NKCA
National Kidney Cancer Audit

NATCAN
National Cancer Audit Collaborating Centre

# National Kidney Cancer Audit State of the Nation Report: Ongoing Methodology Developments

An audit of care received by people diagnosed with kidney cancer between 1 January 2019 and 31 December 2023 in England and 1 January 2022 and 31 December 2024 in Wales. National time trends in kidney cancer diagnoses and treatments between 1 January 2019 and 30 September 2025 in England.

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# Contents

1. Improving timeliness of reporting in England ..... 1

1.1 Under- and over-capture ..... 1

1.2 Performance indicator results ..... 1

2. An alternative approach to estimate the national distribution of performance ..... 2

2.1 Rationale ..... 2

2.2 Estimated distribution of national performance ..... 3

2.3 Other applications ..... 3

# 1. Improving timeliness of reporting in England

It is a high priority for the NKCA to explore whether we can make our State of the Nation performance indicators (PIs) more timely. We use the National Cancer Registration Dataset (NCRD) to generate our PI results as it is the 'gold standard' cancer registration dataset in England. NCRD is available two years after diagnosis. However, an alternative, more timely data source is the Rapid Cancer Registration Dataset (RCRD) which is available four months after diagnosis. There are NATCAN audits that report some or all of their PIs using RCRD. However, there are some kidney cancer specific challenges. Primarily, the delay and completeness of TNM and lesion size data in RCRD.

## 1.1 Under- and over-capture

We compared the most recent NCRD extract with the earliest RCRD extract that covers the same cohort (people diagnosed with kidney cancer between January 2021 and December 2023). This is to simulate what would happen if we used the latest RCRD extract available to us. The NCRD extract was received in November 2025 and the RCRD extract was received in May 2024. Table 1 displays the number of people captured in both datasets as well as the number of people only captured in one.

**Table 1.** Number of people diagnosed with kidney cancer in 2021-2023 present in the November 2025 NCRD extract and/or the May 2024 RCRD extract.

| | **Present in NCRD** (Confirmed registrations) | **Absent from NCRD** | |
|---|---|---|---|
| **Present in RCRD** (Provisional registrations) | 24,586 | 2,859 (**10% over capture**) | *RCRD total:* 27,445 |
| **Absent in RCRD** | 6,322 (**20% under capture**) | N/A | |
| | *NCRD total:* 30,908 | | |

NCRD, National Cancer Registration Dataset; RCRD, Rapid Cancer Registration Dataset.

Of the confirmed registrations in NCRD, 20% were absent from the RCRD extract. Of the provisional registrations in RCRD, 10% were absent from the NCRD extract. This suggests there is 20% under-capture and 10% over-capture in RCRD. This was consistent across all three years. By comparison, the National Prostate Cancer Audit reported an under-capture of 10% and over-capture of 3%[1].

## 1.2 Performance indicator results

The national results for three performance indicators (PI3, PI4 and PI7) were calculated using NCRD and RCRD. These three PIs were selected due to clinical interest and as they encompass different points in the patient pathway. The national averages calculated using RCRD and NCRD were similar (Table 2). However, the numerators and denominators were lower (to varying degrees) using RCRD.

