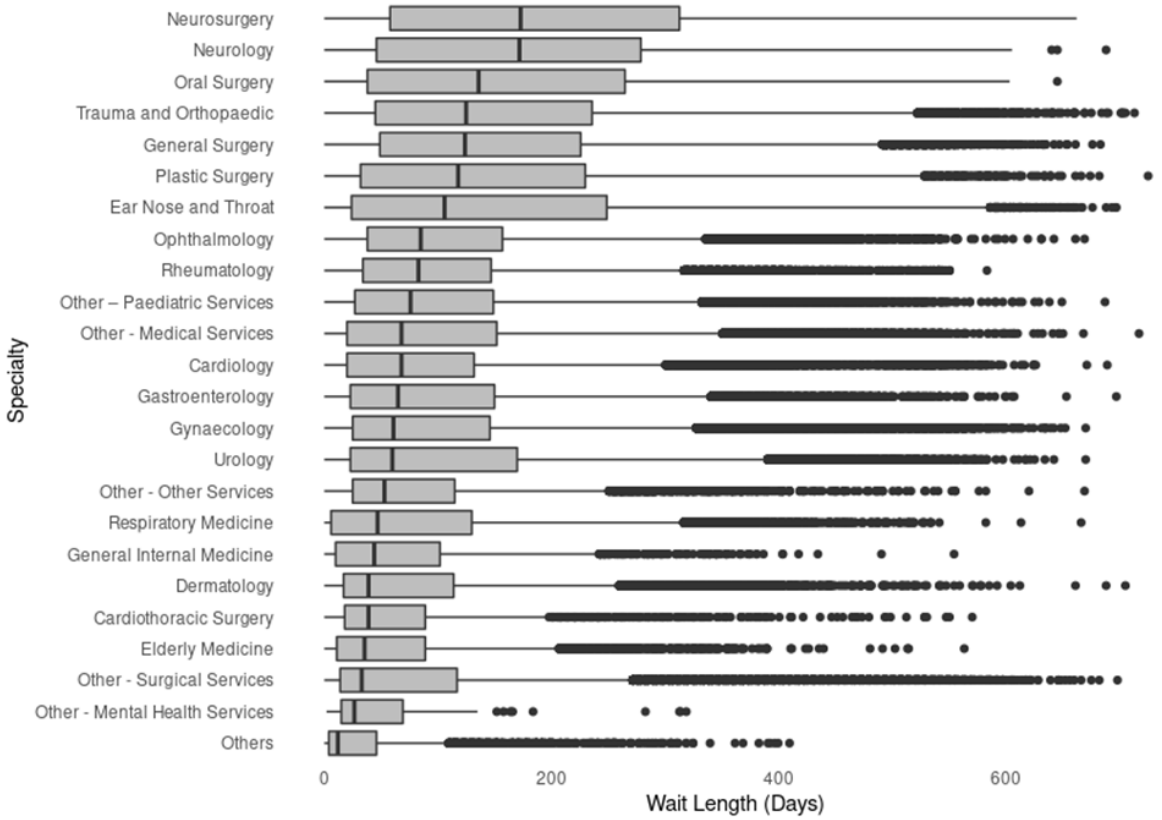
Specialty

Specialty categories were examined with the highest number of pathways recorded under 'Other – Medical Services' (157,063), followed by 'Other – Surgical Services' (133,772). The highest median wait was for Neurosurgery (172.5 days) and Neurology (169 days). Other specialties that had a higher median wait include Oral Surgery (136 days), Trauma & Orthopaedic (125 days), General Surgery (124 days) and Plastic Surgery (118 days).

Neurology and Neurosurgery also had the lowest proportion of pathways at 18 weeks or less, at 42.5% and 41.1% respectively. The highest proportion of pathways at over 52 weeks was for Neurosurgery (15.2%) and Ear Nose and Throat (13.2%). The lowest median wait by specialty excluding unknown specialties was for Other – Mental Health Services (26.5 days), Other – Surgical Services (33 days) and Elderly Medicine (35 days).

