

Health Equity Indicators for the English NHS: a longitudinal whole-population study at the small-area level

Richard Cookson,^{1*} Miqdad Asaria,¹ Shehzad Ali,^{1,2}
Brian Ferguson,³ Robert Fleetcroft,⁴ Maria Goddard,¹
Peter Goldblatt,⁵ Mauro Laudicella⁶
and Rosalind Raine⁷

¹Centre for Health Economics, University of York, York, UK

²Department of Health Sciences, University of York, York, UK

³Knowledge and Intelligence, Public Health England, York, UK

⁴Norwich Medical School, University of East Anglia, Norwich, UK

⁵Institute of Health Equity, University College London, London, UK

⁶School of Health Sciences, City University, London, UK

⁷Department of Applied Health Research, University College London, London, UK

*Corresponding author

Declared competing interests of authors: Richard Cookson and Peter Goldblatt report grants for related work received during this study and that they are members of the NHS Outcomes Framework Technical Advisory Group, and Brian Ferguson reports that he is Chief Economist, Public Health England.

Published September 2016

DOI: 10.3310/hsdr04260

Scientific summary

Health Equity Indicators for the English NHS

Health Services and Delivery Research 2016; Vol. 4: No. 26

DOI: 10.3310/hsdr04260

NIHR Journals Library www.journalslibrary.nihr.ac.uk

Scientific summary

Background

There are inequalities in health-care access and outcomes in the English NHS, which raise concerns about both quality of care and justice. Between 2004 and 2011, the NHS made substantial investments to strengthen primary care and reduce health inequalities. This included the introduction of a substantial primary care pay-for-performance programme, investment in opening new family medical practices in deprived communities, and a programme of guidance and support for local health-care managers to help them meet national targets for reducing health inequality. In 2012, the NHS was given a statutory duty to consider reducing inequalities of health-care access and outcomes, which applies both nationally and at the local level of Clinical Commissioning Groups (CCGs). This report developed methods for systematic monitoring of these inequalities and, in particular, for detailed local monitoring of health-care inequalities within CCG areas.

Objectives

- To develop indicators of socioeconomic inequality in health-care access and outcomes at different stages of the patient pathway.
- To develop methods for monitoring local NHS equity performance in tackling socioeconomic health-care inequalities.
- To track the evolution of socioeconomic health-care inequalities in the 2000s.
- To develop 'equity dashboards' for communicating equity indicator findings to decision-makers in a clear and concise format.

Methods

Indicator selection

The indicator selection process included (1) reviewing existing indicators used by the NHS to monitor health-care quality, (2) consulting health indicator experts about technical feasibility, (3) consulting a diverse range of NHS and public health experts about policy relevance through one-to-one conversations and an online expert survey and (4) consulting members of the public through a full-day citizens' panel meeting and an online public survey.

Our main indicator selection criteria were (1) face validity to NHS and public health stakeholders, as well as the general public; (2) sensitivity to health-care intervention; (3) likely impact on population health; (4) data availability at the small-area level from the early 2000s; and (5) statistical confidence for monitoring within local areas, as well as nationally. Our criteria for selecting an appropriate mix of indicators were (1) coverage of inequality in both access and outcomes; (2) coverage of inequality at all main stages of the patient pathway; (3) coverage of inequality in multiple domains of the NHS Outcomes Framework; (4) synergy between indicators; and (5) relevance to potential future quasi-experimental evaluations of the impacts of interventions on health-care inequalities. Our criteria for selecting the two disease domains were (1) substantial disease burden and cost to the NHS, (2) data availability for national monitoring and (3) synergy between the two domains.

Indicator definitions

We selected eight general indicators for production at both the national and local level:

1. primary care supply: patients per full-time-equivalent general practitioner (GP), need-adjusted for age, sex and ill health
2. primary care quality: composite score based on Quality and Outcomes Framework (QOF) population achievement on clinical indicators weighted by importance in terms of estimated lives saved
3. hospital waiting time: waiting time from outpatient decision to admit to inpatient admission, risk adjusted for specialty
4. preventable hospitalisation: proportion of people with emergency hospitalisation for chronic ambulatory care-sensitive conditions (NHS Outcomes Framework list), risk adjusted for age and sex
5. repeat hospitalisation: proportion of people discharged from hospital who have a repeat emergency hospitalisation within the same year, risk adjusted for age and sex
6. dying in hospital: proportion of deaths that occur in hospital
7. amenable mortality: mortality from causes considered sensitive to health care (NHS Outcomes Framework list), risk adjusted for age and sex
8. overall mortality: all-age all-cause mortality, risk adjusted for age and sex.