**Table 2.** Performance indicator national results calculated using November 2025 NCRD and May 2024 RCRD.

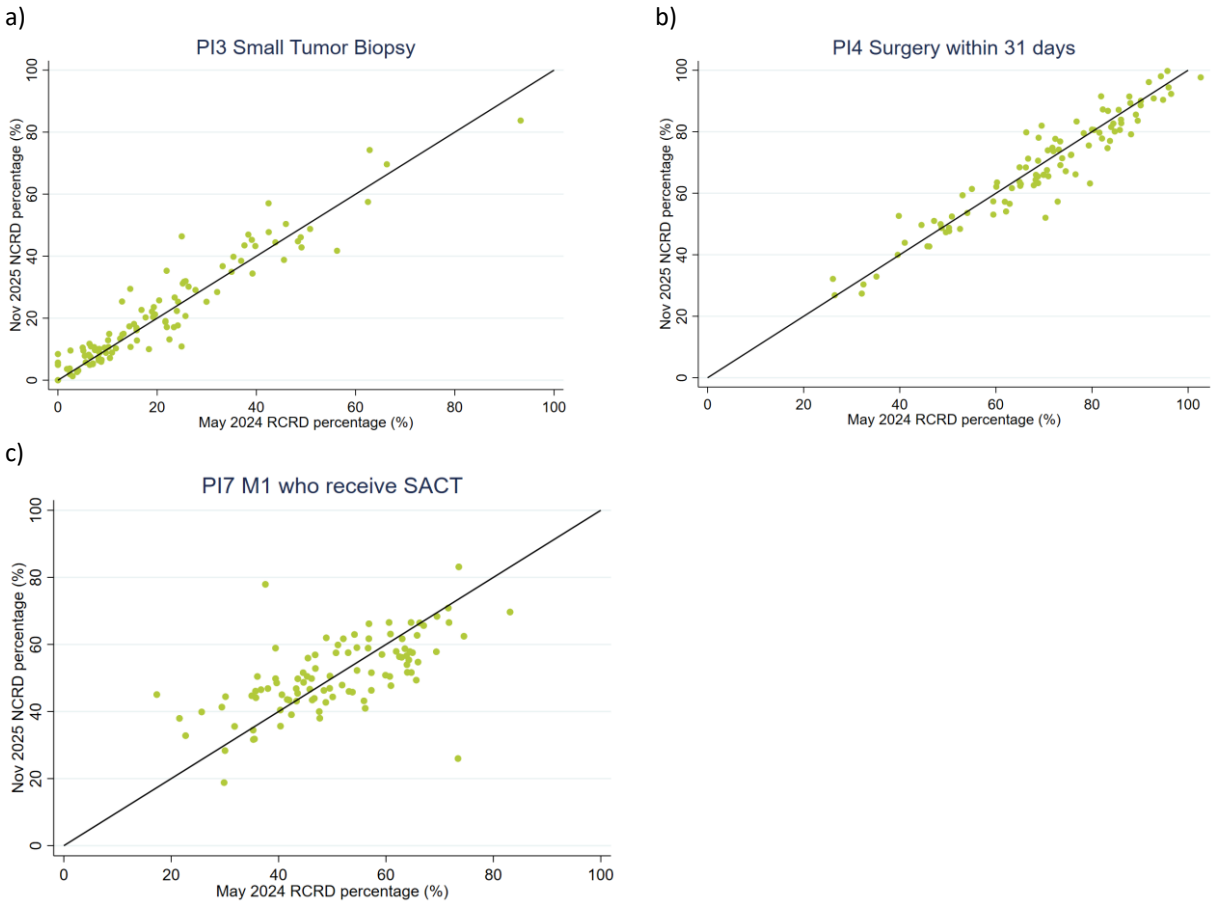
| **PI** | **Data Source** | **National Average** | **Denominator** | **Numerator** |
|---|---|---|---|---|
| **PI3 Small kidney cancer biopsy** | Nov 2025 NCRD | 21% | 9,175 | 1,967 |
| | May 2024 RCRD | 19% | 5,463 | 1,064 |
| **PI4 Surgery within 31 days** | Nov 2025 NCRD | 68% | 4,354 | 2,959 |
| | May 2024 RCRD | 69% | 3,823 | 2,645 |
| **PI7 SACT for M1 disease** | Nov 2025 NCRD | 50% | 7,587 | 3,824 |
| | May 2024 RCRD | 51% | 2,984 | 1,534 |

NCRD, National Cancer Registration Dataset; RCRD, Rapid Cancer Registration Dataset; SACT, systemic anti-cancer therapy.

[1] National Prostate Cancer Audit (NPCA). NPCA: Methodological Update 2023: Comparison of National Cancer Registration Dataset and Rapid Cancer Registration Dataset. NPCA Methodological Update 2023 - National Cancer Audit Collaborating Centre

At the provider level, the agreement in the PI results (percentages) calculated using NCRD and RCRD was good for PI3 and PI4 (Figure A4a and A4b). The agreement was poor for PI7 (Figure A4c). Despite overall good agreement for PI3 and PI4, reporting the results of the providers furthest from the line of perfect agreement could be misleading. There were providers where there was a 10-20% absolute difference in their RCRD and NCRD percentages. For example, their RCRD result was 25% and their NCRD result was 45% or vice versa.

