



National Audit Office

Healthcare across the UK: A comparison of the NHS in England, Scotland, Wales and Northern Ireland

Detailed methodology

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Detailed methodology

1 This document describes the methods we used for our report on *Healthcare across the UK: A comparison of the NHS in England, Scotland, Wales and Northern Ireland*. It adds further details to the description of the study methods included in the main report at Appendix One. It also sets out detailed sources for the data used in the report.

2 The work for the report was carried out in collaboration with the Wales Audit Office and the Northern Ireland Audit Office, and we are grateful for the contribution they made. We are also grateful for the advice and assistance of Audit Scotland during the course of our work.

3 The fieldwork was conducted between September 2011 and May 2012.

Preliminary work

Consultation with experts

4 At the start of our work, we met with a number of organisations with an oversight of UK healthcare to determine the extent to which similar comparative exercises had been undertaken. The organisations included the Royal Colleges of Physicians and Surgeons, the Nuffield Trust, and the Health Foundation.

Literature review

5 We searched electronic libraries for previous publications comparing health services across the nations of the UK. Relevant papers were extracted and details of cross-nation comparisons were recorded. We reviewed these papers to develop our knowledge of the subject area and to inform our study methods. Key authors included the Office for National Statistics, the Health Foundation, the Nuffield Trust and The King's Fund.

Main study methods

Analysis of secondary data

6 To identify variations between the four nations, we collated existing data on:

- health outcomes;
- health spending and priorities; and
- the delivery and performance of health services, including costs, resources, activity and quality.

7 For each measure we collected, where possible, data for three points in time, usually 2000, 2005 and 2010 (although the actual years depended on the availability of data). Where possible, we also collected data for the nine English regions to provide additional comparators for Scotland, Wales and Northern Ireland in terms of similar population size and characteristics.

8 In the first instance, we collated published data from the Office for National Statistics and HM Treasury. Further data items were taken from publications by the Commonwealth Fund; The Health and Social Care Information Centre (England); Information Services Division Scotland; Statistics for Wales; and the Department of Health, Social Services and Public Safety (Northern Ireland). Where data items were felt to be important but were not published in a consolidated form, specific data requests were sent to the respective departments of health of the four nations. Full details of the sources used for the Figures, and some paragraphs/footnotes, in the main report are included at the end of this paper.

9 We found that much of the desired data were neither comparable across the nations nor consistently collected over time. Key data gaps, where we were unable to collect comprehensive comparable information, included on:

- primary and community care activity, e.g. number of consultations;
- aspects of the quality of care, e.g. patient satisfaction and hospital readmission rates; and
- breakdown of costs by care setting (e.g. spending on hospitals, primary care) or type (e.g. spending on treatment compared to public health campaigns).

In-depth analysis of four specific areas of healthcare

10 To gain a greater understanding of the impact of differences in delivering healthcare, we looked in further detail at four specific areas of healthcare. Limiting analysis to distinct specialties can reduce the bias in results due to different structures (e.g. in integration of health and social care). As many management decisions are taken at these more specific levels, we conducted further analysis at this more disaggregated level to understand better the drivers of differences in performance.

11 The four specific areas of healthcare were chosen on the basis that they:

- have relatively distinct inputs and outputs, so attribution of effects on performance is more transparent; and
- cover different aspects of healthcare.

12 Two of the areas we examined are primarily delivered within primary and community care settings (breast cancer screening and vaccination/immunisation programmes) and the other two are delivered within hospital settings (acute obstetric care and hip replacements).

Primary/community care specific areas

13 We analysed delivery structures and performance across breast cancer screening and vaccination and immunisation programmes. Information on how services were delivered was collected from the four departments of health through a short proforma. Further data, including on relative performance, were collected through desk-based research.

