

Case Study: Evaluating Diabetes Care Outcomes Using the National Diabetes Audit (2021–22)

1. Introduction and Background

The National Diabetes Audit (NDA) represents one of the largest annual clinical audits globally and plays a vital role in assessing diabetes care across England and Wales. Aligned with the UK Government's transparency and open data commitments, the audit data for the 2020 to 2021 reporting period were made publicly available via data.gov.uk. This dataset provides a comprehensive overview of the quality of Type 1 and Type 2 diabetes care based on adherence to National Institute of Health and Care Excellence (NICE) Clinical Guidelines and Quality Standards.

Covering the timeframe from 01 Jan 2021 to 31 March 2022, the dataset contains extensive details at the national, regional, ICS, CCG/LHB, and provider levels. It includes metrics on demographics, nine care processes, and treatment targets for Type 1 and Type 2 diabetes cohort.

The Excel file titled *"National Diabetes Audit 2021-22 Data Release, England v2.xlsx"* served as the primary data source. Key care processes tracked include checks for HbA1c, blood pressure (BP), cholesterol, BMI, smoking status, urinary albumin, serum creatinine, foot surveillance, and eye screening. Treatment targets evaluated include $\text{HbA1c} \leq 58 \text{ mmol/mol}$, $\text{BP} \leq 140/80 \text{ mmHg}$, $\text{cholesterol} < 5 \text{ mmol/L}$, and statin use for both primary and secondary prevention.

This case study leverages the open data to evaluate systemic trends, identify regional inequalities, and generate insight into quality-of-care delivery for Type 1 and Type 2/Other diabetes cohorts.

2. Objectives

- To evaluate the effectiveness of diabetes care delivery by measuring performance against NICE benchmarks.
- To identify variations in care quality among different regions, ICSs, and providers.

- To utilise data visualisations and statistical analysis to highlight areas requiring policy or clinical intervention.
- To differentiate outcomes between Type 1 and Type 2 diabetes cohorts.

3. Methodology

A robust Exploratory Data Analysis (EDA) methodology was applied using Python and Power BI to extract and analyse trends from the NDA dataset.

3.1 Tools and Data Sources

- **Primary Data Source:** *National Diabetes Audit 2021-22 Data Release, England v2.xlsx*
- **Python Notebooks Used:**
 - *Exploratory Data Analysis_Type 1.ipynb*
 - *Exploratory Data Analysis_Type_2_CTT and others.ipynb*
- **Visual Tools:** Power BI dashboards to summarise performance at the organisational and regional levels.

3.2 Analytical Process

- Cleaned and filtered the dataset to extract rows relevant to Type 1 and Type 2 diabetes cohorts.
- Computed descriptive statistics for each care process and treatment target.
- Performed correlation analysis to explore interdependencies between clinical measures.
- Applied quality scoring by aggregating metrics into performance tiers: Low, Moderate, High.
- Generated comparative visualisations: boxplots, bar charts, and heatmaps.

3.3 Distinctive Metrics Used

- **Care Processes:**
 - Completion of the following nine checks: HbA1c, BP, cholesterol, BMI, smoking status, urinary albumin, serum creatinine, foot surveillance, eye screening.
- **Treatment Targets:**

- $\text{HbA1c} \leq 58 \text{ mmol/mol}$
- $\text{BP} \leq 140/80 \text{ mmHg}$
- $\text{Cholesterol} < 5 \text{ mmol/L}$
- Statin use for primary prevention (no prior CVD)
- Statin use for secondary prevention (with prior CVD)

Each Python notebook focused on a specific subset:

- **Type 1 analysis** focused on the underperformance in achieving all nine care processes and all three treatment targets.
- **Type 2 analysis** additionally evaluated "Combined Prevention" and "Secondary Prevention" adherence, allowing for enriched performance comparison.

4. Conclusions

The NDA dataset reveals clear and persistent disparities in diabetes care between Type 1 and Type 2 cohorts. While a moderate level of care process delivery was observed across most organisations, treatment target attainment was significantly lower for Type 1 patients, pointing to a gap in outcome-focused care. This trend raises concerns about the overall effectiveness of current interventions for Type 1 diabetes.

