The Networked Data Lab:

Statistical analysis plan for Topic 5 – Waiting Lists

Version 1.0

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## Research rationale and objectives

The NHS waiting list for elective treatment in England has been growing since 2013 – almost tripling in size over the decade to 7.7 million. The waiting list had already reached 4.6 million before the COVID-19 pandemic. During the pandemic the waiting list grew sharply, as care was suspended. Scotland saw a similar dramatic increase in the number of people waiting for both inpatient and outpatient planned care as a result of the pandemic, although prior to this the waiting list for planned care had been stable since 2017. In December 2023, there were 525,000 people waiting for planned outpatient care in Scotland, more than double the number in March 2020, and 62,000 waiting for planned inpatient care.[[1]](#footnote-2)

The elective care recovery plan, published by NHS England in February 2022, set out ambitions to reduce long waits for treatment and an expectation that the waiting list would be falling by March 2024.[[2]](#footnote-3) However the latest figures show minimal, if any, progress towards achieving this goal. In December 2023, there were 7.6 million people on the waiting list for elective care and more than 337,000 people waiting longer than a year.

NHS Scotland have also made commitments to reduce the backlog in planned care by increasing elective care activity by 10% compared with pre-pandemic levels in outpatient services, and by 20 per cent in inpatient and day case services.[[3]](#footnote-4) Some progress has been made in reducing the longest waits and increasing activity. However, demand has also grown and therefore the waiting list has continued to grow. December 2023 saw the first quarterly decrease in two years, but it is not yet clear if this trend will be sustained.[[4]](#footnote-5)

In 2020, after the first wave of the Covid-19 pandemic NHS England laid out five priority areas to focus its operational efforts on, one of which was to “restore elective care inclusively”. This meant examining their waiting lists to identify inequalities relating to the level of deprivation and ethnicity, and prioritising service delivery taking this into account.[[5]](#footnote-6) This was an important change to how NHS organisations were asked to manage waiting lists – embedding work to tackle health inequalities into the process. However, the policy was broad, and left local areas to define their approach.

Unlike most previous NDL topics, the elective waiting list is an area already receiving considerable attention from local and national policy and decision-makers. The monthly Referral to Treatment (RTT) Waiting Times data published by NHS England stands as one of the most scrutinised national healthcare datasets.[[6]](#footnote-7) Many research organisations, including the Health Foundation, have interrogated this data to produce insights about the scale and likely trajectory of the elective care backlog.[[7]](#footnote-8),[[8]](#footnote-9),[[9]](#footnote-10)

The bulk of the published research on backlogs in elective care is focussed on the overall numbers of people waiting. There is, conversely, little analysis on waiting lists that uses patient level data to disaggregate the waiting list, or which uses linked data to take a system-wide view. The current absence of a national patient-level, linked dataset creates an opportunity for the NDL Labs to exploit their local datasets to generate insights to fill national evidence gaps.

Drawing on the priorities raised in our desk research and engagement internal and national stakeholders,[[10]](#footnote-11) patients and the public, the aims of this project will be to:

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;
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;
3. Describe and compare patients’ primary and secondary healthcare use before and after waiting for elective treatment, by specialty and by patient demographic and health characteristics;
4. Assess the causal impact of waiting for longer periods of time on healthcare usage and costs.

In pursuit of these aims, we propose that the NDL labs produce the following set of outputs. Objectives 1 through 3 will be addressed by descriptive analyses, while objective 4 will be explored using a causal 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 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 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 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 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 |

## Study population and cohorts

The study population for this analysis will be 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 6 months after the date of latest pathway end or 31 October 2024, whichever is sooner.

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

**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. This will include some patients without a clock stop (incomplete pathways). This cohort will be used to create outputs 1.1 - 1.4, as well as being the basis for all further cohorts.

**Cohort 2:** Of cohort 1, all pathways with a definitive pathway end (i.e., completed pathways) by 31 March 2024.​ This cohort will be used to create the outputs 1.5 and 2.1 – 2.4, as well as being the basis for cohorts 3 and 4.

​**Cohort 3:** Of cohort 2, 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 will be used to create outputs 3.1 – 3.4.

For the causal analysis (objective 4), the following cohort should be observed:

**Cohort 4:** Of cohort 3, all pathways for procedures of choice. This cohort will be used to create outputs 4.1 – 4.3.

## Statistical methods

**3.1** **Study design**

The descriptive portions of this study (objectives 1-3) will 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) will use a difference-in-difference study design to assess the effect of waiting for longer than target periods of time on healthcare use and costs.

**3.2 Definitions and metrics**

Waiting times

Waiting times will be defined in this study by clock start and stop dates. The clock starts when a referral is made to a consultant-led service with the intention that the patient will be assessed and, if appropriate, treated before responsibility is transferred back to the referring health professional or general practitioner. The clock stops when a first definitive treatment starts, a clinical decision is made that stops the clock, or the patient is added to a transplant list. Wait length is therefore the date of clock stop minus the date of clock start, measured in days.

However, cohort 1 will include some patients without a clock stop (incomplete pathways) – their wait time should be considered as clock stop until the most recent date of reporting, measured in days.

Referrals of the same patient to different specialties should treated independently as different patient pathways. Where a patient has multiple referrals to the same specialty, define clock start as the first referral date and clock stop as when all referrals were closed (i.e. the patient was no longer on the waiting list for that specialty).