In terms of pathway outcomes, Oral surgery has the highest proportion of pathways resulting in the patient declining treatment (4.1%). Other – Surgical Services has the highest proportion of pathways resulting in a clinical decision not to treat (27.9%). Plastic Surgery has the highest proportion of pathways resulting in a DNA (Did Not Attend) (27.9%). Excluding pathways where the specialty is unknown, General Internal Medicine has the highest proportion of pathways where the reason for clock stop is missing or classed as 'Other' (50.4%).

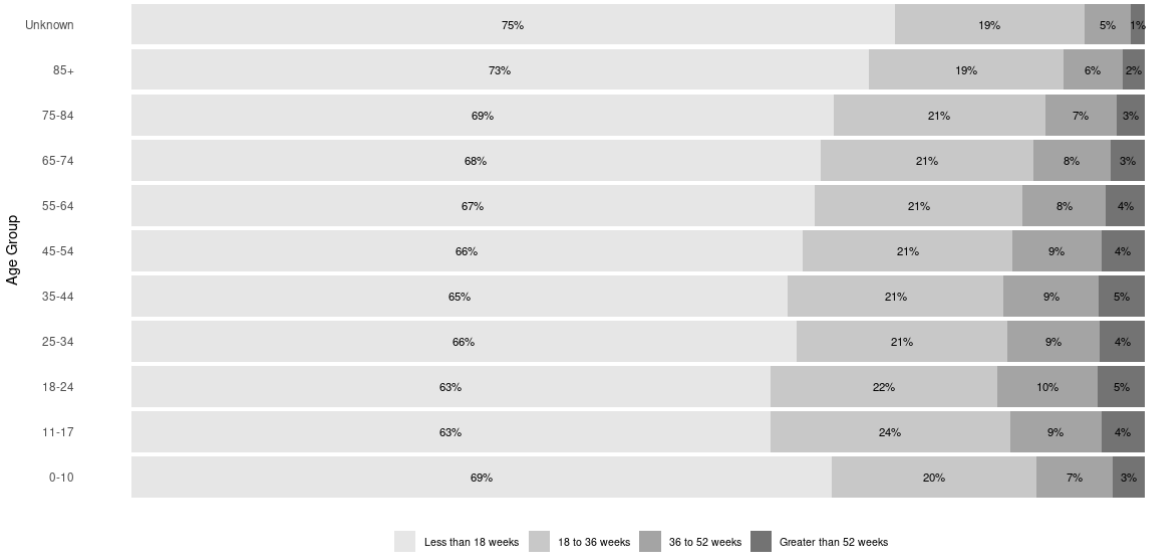
Figure 2: Boxplots of wait length by speciality (days)



Age

In terms of age distribution, the largest group consisted of patients aged 55-64 years at the time of referral (190,936 pathways), followed by patients aged 65-74 years (171,654 pathways) and 45-54 years (167,004 pathways). 15.3% of the patients were aged 75 or older at the time of referral. Patients aged 11-17 had the longest median wait time of 88 days followed by patients aged 18-24 at 81 days, who also had the lowest proportion of pathways 18 weeks or less at 62.3%. The shortest median wait time was for patients aged 85+ at 58 days, with 73.6% of these pathways being 18 weeks or less. For pathway outcomes, the highest proportion of patient declines can be found in the 85+ age group (2.2%). The 25-34 age group has the highest proportion of pathways resulting in a clinical decision not to treat (19.7%).

Figure 3: Waiting Time Distribution by Age Group



Gender

Of completed cases there were 498,280 (38.9%) pathways for male patients, 691,163 (54.0%) for female patients, and 89,901 (7.0%) falling under the 'Other' gender category. Female patients had a higher number of pathways in all age groups except for those aged 17 or younger. Pathways for male patients had a slightly higher median wait time of 73 days, with pathways for female patients having a wait time of 67 days. The largest gender median waiting time gap was observed in the 18-34 and 35-49 age groups. The majority of pathways for 'Other' genders were found within the <=17 age group. 66.3% of pathways for Male patients were 18 weeks or less, 67.8% of pathways for Female patients were 18 weeks or less.

Cross tabulations by age and gender show that the patients with the highest median wait time by a margin of 8 days to the next highest were Male patients aged 18-34 at 89 days, with the equivalent wait for Female patients aged 18-34 at 67 days.