Hospital care specific areas

14 We analysed patient-level data for two specific areas of hospital care (hip replacements and obstetrics) to create a hospital-level measure of efficiency based on length of stay and adjusted for patient case-mix. The analysis was based on methods used in the *EuroDRG* project to evaluate hospital performance across European nations, and presented in research by York University.¹

15 Data were collected for admissions from 1 April 2009 to 31 March 2010. For the first stage of this method, we used regression analysis to assess how much variation in a patient's length of stay could be explained by differences in patient characteristics, case-mix or quality, including:

- Age
- Gender
- Socio-economic status
- Comorbidities (Charlson index, hypertension, obesity)
- Type of procedure (Healthcare Resource Group)
- Adverse events, such as presence of a healthcare associated infection.

16 We interpreted the remaining unexplained variation as due to hospital-level factors, providing a measure of hospital efficiency (recognising that there were some unmeasured patient factors we were unable to control for). In the second stage of this analysis, we tested for associations between performance, in terms of efficiency, and organisational factors, such as hospital type, size and staffing levels.

17 We used a consistent methodology for calculating lengths of stay in the four nations. As a result, the figures quoted in the report may differ from previous publications due to variations in how lengths of stay are usually calculated in each nation.

¹ M Laudicella, K Rosen Olsen, A Street, What Explains Variation in the Costs of Treating Patients in English Obstetrics Specialties? *CHE Research Paper 49*. 2009.

Quality and Outcomes Framework data analysis

18 The analysis repeated the method presented in a previous study by McLean et al.² A more detailed description of this work is available at: www.nao.org.uk/uk-healthcare-2012. We used a sample of indicators, based on data from the Quality and Outcomes Framework (QOF), categorised into: simple process, complex process, intermediate outcome, and treatment.

19 We collated data for the four nations for 1 April 2009 to 31 March 2010 and 1 April 2010 to 31 March 2011. We analysed data for 28 indicators for four disease areas – coronary heart disease, stroke, hypertension and diabetes – to calculate:

- payment quality – the number of patients for whom the procedure had been conducted divided by the number of patients on the practice list with that particular condition (less those ‘exception reported’ by the practice);³ and
- population achievement - the number of patients for whom the procedure had been conducted divided by the number on the practice list with that particular condition.

Analysis of efficiency at local area level

20 We commissioned Deloitte to carry out exploratory work to investigate differences in efficiency at local area level. The methodology used was developed from a study published by the Health Foundation.⁴

21 Existing data on health needs, quality and expenditure were collated for 177 UK local health areas for 2007-08 to 2009-10.⁵ The work, which was conducted in three stages, was limited by a lack of comparable data, in particular on the breakdown of healthcare spending in each area and on aspects of the quality of care. For instance, the analysis suggested that the spending data for Northern Ireland were not consistent with that from the other nations.

22 The first stage of the analysis involved estimating the relative health needs of local areas using measures associated with need that are published in a consistent way across the four nations. Using regression analysis, the indicators were used to approximate the Resource Allocation Formula in England (the formula for England was used as it had more data points than the other three nations and, therefore, a better approximation could be made). This approximation was then used to estimate health needs at local and national levels across the UK.

² G McLean, B Guthrie, M Sutton Differences in the quality of primary medical care for CVD and diabetes across the NHS: evidence from the quality and outcomes framework. *BMC Health Services Research* 7:74. 2007.

³ The number on the practice list may be reduced by practice exception/exclusion reporting on the basis of patient non-attendance or patient dissent, or if a patient is already on maximum treatment.

⁴ S Martin and P C Smith, *A comparison of English primary care trusts*. London: Health Foundation. 2009. We extended this methodology to include data for three years, and to cover all four nations.

⁵ In April 2009, the four local health areas in Northern Ireland merged into a single health and social care board.

23 The measures of need used for this analysis were the percentage of the population:

- over 65 years of age;
- over 65 years of age who are 75 or more years of age;
- over 60 on disability living allowance;
- of working age with no qualifications;
- over 16 years of age on incapacity benefits;
- over 60 years of age on pension credits; and
- of working age claiming unemployment benefits.

24 The second stage of the analysis involved using Stochastic Frontier Analysis to calculate an 'efficiency' score for each local area by comparing expected spending (based on the needs calculation explained above) to actual spending, while making adjustments for variations in some aspects of quality (including mortality rates, Quality and Outcomes Framework indicators, and hospital lengths of stay).