To illustrate the scope for additional disease-specific monitoring at the national level, we also produced versions of indicators 2, 4 and 7 for coronary heart disease and diabetes.

Data sources

We used four main health data sets: practice-level data on GP supply from the annual NHS General and Personal Medical Services workforce census (indicator 1), practice-level data on primary care quality from the QOF (indicator 2), inpatient hospital data from Hospital Episode Statistics (indicators 3–6) and mortality data from the Office for National Statistics (ONS) (indicators 6–8). We produced indicators from 2001/2 to 2011/12 except for indicators 1 and 2, which only started in 2004/5. The basic small-area geographical unit provided in these data sets was the 2001 'lower-layer super output area' (LSOA). The 2001 census defined 32,482 of these small-area neighbourhoods to cover approximately 1500 people each (minimum 1000 and maximum 3000). Indicators were produced using 2001 LSOAs then mapped to the updated LSOA geography from the 2011 census, resulting in 32,844 neighbourhoods that could be aggregated to the CCG level. We measured deprivation using a time-fixed deprivation score to ensure that time trends reflect real changes in health care rather than changes in deprivation measurement methodology or the composition of neighbourhoods, in particular quantile groups. We used the 2010 Index of Multiple Deprivation overall deprivation rank, which combines data on multiple domains of deprivation mostly relating to the year 2007 in the middle of our analysis period. For indicators 1 and 2, we used the NHS Attribution Data Set of GP-registered populations to map the number of GPs and quality scores provided at the practice to small-area level. For all indicators requiring a general population denominator, including indicator 1, we used time-varying mid-year population estimates from the ONS at the 2001 LSOA level rather than GP-registered populations. The ONS figures estimate the total resident population including homeless people and people living in institutions such as prisons, barracks and nursing homes. For age breakdowns and risk adjustment, we used seven age groups (0–4 years, 5–15 years, 16–24 years, 25–39 years, 40–59 years, 60–74 years and ≥ 75 years) to minimise the number of subgroups while distinguishing key life stages of policy interest. We cleaned the assembled LSOA-level data using national year-specific trimming of outliers six standard deviations from the mean. This excluded $< 0.15\%$ of LSOAs in any year for any indicator and did not disproportionately exclude deprived neighbourhoods.

Data analysis

For national monitoring, we computed the slope index of inequality (SII), which measures the gap between the most and least deprived neighbourhoods in England, allowing for the gradient in between. We also computed the relative index of inequality (RII): the SII divided by the England mean. We computed adjusted indicators for each LSOA in England, along with fractional deprivation rank 'ridit score' from 0 (least deprived) to 1 (most deprived). We used the Carr-Hill workload adjustment to need-adjust indicator 1,

and indirect standardisation to risk-adjust indicators 3, 4, 5, 7 and 8. We used LSOA-level ordinary least squares regression to model the association between the adjusted indicator and fractional deprivation rank, and used the slope coefficient to estimate the SII and its associated 95% confidence interval. We also performed tests of change in the SII over time using time-series cross-section regression with year interactions. For local monitoring, we used the same approach based on national fractional deprivation rank, except using only LSOAs within the local CCG area. We term the local slope coefficient the 'absolute gradient index' (AGI), to avoid confusion with the different local slope index approach used to monitor inequalities in population health in the Public Health Outcomes Framework, which uses local within-area deprivation rank rather than national deprivation rank. We also constructed a local 'relative gradient index' that can be compared with the national RII. We tested the difference between the local AGI and the national SII, allowing for uncertainty around both variables. In sensitivity analysis we also used more sophisticated regression approaches including non-linear models and empirical Bayes random-effect models to shrink the local AGI towards the national SII.

Results

National equity trends

Between 2004/5 and 2011/12, more deprived neighbourhoods gained larger absolute improvements on all indicators except waiting time, repeat hospitalisation and dying in hospital.