IMD

Patients in IMD decile 4 accounted for the highest number of completed pathways (200,834), followed by decile 3 (181,506). A subset of 94,365 pathways had an unknown IMD quintile. The analysis showed that pathways for older age groups (65-84 and 85+) were more likely to be in the least deprived IMD quintiles (4 & 5). Patients in the most deprived decile had a median wait time of 73 days, with 66.5% of pathways being 18 weeks or less, whilst patients in the least deprived decile had a median wait time of 66 days with 68.5% of pathways being 18 weeks or less. The largest difference in median wait time between the most deprived IMD decile and least deprived decile was in the age groups 35-49 (80 days for decile 1, 65 days for decile 10) and 50-64 (73 days for decile 1, 61 days for decile 10). In terms of pathway completion, the lowest proportion of pathways resulting in DNAs can be found in the least deprived IMD deciles 7-10 (1.9-3.0%)

Ethnicity

For ethnicity, the majority of pathways were for White patients, totalling 520,692, followed by Asian or Asian British patients with 308,302 pathways. There were also 196,847 pathways with an unspecified or 'Not Stated' ethnic category. White patients had the shortest median

wait time at 65 days and the highest proportion of pathways being 18 weeks or less at 68.4%, with all other ethnicities excluding unknown or not stated having a wait time of 72 days or more.

Frailty

Frailty, assessed using the eFI, was another variable considered. The majority of pathways (513,975) involved patients who were classified as 'Fit' on the eFI scale. Frailty scores were higher for a smaller proportion of pathways, with 175,591 involving severely frail patients, 169,896 moderately frail patients, and 209,528 patients categorized as mildly frail. Historical data for eFI was not available, therefore this measures a patients most recent frailty score, not their frailty score at the time of referral. Patients with severe frailty had the shortest median wait time at 66 days and highest proportion of pathways being 18 weeks or less at 69.1%. Patients with moderate or mild frailty had a median wait time of 69 days, whilst patients classed as fit had a median wait time of 72 days with 66.7% of pathways being 18 weeks or less.

Number of comorbidities

The most common profile was patients with 3 or more long-term conditions, with 433,727 pathways in this category. 356,819 pathways involved patients with no long-term conditions. Patients with no long-term conditions had median wait time of 73 days, one long term condition 69 days, two long term conditions 69 days, and 3+ long term conditions had a median wait time of 67 days with 68.3% of pathways being 18 weeks or less.

Healthcare usage

Across all pathways there was a higher rate per 100 patient weeks of emergency admissions in the 3 months prior to referral (0.8, £2,708) compared to whilst waiting (0.5, £1,362) and the 3 months after treatment (0.6, £1,897). This is most noticeable in General Surgery (1.3, £4,367 before referral; 0.6, £1,256 whilst waiting).

A&E attendances have a similar trend, with a rate per 100 patient weeks of 2.6 (£492) prior to referral, 1.7 (£308) whilst waiting and 1.8 (£336) after treatment. This trend is most noticeable in Trauma & Orthopaedics (2.5, £398 before referral; 1.3, £214 whilst waiting) and Cardiothoracic Surgery (4.6, £944 before referral; 2.4, £520 whilst waiting).

Elective admissions show the highest rate of events per 100 patient weeks whilst waiting (2.6, £4,230), followed by after treatment (2.0, £2,109) and before treatment (1.6, £1,950). Gastroenterology demonstrates this trend the most with a rate of 5.0 (£3,564) events whilst waiting, 1.3 (£1,263) before and 2.5 (£2,399) after. Cardiothoracic Surgery has by far the largest elective admissions cost per 100 patient weeks at £14,589 before referral, £96,358 whilst waiting and £6,402 after treatment.

GP appointments show a fairly flat trend of rate of events per 100 patient weeks, with 26.3 (£708) prior to referral, 25.6 (£690) whilst waiting and 23.4 (£629) after treatment. Cardiothoracic Surgery shows an increase in the rate of events after treatment (35.7, £961 whilst waiting; 44.5, £1,198 after treatment), whilst Mental Health Service has the opposite trend (54.0, £1,453 whilst waiting; 35.0, £942 after treatment).