25 The third stage of the analysis involved comparing the efficiency scores to organisational factors (such as: hospital staff mix; GP numbers; bed availability; education QOF score and management QOF scores) to seek to identify possible drivers of efficiency.

Quality assurance

26 We drew on advice from the National Audit Office's in-house specialist methods and statistics teams during the development of our methodology and during the fieldwork and data analysis.

27 We contracted academic experts to assure the quality of certain analyses. In particular, we commissioned a review of the methods and presentation of results for the work to analyse efficiency at local area level (paragraphs 20 to 24 above), and we used experts to provide methodological advice and validate the findings of the in-depth analysis of specific areas of hospital care (paragraphs 14 to 17 above).

28 Our provisional findings were reviewed by the Office for National Statistics. Comments on the provisional findings were also provided by data experts in the four nations regarding the accuracy and appropriateness of presentation of the results.

Detailed sources

Figure/paragraph	Source
Figure 2	Office for National Statistics, <i>Life expectancy at birth and at age 65 by local areas in the United Kingdom, 2004–06 to 2008–2010</i> , 2011. Office for National Statistics, <i>Health Expectancies at birth and at age 65 in the United Kingdom, 2007–2009</i> , 2011.
Para 1.4	Footnote 1: Office for National Statistics, <i>United Kingdom Health Statistics 2010</i> , Table 7.1.
Figure 3	Office for National Statistics, <i>Mortality Statistics: Deaths registered by area of usual residence, 2010</i> registrations, Table 1b. Office for National Statistics, <i>United Kingdom Health Statistics 2010</i> , Table 2.6 (2005 figures). Office for National Statistics, <i>Key Population and Vital Statistics</i> , No. 27, 2000 Edition, Table 4.1. Statistics for Wales, <i>Births and Infant Mortality Statistics Wales</i> , 2010, Table 8 (Wales 2000).
Figure 4	Actual spending HM Treasury, <i>Public Expenditure Statistical Analyses, 2006</i> , Table 7.11; and <i>October 2011</i> , Table A15. Planned spending. HM Treasury, <i>Spending Review 2010</i> , Table A.9. The Scottish Government, <i>Scottish spending review 2011 and draft budget 2012–13</i> , Table 6.02. Wales Audit Office analysis of Welsh Government data (unpublished), 2012. Northern Ireland Executive, Department of Health, Social Services and Public Safety – Current Expenditure, <i>Northern Ireland Executive Budget 2011–15</i> , 2011. GDP deflator HM Treasury, <i>Latest GDP deflators</i> , 2012.
Figure 5	HM Treasury, <i>National Statistics release: October 2011</i> , Chapter B.
Figure 6	Office for National Statistics, <i>Population estimates for UK, England and Wales, Scotland and Northern Ireland, mid-2010</i> , 2011. Office for National Statistics, <i>Regional household income</i> , March 2011. Office for National Statistics, <i>UK health statistics 2010</i> , Table 1.4 (disability), Table 4.1 (smoking), Figure 4.2 (drinking), Table 4.5 (overweight and obese). Department of Health, Social Services and Public Safety (Northern Ireland), <i>Health Survey Northern Ireland: First Results from the 2010–11 Survey</i> , 2011 (overweight and obese). Data provided by Department for Work and Pensions (disability) (unpublished).

