



## **Supplementary Material**

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### **Methods**

Data were obtained from Public Health Scotland.<sup>1</sup> Data were published on 6 September 2022, and cover all elective orthopaedic inpatient and day-case treatment from July 2021 to June 2022, including a breakdown by individual health boards. These data contain details of all patients added to the waiting list for treatment, the number of patients currently waiting (including length of wait), and the number of patients admitted for treatment. For the purposes of this study, we have focused on 'routine' patients, i.e. those previously classified by the Federation of Surgical Speciality Associations (FSSA) as P3 and P4 priority classifications.<sup>2</sup>

#### **Percentage of 2019 activity**

Orthopaedic elective 2019 activity (including all patients, not just those classified as routine) was first extracted from the Public Health Scotland data for new additions to the waiting list and new admissions for treatment. The June 2022 proportion of P3/P4 patient activity was then used as a reference (71%) and applied to the overall 2019 volumes to provide a detail on activity that was related to this routine category of patients.

We then calculated the percentage activity for new additions to the waiting list by taking the number of new P3/P4 additions over one year up to the end of June 2022 and dividing this by the estimated attributable number of P3/P4 patients added to the waiting list in 2019. This was then multiplied by 100 to provide the relative percentage. The process was then repeated regarding admissions for treatment to provide the relative percentage of operative activity for one year up to June 2022 in routine patients compared to 2019 values.

Across all elective orthopaedic activity, the stated 2019 monthly average for operative admissions and additions were 3,817 and 5,004, respectively.

#### **Predicted waiting times for orthopaedic surgery**

Predicted waiting times are calculated for a patient added to the waiting list for routine (P3 & P4) orthopaedic surgery in July 2022. Calculations are based on the previous one-year historical activity. The volume of routine patients currently waiting for

surgery as of the end of June 2022 was then calculated. This was divided by the historical activity in one year to give the amount of time taken to clear all waiting patients, so that a theoretical patient would be next in line for surgery. This was performed for routine patients across Scotland, and for within each individual health board.

We also performed adjustment for the potential impact of upcoming available orthopaedic operating capacity within the National Treatment Centres (NTCs) on predicted national operative volume. This was calculated as the predicted volume of routine operations per year (based on one-year historical activity) added to the one-year predicted orthopaedic activity from the four 2023 opening NTCs (taken from Scottish Government activity allocations). This totals 3,746 cases (71% of 5,276 – P3 & P4 cases as a proportion of total volume orthopaedic activity performed across Scotland in June 2022). The total (unadjusted) NTC capacity is as follows: 542 NHS Fife; 1,086 NHS Forth Valley; 1,506 NHS Highland; 3,436 Golden Jubilee National Hospital.

For each individual health board in scenarios where additional NTC capacity was present, we stratified this according to a weighting criterion based on the predicted unadjusted waiting times (i.e. the health boards with the longest projected wait had more NTC capacity applied to their activity).

The presented sensitivity estimates used the following information:

- Best-case scenario – full return to pre-COVID-19 activity by November 2022, with full additional NTC capacity. A monthly average of one-year historical activity was used as the basis for activity in July to October 2022. Pre-COVID-19 activity levels were calculated as detailed above.
- Current scenario – a monthly average of one-year historical activity used from July 2022 to June 2023. From July 2023 onwards, the monthly average activity included full additional projected NTC capacity.
- Cautious scenario – a monthly average of one-year historical activity used from July 2022 to June 2023. From July 2023 onwards, the monthly average activity included half the projected additional NTC capacity. In this scenario, we hypothesized the potential for issues with recruitment of staff to NTCs given current wider NHS staffing pressures.
- Worst-case scenario – a monthly average of one-year historical activity used as a prediction of future activity alone. In this scenario, we hypothesized the potential for extra NTC capacity to be cancelled out by deterioration in other NHS activity (for example, due to urgent care bed pressures, or migration of existing staff to NTCs leaving a deficit in pre-existing services).
- The longest individual health board wait was taken from individual health board calculations for each of the included scenarios.

## Annual case deficit

The annual case deficit was calculated by comparing the total number of new routine (P3 & P4) waiting list additions over the last year with the number of operations performed on routine cases over the last year. Again, adjustment has been performed based on calculation of potential additional P3 & P4 activity from the NTCs (as detailed

above). Additional calculations using a return to pre-COVID-19 activity (both additions and admissions as detailed above) were also performed.

We then calculated the amount of additional time this would add to the waiting list for each year that this case deficit continued. This was determined as the total case deficit per year divided by the number of routine cases undertaken per year (including additional predicted activity from the NTCs and full pre-COVID-19 activity).

## Feasibility of achieving current Scottish Government targets of a one-year wait for surgery by September 2024

Current targets have been taken from the Scottish Government website following their release on 6 July 2022.<sup>3</sup> This included a target to limit patients to no more than a one-year wait for inpatient and day-case cases in most specialities by September 2024. This, therefore, means a need for no patient added to the waiting list as of September 2023 waiting more than one year (to enable completion of their operation by September 2024).

We therefore calculated potential predicted waits for patients added to the waiting list in September 2023, in order to determine the feasibility of achieving the current target. This included calculations based on historical one-year routine operative activity, and then 25% incremental increases up to 100% (2x) of this baseline. We also included the scenario of a return to pre-COVID-19 activity and full additional NTC capacity.

To achieve this, we calculated the number of additional patients on the waiting list per month (predicted new additions to the wait list minus the predicted number of operated patients) out to September 2023, dividing this by the predicted number of patients admitted for surgery per month to calculate the wait in months. This was then divided by 12 to give the annual wait. This was based on a historical baseline of 1,415 routine patients per month, with adjustment for the potential incremental increases (for example 2,830 for a 100% increase). Pre-COVID-19 activity was determined based on 2019 activity (both new additions to the waiting list and numbers of operations performed) for routine patients as detailed above.