The number of unique prescriptions per patient slightly decreases in the whilst waiting period (3.9 compared to 4.5 before referral and 4.6 after treatment). However, this could be affected by pathways with shorter waiting periods. Generally, there is no noticeable difference in the number of unique prescriptions in the 3 months prior to referral compared to the 3 months after treatment for any specialty.

The rate of sick notes issues per 100 patient weeks was relatively flat across periods (0.7 before referral, 0.6 whilst waiting, 0.8 after treatment), though with variations by specialty. General Surgery pathways saw an increase in the rate of events after treatment (1.7, compared to 0.7 whilst waiting)

3.2 Causal Analysis (Objective 4)

Hip replacement

After all exclusions, we found 908 pathways for hip replacement surgery, of which 208 (22.9%) were complete within 18 weeks. 7,308 pathways were excluded due to an unknown end date, 472 due to insufficient follow-up data, and 188 due to being short waiters. A higher proportion of the youngest age groups were excluded from the causal analysis.

The majority of patients waiting for hip replacement surgery were aged 55 or over. There was no noticeable trend in the distribution of wait lengths by age group. Patients with one long term condition had the lowest proportion of their hip replacement pathways completed within 18 weeks (20.6%), and those with two long term conditions has the highest proportion (26.9%).

Outcome events were generally low frequency, meaning many of the results of the difference-in-difference analysis did not meet the threshold for significance. Compared to patients waiting 18 weeks or less, patients who wait longer than 18 weeks for hip replacement surgery were found to have an excess healthcare usage of 0.11 (p=0.439, SE=0.148) unique prescriptions, and 0.05 (p=0.562, SE=0.079) elective admissions during their waiting period. We found that long waiters had a statistically significant negative excess i.e. more healthcare utilisation after surgery, for GP appointments [1.10 (p=0.001, SE=0.315)] and emergency admissions [0.09 (p=0.018, SE=0.039)], and non-significant negative excess for A&E attendances [0.16 (p=0.052, SE=0.083)] and sick notes [0.11 (p=0.096, SE=0.068)], compared to those who waited less than 18 weeks.

Difference-in-difference analysis of total healthcare usage in the full cohort of hip replacement surgery found an excess in the above-target waiters of 212 elective admissions. There was a negative excess of total GP appointments (768), A&E attendances (149), sick notes (94), emergency admissions (60) and unique prescriptions (10). We found an excess cost in the above-target waiters of £1,759,521 for elective admissions, and a negative excess cost of £300,564 for emergency admissions, £27,747 for A&E attendances and £20,667 for GP appointments.

Cardiothoracic surgery

We found 627 pathways for cardiothoracic surgery after exclusions, of which 353 (56.3%) were completed within 18 weeks. 2,926 pathways were excluded due to having an unknown end date, 217 due to insufficient follow-up, and 150 due to being short waiters. Compared to hip replacement, cardiothoracic surgery is more likely to have a higher proportion of <18 week waiters because of the comparatively higher mortality risk of the procedures.

Male and female patients had the same proportion of cardiothoracic pathways completed within 18 weeks (56.7%). The age groups with the highest proportion of cardiothoracic pathways completed within 18 weeks were the 55-64 group (60.9%), the 45-54 group (60.5%) and the 65-74 group (60.2%). Proportions of cardiothoracic pathways completed within 18 weeks across IMD quintiles was varied, with no clear trend. Proportions of cardiothoracic pathways completed within 18 weeks across ethnicities was also varied,

somewhat caused by the relatively small sample sizes within groups. No trends were observed across frailty status or number of long term conditions.

Similarly to hip replacements, outcome events were generally low frequency, meaning none of the results of the difference-in-difference analysis met the threshold for significance. Patients who wait longer than 18 weeks for cardiothoracic surgery were found to have an excess healthcare usage of 0.27 (p=0.186, SE=0.201) unique prescriptions, and 0.02 (p=0.812, SE=0.067) sick notes during their waiting period. We found a negative per pathway excess of 0.12 (p=0.070, SE=0.068) emergency admissions, 0.08 (p=0.424 SE=0.102) A&E attendances, 0.04 (p=0.933, SE=0.514) GP appointments, and 0.01 (p=0.971, SE=0.138) elective admissions in the above-target waiters.