Figure/paragraph	Source
Figure 7	<p>Deloitte analysis for National Audit Office (unpublished).</p> <p>Additional note: In April 2009 (within the time period of the data analysed), the four local health areas in Northern Ireland merged into a single health and social care board.</p>
Figure 8	HM Treasury, <i>National Statistics release: October 2011</i> , Chapter A.
Paras 1.19-1.20	National Audit Office, <i>NHS (England) Summarised Accounts 2010-2011</i> , HC 1297, October 2011, Page B27 Table 2.3.
Figure 9	<p>Office for National Statistics, <i>Population estimates for UK, England and Wales, Scotland and Northern Ireland, mid-2010</i>, 2011.</p> <p>Office for National Statistics, <i>Primary Care Organisation Population Estimates (experimental)</i>, mid-2010, 2011.</p> <p>General Register Office for Scotland, <i>mid-2010 population estimates Scotland</i>, 2011.</p> <p>Public Health Wales, <i>Population Projections</i>, available at http://www.wales.nhs.uk/sitesplus/888/page/44764, accessed 20 May 2012.</p>
Figure 10	<p>The Health and Social Care Information Centre, <i>GP earnings and expenses 2009-10</i>, 2011, p.22.</p> <p>The Health and Social Care Information Centre, <i>Dental earnings and expenses, England and Wales, 2009-10</i>, Table 16; <i>Dental earnings and expenses, Scotland, Experimental Statistics, 2009-10</i>, p.15; <i>Dental earnings and expenses, Northern Ireland, 2009-10</i>, p.16, 2011.</p>
Para 2.13	<p>Footnote 8</p> <p>The Health and Social Care Information Centre, <i>NHS Staff 2000–2010 (General Practice)</i>, 2011, Annex A.</p> <p>Additional notes: Percentage change figures may differ due to rounding; data quoted in the report use more precise population figures.</p>
Para 2.14	<p>Footnote 9</p> <p>Office for National Statistics, <i>United Kingdom Health Statistics 2010</i>, Table 8.3, (England and Wales), 2011.</p> <p>Information Services Division Scotland, <i>NHS Scotland Workforce Statistics</i>, Table D5, 2012.</p> <p>Northern Ireland Neighbourhood Information Service, <i>Dentists and Surgeries 2010</i>, available at www.ninis.nisra.gov.uk/mapxtreme/DataCatalogue.asp, accessed 9 April 2012.</p>
Figure 11	<p>Office for National Statistics, <i>United Kingdom Health Statistics 2010</i>, 2010, Table 8.3.</p> <p>The Health and Social Care Information Centre, <i>NHS Staff 1999–2009 (General Practice), Detailed Results</i>, 2010. (Regional figures may differ from those in source document as data quoted in the report uses updated population figures).</p>

Figure/paragraph	Source
Figure 12	Office for National Statistics, <i>United Kingdom Health Statistics 2010</i> , Table 8.2. The Health and Social Care Information Centre, <i>NHS Staff 1999–2009 (Medical and Dental)</i> , 2010 Detailed Results, Table 2. Office for National Statistics, <i>Population Estimates for UK, England and Wales, Scotland and Northern Ireland – mid 2009</i> , 2010.
Figure 13	Office for National Statistics, <i>United Kingdom Health Statistics 2010</i> , Table 8.2. Office for National Statistics, <i>Population Estimates for UK, England and Wales, Scotland and Northern Ireland – mid 2009</i> , 2010.
Para 2.19	Footnote 10 HM Treasury, <i>Public Expenditure Statistical Analysis 2007</i> , Tables 9.2, 9.11 and 9.5b. HM Treasury, <i>Public Expenditure Statistical Analysis 2011</i> , Table A.1, A11, and A15. Additional notes: Average capital expenditure calculated using the aggregate capital spend per head (in cash terms) from 2003-04 to 2010-11 for each nation.
Figure 14	Office for National Statistics, <i>UK Health Statistics 2010</i> , Table 6.8.
Figure 15	Aston Business School, <i>Further Analysis of responses from UK GPs to the Commonwealth Fund International Health Perspectives 2009: A Survey of Physicians in Eleven Countries</i> , February 2010. Appendix 2. (Report provided by the Health Foundation).
Figure 16	Department of Health (England), <i>NHS reference costs 2008-09</i> , 2010. The Health and Social Care Information Centre, <i>NHS Staff 2000–2010 Overview</i> , <i>NHS Staff 2000–2010 Overview</i> , 2011. Information Services Division Scotland, <i>NHS Scotland Workforce Statistics, NHS Region & Board</i> , WTE, 30 September 2008, 2012. Statistics for Wales, <i>Medical and dental staff</i> , pre 2009, available at http://www.statswales.wales.gov.uk/ReportFolders/reportFolders.aspx accessed 12 March 2012. Department of Health, Social Services and Public Safety (Northern Ireland), <i>Key Facts Workforce Bulletin</i> , June 2008. Office for National Statistics, <i>United Kingdom Health Statistics 2010</i> , Tables 6.1 and 6.2.
Figure 17	Office for National Statistics, <i>United Kingdom Health Statistics 2010</i> , Table 6.1. Office for National Statistics, <i>United Kingdom Health Statistics 2008</i> , Table 6.1. Office for National Statistics, <i>United Kingdom Health Statistics 2000</i> , Table 5.1.
Figure 18	Analysis of data provided by The Health and Social Care Information Centre; Information Services Division Scotland; Statistics for Wales; Department of Health, Social Services and Public Safety (Northern Ireland).
Figure 19	Office for National Statistics, <i>United Kingdom Health Statistics 2010</i> , Table 6.1.