Healthcare use

For objectives where we seek to describe healthcare use (Objectives 3 and 4), we would propose that labs record healthcare use via the following points of delivery:

|  |  |  |
| --- | --- | --- |
| **Point of delivery** | **Priority level** | **Notes** |
| Emergency attendances | Top priority – must be delivered | Major A&E attendances as primary outcome; also report type 2/1/minor units if available |
| GP appointments | Top priority – must be delivered | Measured as number of contacts (exclude multiple contacts on same day?)  Grampian will instead use days prescription issued and out of hours primary care contacts |
| Elective admissions | Priority |  |
| Emergency admissions | Priority |  |
| Prescriptions | Priority | Measured as number of unique drugs prescribed  Primary care prescriptions for English labs / prescriptions dispensed from community pharmacies for Grampian |
| Prescriptions (pain) | Priority | Measured as number of unique drugs prescribed  Code list in appendix |
| Prescriptions (anxiety/depression) | Priority | Measured as number of unique drugs prescribed  Code list to be agreed |
| Sick notes | Priority | Code list to be shared/agreed |
| NHS 111 calls | Lower priority – if already completed previous measures | Measured as number of calls, regardless of outcome |
| NHS 999 calls | Lower priority – if already completed previous measures | Measured as number of calls, regardless of outcome |
| Prescriptions (antibiotics/anti-microbials) | Lower priority – if already completed previous measures |  |

*Table 3.2.1: Healthcare use points of delivery*

Unless not possible using local data, top priority points of delivery should be examined at a minimum.

**3.3 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**

For outputs supporting objective 1, wait lengths are divided into groups based on the nearest whole week (e.g. – someone who received their treatment at 128 days would be assigned to the <=18 weeks group, while someone waiting for 132 days would be assigned to the >18 weeks group). If the day is equidistant from its nearest whole weeks, assign to the lower group (e.g. a 130-day waiter would be assigned to the <=18 weeks group).

The above 18 week wait length groups proposed (>18 weeks, >36 weeks and >52 weeks) 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.

For all pathways (Cohort 1), report the number and percentage of patient pathways by waiting time category. For completed pathways (Cohort 2), mean, median, standard deviation and inter-quartile ranges should be supplied for waiting times in days. In both cases, please stratify these results by:

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

Results for this output should be supplied in Tables 1.1 - 1.4. Data quality metrics, outlining the size of the initial cohort at different stages in the data processing, should be included in table 1.5.

**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, please assign the case to “Missing – imputed clock stop” see Table 2.1).

For completed pathways (Cohort 2), the number of patient pathways falling into each clock stop category and the percentage they represent of the total cohort should be 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 (if available)

These results should be reported in table 2.1.

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

For completed pathways with a definitive treatment (Cohort 3) and patient-level linkage to local electronic health records, please report healthcare use for each of the points of delivery described in in section 3.2. Healthcare use should be 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 should be excluded. For these time periods, please 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 3 months prior to referral and 3 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 3 months prior to referral and 3 months following treatment; per week for whilst waiting)

These results should 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 (if available)
* Wait length (<=18 weeks, >18 weeks, >36 weeks, >52 weeks).

These results should be reported in tables 3.1 and 3.2.

Causal Analysis

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

[Forthcoming]

1. [NHS waiting times - stage of treatment (publichealthscotland.scot)](https://publichealthscotland.scot/publications/nhs-waiting-times-stage-of-treatment/stage-of-treatment-waiting-times-inpatients-day-cases-and-new-outpatients-quarter-ending-31-december-2023/) [↑](#footnote-ref-2)
2. [Coronavirus » Delivery plan for tackling the COVID-19 backlog of elective care (england.nhs.uk)](https://www.england.nhs.uk/coronavirus/publication/delivery-plan-for-tackling-the-covid-19-backlog-of-elective-care/) [↑](#footnote-ref-3)
3. [NHS Recovery Plan 2021-2026 (gov.scot)](https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2021/08/nhs-recovery-plan/documents/nhs-recovery-plan-2021-2026/nhs-recovery-plan-2021-2026/govscot%3Adocument/nhs-recovery-plan-2021-2026.pdf) [↑](#footnote-ref-4)
4. [NHS in Scotland 2023 (audit.scot)](https://audit.scot/uploads/docs/report/2024/nr_240222_nhs_in_scotland_2023.pdf) [↑](#footnote-ref-5)
5. [NHS England » Implementing phase 3 of the NHS response to the COVID-19 pandemic](https://www.england.nhs.uk/publication/implementing-phase-3-of-the-nhs-response-to-the-covid-19-pandemic/) [↑](#footnote-ref-6)
6. [Statistics » Referral to Treatment (RTT) Waiting Times (england.nhs.uk)](https://www.england.nhs.uk/statistics/statistical-work-areas/rtt-waiting-times/) [↑](#footnote-ref-7)
7. [The past and future of NHS waiting lists in England | Institute for Fiscal Studies (ifs.org.uk)](https://ifs.org.uk/publications/past-and-future-nhs-waiting-lists-england) [↑](#footnote-ref-8)
8. [Elective (planned) treatment waiting times | Nuffield Trust](https://www.nuffieldtrust.org.uk/resource/treatment-waiting-times) [↑](#footnote-ref-9)
9. [Waiting times for elective (non-urgent) treatment: referral to treatment (RTT) | The King's Fund (kingsfund.org.uk)](https://www.kingsfund.org.uk/insight-and-analysis/data-and-charts/waiting-times-non-urgent-treatment) [↑](#footnote-ref-10)
10. To date: Head of the NHSE Elective Recovery Analytics team; Head of Strategic Analytics at The Strategy Unit; Director of the National Healthcare Inequalities Programme, NHSE; Health Foundation Chief Executive and Directors of Policy and Data Analytics. [↑](#footnote-ref-11)