Difference-in-difference analysis of total healthcare usage in the full cohort of cardiothoracic surgery found an excess in the above-target waiters of 114 unique prescriptions and 70 GP appointments, and a negative excess of 65 elective admissions, 41 emergency admissions and 21 A&E attendances. We found an excess cost in the above-target waiters of £1,834 for GP appointments. There was a negative excess cost of £734,575 for elective admissions, £593,816 for emergency admissions and £6,147 for A&E attendances. We have very low confidence in this result based on the small sample size for cardiothoracic surgery.

4. Discussion

Despite concerted efforts and additional resources during the years following the COVID-19 pandemic, elective care waiting lists remain stubbornly high, ensuring that they remain a critical priority for citizens, the NHS and the UK Government (NHS England, 2025). This research paper set out to provide detailed qualitative and quantitative insights into the experience and implications of outsized waiting list sizes on our population and healthcare service. It has sought to outline who is waiting for what services and how that waiting impacts the broader health system and people's lives.

4.1 How is the NHS serving those who are waiting?

Regarding who is waiting, the growth in our waiting lists affects every demographic in our community. However, there are some key disparities across the protected characteristics that we see at the global waiting list level: males have marginally longer median wait time than females; younger people tend to wait longer than older people; and, those who are more deprived tend to wait longer than those who are least deprived.

However, given the number of different specialties (24) across eight providers of services, these global observations cannot be extrapolated to individual pathways or providers who could exhibit very different disparities. Inferences about disparities in waiting lists require in-depth analysis, as the multiplicity of pathways make it a topic that is prone to the ecological fallacy, 'a problematic assumption that relationships that hold at one level of aggregation also hold at another level of aggregation' (Firebaugh, G., 2001).

This phenomenon was reflected in our feedback regarding disparities from our patient reference group, who were surprised not to see wider disparities in waiting times across different demographic groups. These disparities may exist within local pathways but not at the global level. Interestingly, the group also remarked on how the definition of the clock start might fundamentally mask the "true" disparities in wait time. The group noted that our analysis does not include patients who do not make it onto the waiting list. They hypothesized that some groups, e.g. patients with lower education levels or whose preferred

language is not English, may find it more difficult to navigate the system and get referred for treatment. Nor does it include patients with higher income levels who may opt for private care to receive treatment more quickly.

The NHS Constitution sets out an internationally recognised standard to ensure 'access to NHS services is based on clinical need, not an individual's ability to pay' (DHSC, 2023). Discounting for the limitations of global level inferences and the selection bias that may occur through our methodology, it does seem that NWL NHS services are adhering to this principle and prioritising demand according to greatest clinical need. This interpretation is supported by some global-level findings e.g. those with more co-morbidities have shorter waiting median times, and those with severe frailty have shorter waiting times than others.

However, regarding frailty, the ecological fallacy is demonstrated when we compare this global finding to hip replacements. Within hip replacements, those who have a Fit eFI score have a greater proportion of patients seen within 18 weeks. This is probably due to some operational nuances for that pathway. Hip replacements can be done in high volume centres for patients who meet certain criteria, and it is less likely that those are more frail will fit those criteria. Therefore, frailer patients will likely wait longer as they need to be done in an appropriate hospital, on an appropriate list, which is generally better staffed but sadly rarer. Sometimes if very frail, a High Dependency Unit bed needs to be ready just in case, a further rate limiting factor.

4.2 The implications of waiting for the system

A central hypothesis of this research project was that increased numbers of people waiting and increased time on the waiting list would be associated with increased demand for non-elective healthcare services. We did not find any statistically significant excess utilisation to validate this hypothesis. However, counter to this hypothesis, we found that with hip replacements, long waiters had a statistically significant negative excess i.e. the difference in utilisation is higher in the reference period (i.e. time after the procedure) than in the intervention period i.e. the time waiting for the procedure. This was observed for GP appointments and emergency admissions. This therefore suggests that the overall design of our causal analysis needs to be reviewed as this is not the hypothesis that our statistical method set out to test.