Figure/paragraph	Source
Para 2.35	<p>Footnote 16</p> <p>Department of Health (England), <i>Average daily number of available and occupied beds by sector, England, 2009-10</i>, 2011.</p> <p>Information Services Division Scotland, <i>Annual Statistics showing Available Beds by Specialty & NHS Board of Treatment (all specialties)</i>, 2011.</p> <p>Statistics for Wales <i>NHS beds and their use: summary data, all specialties</i>, available at http://www.statswales.wales.gov.uk/ReportFolders/reportFolders.aspx accessed 12 March 2012.</p> <p>Department of Health, Social Services and Public Safety (Northern Ireland), <i>Hospital Statistics: Inpatient and Daycase Activity Statistics 2009-10</i>, 2011, Table 1.</p>
Para 2.36	<p>Footnote 17</p> <p>Department of Health (England) <i>Average daily number of available and occupied beds by sector, strategic health authorities in England, 2008-09</i>, 2010.</p>
Figure 20	<p>Office for National Statistics, <i>United Kingdom Health Statistics 2000</i>, Table 8.1.</p> <p>Office for National Statistics, <i>United Kingdom Health Statistics 2008</i>, Table 6.1.</p> <p>Office for National Statistics, <i>United Kingdom Health Statistics 2010</i>, Table 8.1.</p>
Para 2.43	<p>Footnote 22</p> <p>The Health and Social Care Information Centre, <i>HESonline, headline figures 2000-01 and 2009-10</i>.</p> <p>Information Services Division Scotland, <i>Summary Statistics, Emergency Admissions 2001-02 to 2010-11 and Summary Statistics, Emergency Admissions (archive) 2000-01 to 2009-10</i>.</p> <p>NHS Wales Informatics Service, <i>PEDW Statistics, Headlines, 2000-01 and 2009-10</i>, Table 1.</p> <p>Department of Health, Social Services and Public Safety (Northern Ireland) <i>Hospital Statistics: Inpatient and Daycase Activity Statistics, 2005-06 and 2009-10</i>.</p>
Figure 21	<p>The Health and Social Care Information Centre, <i>HESonline, headline figures 2000-01, Table 1 and 2009-10, Table 3</i>.</p> <p>Information Services Division Scotland, <i>Multiple and All Emergency Admissions, Emergency Admissions</i>, NHS Board 2001-02 to 2010-11 and <i>Multiple and All Emergency Admissions (archive), Emergency Admissions</i>, NHS Board 2000-01 to 2009-10.</p> <p>NHS Wales Informatics Service, <i>PEDW Statistics, Headlines, 2000-01 and 2009-10</i>, Table 1.</p> <p>Department of Health, Social Services and Public Safety (Northern Ireland) <i>Hospital Statistics: Inpatient and Daycase Activity Statistics, 2005-06 and 2009-10</i>.</p>
Figure 22	<p>Office for National Statistics, <i>United Kingdom Health Statistics 2010</i>, Table 6.6.</p>