Key insights include:

- Fewer than 50% of Type 1 patients received all nine care processes in most organisations, indicating a systemic shortfall in holistic monitoring.
- Achievement of all three treatment targets ($\text{HbA1c} \leq 58 \text{ mmol/mol}$, $\text{BP} \leq 140/80 \text{ mmHg}$, $\text{cholesterol} < 5 \text{ mmol/L}$) for Type 1 patients averaged around 32%, with some regions performing below 25%, suggesting a need for aggressive intervention.
- Type 2 services, by contrast, consistently exhibited better performance. In particular, the average combined prevention rate for statin use exceeded 76%, and secondary prevention in patients with CVD reached nearly 87%, reflecting stronger protocol adherence and patient management.
- Correlation analyses demonstrated strong interdependence between care processes and treatment targets, especially between HbA1c and cholesterol or BP control, reinforcing the importance of integrated care approaches. [Figure 1] [Figure 2]

- Regional disparities were stark. Organisations in regions like the South West and East of England fared better, while underperforming ICBs revealed gaps that may reflect resource distribution, patient demographics, or clinical practice variation.

Overall, the findings highlight the urgent need for targeted interventions, enhanced real-time performance monitoring, and reallocation of resources to bridge these care quality gaps particularly for the underserved Type 1 cohort.

5. Recommendations

- **Targeted Resource Allocation:** Prioritise support to low-performing regions and trusts, especially those where fewer than 25% of patients achieve all three treatment targets. [Figure 3] Funding should be aligned with performance metrics and population health needs. For Type 2 regions with inconsistent care process adherence, targeted reinvestment can support preventive interventions.
- **Quality Improvement Initiatives:** Establish collaborative programs to address identified care gaps in both Type 1 and Type 2 services. For Type 1, initiatives should focus on treatment target support; for Type 2, focus can include maintaining and replicating high-performing strategies in other regions.
- **Interdisciplinary and Patient-Centred Teams:** Deploy integrated care teams to holistically manage diabetes. For Type 2 patients, include comorbidity and lifestyle management; for Type 1, ensure tailored mental health, insulin adherence, and dietary support.
- **Benchmarking and Peer Learning:** Promote cross-learning between well-performing and underperforming ICBs and providers. Identify Type 2 success stories in achieving Combined and Secondary Prevention and apply those learnings to other localities.
- **Patient Engagement and Education:** Tailor educational materials and support programs for both cohorts. For Type 2, continue focusing on prevention and management; for Type 1, focus on goal-setting and treatment confidence through structured self-management education programs. Develop personalised care plans and self-management resources for Type 1 patients, especially those struggling to meet treatment goals. Improved patient literacy around disease management can lead to better long-term outcomes.

6. Glossary of Abbreviations

- **NDA:** National Diabetes Audit
- **NICE:** National Institute for Health and Care Excellence
- **CCG:** Clinical Commissioning Group
- **LHB:** Local Health Board
- **ICS:** Integrated Care System
- **HbA1c:** Glycated Haemoglobin (indicator of average blood glucose levels)
- **BP:** Blood Pressure
- **BMI:** Body Mass Index
- **CVD:** Cardiovascular Disease
- **EDA:** Exploratory Data Analysis
- **CTT:** Combined Treatment Targets
- **ICB:** Integrated Care Board

Figures:

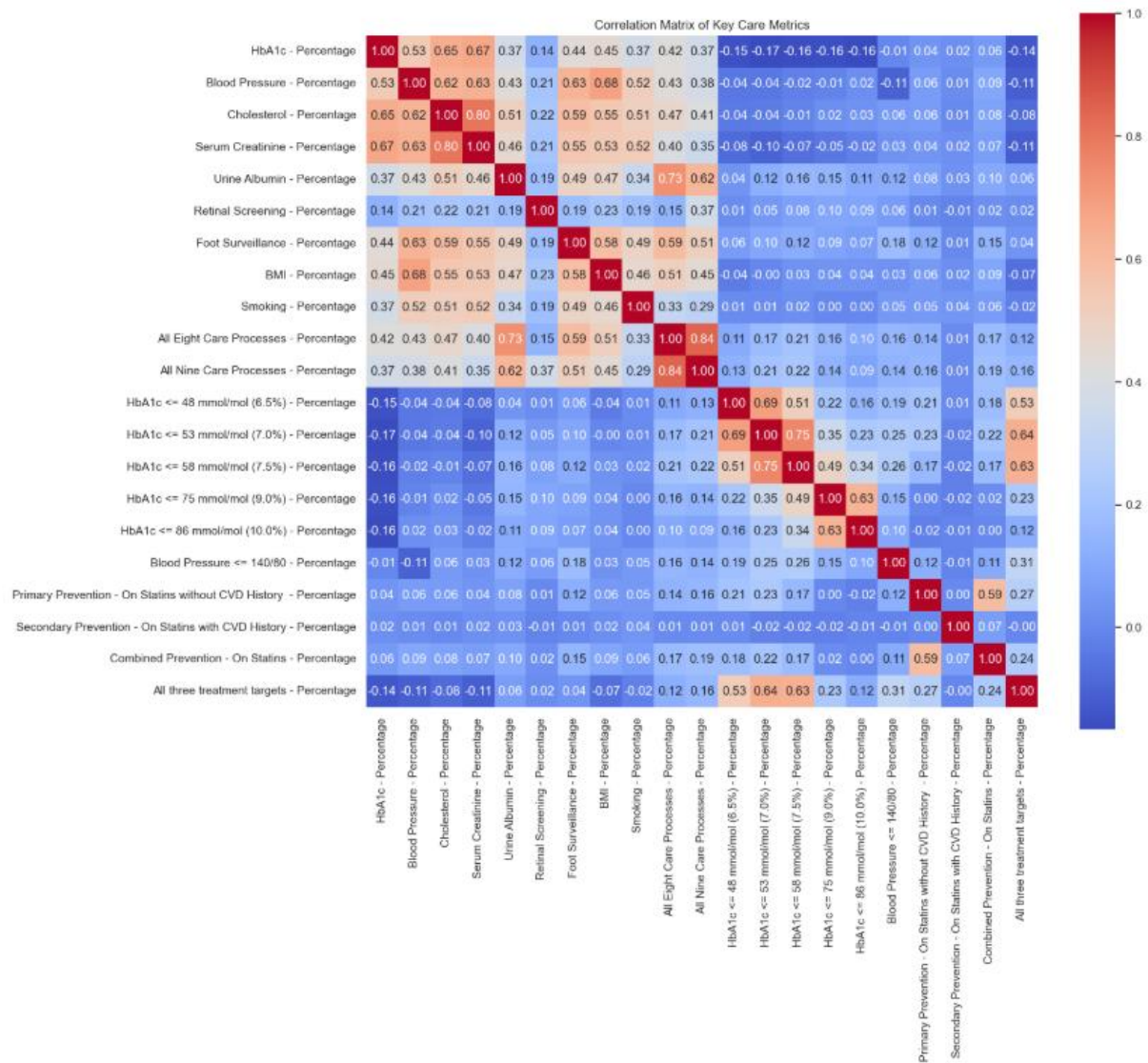


Figure 1: Correlation matrix of Key Care Metrics Type 1

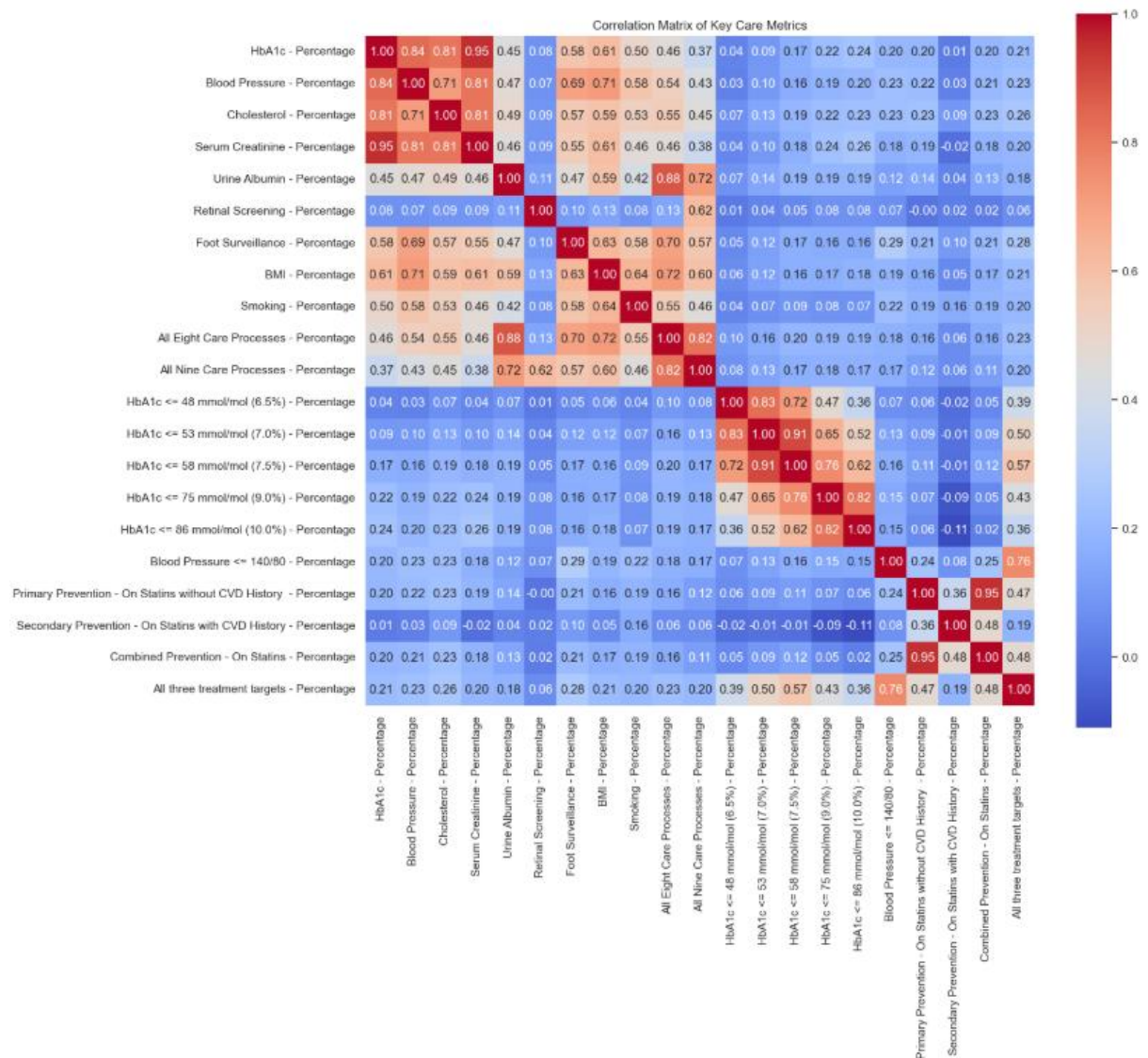


Figure 2: Correlation of Key Care Metrics Type 2

ICB	
England	22.435230
QE1	30.022179
QF7	28.188739
QGH	25.934649
QH8	34.282684
QHG	25.892010
QHL	39.311707
QHM	26.001510
QJ2	25.167901
QJG	26.777263
QJK	25.204834
QJM	25.115776
QK1	32.974553
QKK	33.115806
QKS	28.515710
QM7	28.033221
QMF	49.460641
QMJ	42.978890
QMM	20.542226
QNC	31.955221
QNQ	29.369121
QNX	28.120832
QOC	32.224894
QOP	34.657974
QOQ	26.266167
QOX	25.741331
QPM	25.972905
QR1	27.669138
QRL	24.928030
QRV	45.087904
QSL	24.701373
QT1	23.046231
QT6	24.256401
QU9	32.023935
QUA	41.906236
QUE	27.004671
QUY	24.044610
QVV	25.023721
QWE	38.814219
QWO	29.979325
QWU	37.447288
QXU	29.023277
QYG	33.268059

Name: All three treatment targets - Percentage, dtype: float64

Figure 3: <25 % Regional level performance