Regardless in the following section, we will theoretically explore the implications of the finding that longer wait times could lead to prolonged increased healthcare utilisation. The negative excess in total cost for the system was £20,667 for GP appointments and £300,564 for emergency admissions for a combined £321,231. The finding of negative excess in healthcare usage for patients waiting longer for hip replacements, indicates that challenges of waiting longer could be observed post procedure. This creates a worrying insight in the context of long waits in the NHS i.e. those who wait longer for hip replacements are likely to have increased ongoing costs even once the procedure is completed.

This finding provides an additional impetus for timely reduction of the NHS waiting lists, with a focus on those waiting longest. We believe that research, with a study design to test this new hypothesis, should be replicated across other specialities, as it could lead to a novel factor to be considered when prioritising waiting lists i.e. procedures which are most likely to lead to enhanced long-term healthcare utilisation. Furthermore, this future research allowing a longer follow-up observation period to understand how long this post-surgery enhanced cost occurs for would be helpful.

We did not find any other statistically significant findings but there are overarching limitations to our methodology that could mask this: the requirement to analyse completed pathways and the decision to analyse at a procedure level. Firstly, a critical limitation in our methodology is the requirement to have pathways being completed. This means that we were only able to include 908 (10.2%) of the 8,876 hip replacement procedures identified in the Discover dataset. The largest cohort of exclusions is "unknown end date" 82%. This could create a significant selection bias. For argument's sake, it could be that those who are more likely to have unknown end dates are more likely to create additional demand for other healthcare services. Further analysis of the relative healthcare utilisation of this 82% group could be helpful. But ultimately, we might need to wait for greater number of these pathways to close to truly understand the associations between elective care waiting and wider healthcare system utilisation.

Secondly, the 908 hip replacement procedures analysed is only 4.8% of the 18,961 Trauma and Orthopaedic patients who are waiting to start treatment as of January 2025. (NHS England, 2025). A simple extrapolation of this £321,231 additional cost to the 17,674 completed pathways represents an additional cost pressure of £6.7 million (NB. this only includes the statistically significant findings of excess GP appointments and emergency admissions). This is no longer an insignificant cost pressure. For context, and ignoring contractual realties regarding cashable savings, it would represent more than one fifth of NWL ICB's 2024/25 forecast outturn deficit of £23.4 million (NWL ICB, 2025). Whilst these extrapolations are spurious, the approach aims to argue that analysis at the speciality level might be more appropriate for analysing system cost pressures as the relatively small volume of completed pathways at the procedural level might impede the identification of a significant relationship, if one exists (These et al., 2016).

4.3 The implications of waiting for individuals

The public we spoke to were not surprised that most patients are not being seen within the 18-week target. They were understanding of the pressures being faced by the NHS and did not expect wait times to drop significantly anytime soon. Instead, they wanted honest and transparent communication to help manage their expectations around wait times.

> *"It would have been nice to have some sort of medical support. My GP has been good, but a lot I've found out by myself. The NHS is so stretched for resources, so I've looked at it and thought this is down to me. I've got the painkillers, I've got the meditation, I've got the shoes... It's probably cost a couple thousand with all of the different avenues I've pursued."*
> ***– Cathy Wilcox, Patient and Carer Advisory Group member (Hip replacement)***

There was also a strong desire for practical and emotional support from the NHS during the wait. Long waits have a significant toll on patients and their families, particularly with regards to their mental and social wellbeing. Patients wanted more information about how to prepare for their operation and what to expect post-op so that they could feel more productive and in control while waiting. They also said they would appreciate having someone from the NHS call and check in to ask how they're doing, and to reassure they haven't been forgotten, signposting to mental health support if needed. When this practical and emotional support isn't provided by the NHS, it leaves patients to find it themselves. Some patients we spoke to were able to find information and access support services on their own, but others were not, introducing health inequities.

"It's not just the anxiety of having waited for so long. It's having been told that I needed that operation quickly. So it's like, what is the health implication for me? Am I actually going to be here next week?... I questioned whether I wanted to carry on living or not. And that's partly about no services to offer you support during your waiting time, and also about the lack of information that's provided to you. So all you see is doom and gloom."
– Patient (cardiothoracic surgery)

Alongside our findings that waiting a long time for hip replacements could create significant costs to the NHS. Our qualitative findings also highlight a strong drive towards utilisation of private healthcare sector. Patients are turning to private healthcare providers, this is seen by significant increases in private health insurance revenue and out of pocket payments remaining significant, especially in clinics. The specialties with the longest NHS waits, ophthalmology and orthopaedics, demonstrate the greatest private sector activity highlighting the link between the long NHS waits and increased utilisation of the private sector (LaingBuisson, 2024).