Figure/paragraph	Source
Figure 23	<p data-bbox="676 443 922 465">Accident and Emergency</p> <p data-bbox="676 488 1410 539">Department of Health, Archive - <i>Total Time Spent in Accident and Emergency</i>, 2010-11, Q1-4.</p> <p data-bbox="676 562 1474 640">Information Services Division Scotland, <i>NHS Scotland – Emergency Department Activity</i>, Table 1 – Attendances and performance against 4-hour standard, April 2010 to March 2011.</p> <p data-bbox="676 663 1422 714">Statistics for Wales, <i>Time spent in NHS Wales Accident and Emergency Departments: performance against the 4 hour target</i>, April 2010 to March 2011.</p> <p data-bbox="676 736 1474 788">Department of Health, Social Services and Public Safety (Northern Ireland), <i>Hospital Statistics: Emergency Care (2010-11)</i>, 2011.</p> <p data-bbox="676 810 874 833">Elective procedures</p> <p data-bbox="676 855 1401 907">Department of Health, <i>NHS Referral to Treatment Waiting Times Statistics for England, 2011 Annual Report</i>, Table 1.</p> <p data-bbox="676 929 1353 981">Scottish Government, A10: <i>18 weeks RTT, Calendar of updates for NHS HEAT targets</i>.</p> <p data-bbox="676 1003 1422 1055">Statistics for Wales, <i>NHS Wales Referral to Treatment Times – December 2011</i>, February 2012.</p> <p data-bbox="676 1077 1442 1155">Department of Health, Social Services and Public Safety (Northern Ireland), <i>Northern Ireland waiting time statistics: Outpatient/Inpatient waiting times quarter ending December 2011</i>.</p>
Figure 24	<p data-bbox="676 1187 804 1209">All infections</p> <p data-bbox="676 1232 1458 1283">Health Protection Agency, <i>English National Point Prevalence Survey on Healthcare-associated Infections and Antimicrobial Use, 2011: preliminary data</i>.</p> <p data-bbox="676 1305 1442 1357">Hospital Infection Society, <i>The Third Prevalence Survey of Healthcare Associated Infections in Acute Hospitals in England</i>, 2006.</p> <p data-bbox="676 1379 1474 1431">Health Protection Scotland, <i>Scottish National Point Prevalence Survey of Healthcare Associated Infection and Antimicrobial Prescribing, 2011</i>.</p> <p data-bbox="676 1453 1474 1476">Health Protection Scotland, <i>NHS Scotland National HAI Prevalence Survey</i>, July 2007.</p> <p data-bbox="676 1498 1163 1520">Public Health Wales, <i>Point Prevalence Survey, 2011</i>.</p> <p data-bbox="676 1543 1426 1594">Welsh Government, <i>Summary of Preliminary Results of Third Prevalence Survey of Healthcare-associated Infections in Acute Hospitals, 2006</i>.</p>

continued overleaf

Figure/paragraph	Source
Figure 24 continued	MRSA
	Health Protection Agency, <i>MRSA bacteraemia tables – annual</i> , Table 2a.
	Health Protection Scotland, <i>The Staphylococcus aureus bacteraemias Quarterly Report of Cumulative Data from all NHS Boards in Scotland, Staphylococcus aureus bacteraemias Report – April 2012</i> , Online Appendix 2.
	Public Health Wales, <i>All Wales Infection Surveillance Reports</i> , April 2007 to March 2008 and April 2009 – March 2010.
	HSC Public Health Agency, <i>S aureus bacteraemia surveillance quarterly report</i> , July, Appendix 3, Table 3.
	Clostridium difficile
	Office for National Statistics, <i>Deaths involving Clostridium difficile</i> , 1999 and 2001 to 2010, Number of deaths.
	General Register Office for Scotland, <i>Clostridium Difficile (C.diff) deaths</i> , Table 1.
	Northern Ireland Statistics and Research Agency, <i>Healthcare-Associated Infection, Deaths Registered with Clostridium Difficile Mentioned on the Death Certificate</i> , 2001–2010.