**Figure 1.** Scatter plots depicting agreement in provider-level performance indicator results a) PI3 b) PI4 c) PI7.




NCRD: National Cancer Registration Dataset, RCRD: Rapid Cancer Registration Dataset, SACT: systemic anti-cancer therapy.

We will continue this work in the hope that we can use RCRD to improve the timeliness of our State of the Nation PI reporting in the future. Our next steps include further understanding the under- and over-captured people. We will explore rules to remove over-captured people from RCRD and assess whether this improves the agreement of PI reporting at the provider level.

Please note Wales wasn't included in this methodological work as the data we use to generate PI results for Wales is more timely than NCRD and there isn't currently an equivalent dataset to RCRD for Wales. However, NHS Wales Performance and Improvement are working on further improving the timeliness of their data delivery to us.

## 2. An alternative approach to estimate the national distribution of performance

### 2.1 Rationale

NKCA uses funnel plots to identify statistical outliers (i.e., performance outside control limits representing sampling variability). Most of our performance indicators (PI3-PI8) are computed using risk-adjusted models and indirect standardisation. While this is a valid approach to identifying outliers, sampling variability can limit meaningful

comparisons between providers, and the national distribution of performance can be inflated (hence why min/max ranges have not been included in this report).

Here we pilot the use of mixed-effects models, accounting for differences between providers (such as case volume) and partially separating true provider differences from sampling variability through shrinkage of noisy (small provider) estimates toward the mean. These models have several applications, including facilitating estimation of a more stable national distribution of provider performance.

## 2.2 Estimated distribution of national performance

We simulated the expected distribution of performance using mixed-effects models incorporating clustering by provider. Repeated 1,000 times, each simulation combined uncertainty in model parameters, between-provider variation and variability in provider case-mix and volume by repeatedly drawing different patient samples. This yielded a national distribution of providers' average predicted probabilities (Table 3).

For example, the IQR for the percentage of people with T1aN0M0 RCC who undergo nephron sparing treatment (PI6) is 62% to 79%. While similar to the IQR of indirectly standardised estimates (59%-81%), the advantages of using mixed-effects modelling are more likely to be evident when there are many small providers, substantial variation in provider case volume/mix, or when the outcome is rare (i.e., scenarios where indirect standardisation is more sensitive to sampling variability). Furthermore, while simulations provide a more robust way to capture both data and model-based uncertainty, the close alignment to the estimates without simulation suggests that the underlying performance distribution is relatively stable, likely reflecting the large dataset and modest between-provider variation.

**Table 3.** Comparing the national distribution of performance (median [interquartile range]) using different approaches.

| | **Indirect standardisation** | **Mixed-effects modelling** | |
|---|---|---|---|
| | | **without simulations*** | **with simulations** |
| PI1 | 85.4% [74.2%-91.2%]** | 84.6% [75.3%-90.8%] | 84.6% [75.3%-90.9%] |
| PI2 | 1.1% [0.0%-2.2%]** | 1.2% [0.8%-1.8%] | 1.2% [0.8%-1.8%] |
| PI3^ | 17.3% [9.5%-34.9%] | 17.3% [8.6%-31.8%] | 18.7% [9.4%-33.4%] |
| PI4 | 68.8% [56.6%-80.7%] | 70.9% [58.7%-80.7%] | 70.6% [58.4%-80.4%] |
| PI5^ | 79.3% [71.9%-83.3%] | 82.5% [76.4%-87.3%] | 78.7% [72.3%-84.1%] |
| PI6 | 71.3% [59.4%-81.3%] | 71.9% [62.7%-79.6%] | 71.1% [61.9%-78.9%] |
| PI7^ | 50.4% [43.6%-58.2%] | 48.9% [41.2%-56.6%] | 51.0% [43.7%-58.2%] |
| PI8^ | 1.4% [0.0%-2.5%] | 1.7% [1.4%-2.0%] | 1.9% [1.6%-2.3%] |

*Estimates derived by constructing a normal distribution around the national average performance ± between-provider standard deviation.
**PI1/PI2 are not risk-adjusted and therefore are not indirectly standardised.
^English and Welsh data analysed together (all others are England only).

## 2.3 Other applications

We plan to extend this modelling framework to support quality assessment by estimating the probability that a provider's performance is below the national mean, quality assurance by pairing lower- and higher-performing providers, and quality improvement by estimating the probability of achieving performance targets.