In conclusion, whilst our central hypothesis of waiting lists driving up demand for other NHS services has not been demonstrated, we have tentatively found a potential ongoing relationship between healthcare utilisation and waiting. It is clear that waiting for elective care creates a healthcare and life burden for those who experience long waits. This burden is multifaceted: physical, associated with the procedure they are waiting for; mental, as it affects the mental wellbeing of those who wait and their carers, friends and families; and/or, economic, driving individuals to invest in private healthcare and support to address their needs whilst waiting for NHS care. We hope this finding helps drive up focus on "waiting well" for patients, an objective missing from the 2025 operating and planning guidance.

3. Limitations

Our study acknowledges several limitations that impact the external validity of our findings and highlight areas for further research. Firstly, our approach excluded a significant proportion of those waiting, this potentially renders them unrepresentative of the general population. This limitation underscores the need for either a greater lapsed timeframe before conducting analysis like this or development of an alternative methodological approach to reduce the exclusions and any associated selection bias.

Additionally, we lack data on private care usage within our dataset. Consequently, we are unable to assess the extent to which private care usage increases while individuals await treatment or determine whether patients are opting for private care over the NHS from the outset due to the perception of long waits. Whilst we have provided some of the national evidence to support our discussion, incorporating individual level data on private care utilisation could provide a stronger evidence-base for any substitution choices of individuals from public to private care.

Furthermore, our analysis does not account for the effect of covariates in causal analysis. Evaluating the influence of various covariates is crucial for understanding the underlying factors affecting patient outcomes and should be considered in future research.

Another limitation is the absence of data on the duration from when a patient first notices an issue to when they are referred for treatment. For example, if a patient had to visit their GP multiple times before being referred for treatment, this waiting period is not reflected in our

analysis. Including such data could provide a more comprehensive understanding of waiting times and patient experiences. This was a limitation flagged emphatically by our patient reference group.

The assumption that the a follow-up period post-treatment is a sufficient reference period for a difference-in-difference analysis in order to measure the excess healthcare use during treatment may not hold true for certain procedures or points of delivery. We saw an increased level of healthcare usage after treatment compared to the waiting period for some types of healthcare usage, particularly for hip replacements. Our significant results for GP appointments and emergency admissions that indicate a negative excess for above-target waiters during their waiting period may indicate that for hip replacements, a long waiting period may be more likely to impact the post-treatment period in terms of excess healthcare usage. Further research should also increase the follow-up observation period to understand how long any excess utilisation post procedure occurs for.

Finally, we have not conducted an analysis of the disparities that exist in missing clock stops. This omission could significantly influence the interpretation of our results, particularly if there are inequalities in who receives clock stops. This could skew the outcomes of our research. Investigating these disparities represents an important area for future research to ensure equitable healthcare access and accurate interpretations of waiting times.

4. Impact and dissemination

We will share final results findings with the North West London Acute Care Board, which has oversight of elective care. Furthermore, we will work relevant stakeholders to determine what for check and challenge and further understanding of the findings in local context. NWL ICB is also conducting an engagement exercise on improving planned care and reducing NHS waiting times (NWL ICB, 2025b). We will collaborate with these colleagues to share our findings. We will also work with the national Networked Data Lab to review common themes and differences in our outcomes and consider what might be the national policy implications of our collective work.

Regarding PPIE, At the conclusion of the project, we will consult our Patient and Carer Advisory Group again to discuss the implications of our findings for future policy and research recommendations, and to agree on how best to disseminate our findings to the public. We will work with several members of the group to develop a lay output to assist in disseminating the findings – in previous topics, this has been an infographic or video. The output will be shared on social media and through relevant community organisations and networks. We will also have several members of the group present the findings and why they matter from a patient perspective to project stakeholders such as our clinical leads.

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