## References

1. **No authors listed.** NHS waiting times - stage of treatment. Public Health Scotland. 2022. <https://publichealthscotland.scot/publications/nhs-waiting-times-stage-of-treatment/stage-of-treatment-waiting-times-inpatients-day-cases-and-newoutpatients-30-june-2022/clinical-prioritisation-dashboard/> (date last accessed 18 November 2022).
2. **No authors listed.** Clinical Guide to Surgical Prioritisation in the recovery from the Coronavirus Pandemic. Federation of Surgical Specialty Associations (FSSA). 2022. [https://fssa.org.uk/\\_userfiles/pages/files/covid19/prioritisation\\_master\\_28\\_01\\_22.pdf](https://fssa.org.uk/_userfiles/pages/files/covid19/prioritisation_master_28_01_22.pdf) (date last accessed 18 November 2022).
3. **No authors listed.** New national targets to tackle long waits for planned care. Scottish Government. 2022. <https://www.gov.scot/news/new-national-targets-to-tackle-long-waits-for-planned-care/> (date last accessed 18 November 2022).



## Supplementary Tables

**Table i.** Individual health board sensitivity estimates regarding predicted waiting times for routine elective orthopaedic surgery for patient added to the waiting list in July.

Health board	Worst-case scenario	Cautious scenario	Current scenario	Best-case scenario
NHS Scotland	2.3*	2.2*	2.0*	1.3
NHS Ayrshire & Arran	2.0*	1.9	1.8	1.2
NHS Borders	3.0*	2.2*	1.9	1.2
NHS Dumfries & Galloway	1.6	1.5	1.5	1.0
NHS Fife	1.2	1.2	1.2	0.9
NHS Forth Valley	1.1	1.1	1.1	0.9
NHS Grampian	2.0*	1.9	1.9	1.4
NHS Greater Glasgow & Clyde	2.7*	2.6*	2.5*	1.7
NHS Highland	7.0*	3.8*	2.8*	1.6
NHS Lanarkshire	1.9	1.8	1.7	1.1
NHS Lothian	3.3*	2.9*	2.6*	1.8
NHS Orkney	0.9	0.9	0.9	0.9
NHS Shetland	0.0	0.0	0.0	0.0
NHS Tayside	2.5*	2.4*	2.2*	1.7
NHS Western Isles	0.8	0.8	0.8	1.1

2022 (wait in years).

\*At least a two-year predicted wait.

Individual health board weighting: NHS Ayrshire & Arran 0.065; NHS Borders 0.099; NHS Dumfries & Galloway 0.053; NHS Fife 0.040; NHS Forth Valley 0.038; NHS Grampian 0.067; NHS Greater Glasgow & Clyde 0.089; NHS Highland 0.233; NHS Lanarkshire 0.063; NHS Lothian 0.111; NHS Orkney 0.029; NHS Shetland 0.000; NHS Tayside 0.084; NHS Western Isles 0.028.

**Table ii.** Individual health board case deficit calculations (new additions to the wait list minus the number of operated patients), including sensitivity estimates, regarding routine elective orthopaedic surgery.

Health board	Worst-case scenario case deficit, n	Increased wait per year (years)*	Cautious case scenario case deficit, n	Increased wait per year (years)*	Current case scenario case deficit, n	Increased wait per year (years)*	Best-case scenario case deficit, n	Increased wait per year (years)*
NHS Scotland	20,108	1.1	18,848	0.8	16,362	0.5	6,327	0.18
NHS Ayrshire & Arran	1,304	0.9	1,181	0.8	1,059	0.6	224	0.1
NHS Borders	373	1.2	188	0.4	4	0.0	-148	-0.1
NHS Dumfries & Galloway	651	1.1	551	0.8	451	0.6	98	0.1
NHS Fife	1,330	0.9	1,255	0.8	1,180	0.7	378	0.1
NHS Forth Valley	1,004	1.0	933	0.9	861	0.8	292	0.2
NHS Grampian	2,184	1.0	2,059	0.9	1,934	0.8	849	0.2
NHS Greater Glasgow & Clyde	5,820	1.3	5,654	1.2	5,487	1.1	4,030	0.4
NHS Highland	1,152	3.0	716	0.9	281	0.2	-684	-0.3
NHS Lanarkshire	1,280	1.0	1,161	0.8	1,043	0.7	462	0.1
NHS Lothian	3,226	1.7	3,017	1.4	2,808	1.2	699	0.1
NHS Orkney	45	0.6	-10	-0.1	-65	-0.4	-68	-0.3
NHS Shetland	27	0.2	27	0.2	27	0.2	0.0	0.0
NHS Tayside	1,552	1.2	1,394	1.0	1,236	0.8	280	0.1
NHS Western Isles	160	0.7	108	0.4	57	0.2	-44	-0.13

\*Increased wait per year (years) denotes the additional length of time that a theoretical patient will have to wait compared to one added in July 2022. So, for example in the worst-case scenario the predicted wait for a new patient added in July 2022 will be 2.3 years for Scotland (Table i). This will then increase by 1.1 years for every year this level of case deficit continues, so it would become 3.4 years in July 2023, 4.5 years in July 2024, and so on.

Individual health board weighting: NHS Ayrshire & Arran 0.065; NHS Borders 0.099; NHS Dumfries & Galloway 0.053; NHS Fife 0.040; NHS Forth Valley 0.038; NHS Grampian 0.067; NHS Greater Glasgow & Clyde 0.089; NHS Highland 0.233; NHS Lanarkshire 0.063; NHS Lothian 0.111; NHS Orkney 0.029; NHS Shetland 0.000; NHS Tayside 0.084; NHS Western Isles 0.028.