National equity findings in 2011/12

- There was no evidence of 'pro-rich' inequality in primary care physician supply. Deprived neighbourhoods had slightly more GPs relative to measured need than less deprived neighbourhoods. However, the Carr-Hill formula may underestimate additional needs in deprived neighbourhoods, so there may be pro-rich inequality that we are unable to measure.
- There was a small amount of pro-rich inequality in primary care physician quality of care, with an estimated SII gap of 1.45 percentage points (95% confidence interval 1.37 to 1.53 percentage points) between the most and least deprived neighbourhoods in England.
- There was a small amount of pro-rich inequality in inpatient hospital waiting time, with an estimated inequality gap of 2.29 days waiting (95% confidence interval 1.95 to 2.62 days).
- There was substantial pro-rich inequality in preventable hospitalisation, with an estimated inequality gap of 6.50 hospitalisations per 1000 (95% confidence interval 6.40 to 6.59 hospitalisations per 1000).
- There was substantial pro-rich inequality in repeat hospitalisation, with an estimated inequality gap of 6.97 percentage points of people hospitalised (95% confidence interval 6.85 to 7.09 percentage points).
- There was substantial pro-rich inequality in dying in hospital, with an estimated inequality gap of 5.95 percentage points of people dying in hospital (95% confidence interval 5.26 to 6.63 percentage points).
- There was substantial pro-rich inequality in amenable mortality, with an estimated inequality gap of 1.56 amenable deaths per 1000 (95% confidence interval 1.50 to 1.62 amenable deaths per 1000).
- There was substantial pro-rich inequality in overall mortality, with an estimated inequality gap of 5.17 deaths per 1000 (95% confidence interval 5.03 to 5.31 deaths per 1000).

General practitioner supply is a limited measure of primary care access, need in deprived neighbourhoods may be underestimated because of a lack of data on multimorbidity, and the quality and outcomes indicators capture only one aspect of primary care quality. Indicators 4, 5, 7 and 8 adjust for age and sex but not for morbidity and other health risk factors outside NHS control which increase the risk of poor health-care outcomes in deprived neighbourhoods. So they overestimate the extent of pro-rich inequality in health-care outcomes for which the NHS can reasonably be held responsible.

Local equity findings in 2011/12

In 2011/12, > 20% of CCGs performed significantly differently on equity than the national benchmark for indicators 1–5, with at least 10% better and 10% worse. For indicator 6, dying in hospital, only 8% of CCGs were significantly different from average: 3% worse and 5% better. For indicator 7, amenable mortality, 11% were significantly different from average: 8% worse and 3% better. Finally, for indicator 8, overall mortality, 17% were significantly different from the national average, but most of these were significantly worse: only 3% were significantly better. Pooling additional years of data did not improve substantially the ability to detect significant differences, and more sophisticated regression approaches, including empirical Bayes random-effects models, made little difference to the list of CCGs performing significantly better or worse than the national average.

Visualisation tools

We developed three main visualisation tools:

1. Equity dashboards: a one-page summary for decision-makers at national and local levels, including a Microsoft Excel® 2010 (Microsoft Corporation, Redmond, WA, USA) tool that can display findings for any CCG in England.
2. Equity chart packs: a standard set of slides, with tables and graphs, showing the underlying inequality patterns and trends in a common format for each indicator, including a portable document format (PDF)-creating tool that can create slides for any CCG in England.
3. Equity custom graphs: a web-based interactive chart tool that allows users to draw their own customised graphs and see how equity changes over time by selecting variables and chart styles.

We found that eight or nine indicators could comfortably fit on a single-page 'equity dashboard' in a landscape orientation. The NHS and public health officials we consulted wanted to see information about average performance alongside equity performance, to put the equity findings into context. They also wanted equity findings to be presented in 'real' units, for example numbers of GPs, hospitalisations and deaths, as well as percentages, to help them interpret the size and importance of the inequality problem.

Conclusions

Implications for health care

1. NHS actions can have measurable impacts on socioeconomic inequality in both health-care access and health-care outcomes.
2. Increasing the number of primary care physicians and paying them for the quality of care they provide has been associated with small impacts on reducing inequality in health-care outcomes, although the causal link between primary care inputs and health-care outcomes has not been established in this study.
3. Our methods for monitoring health-care inequalities within local areas can usefully be applied to any administrative geography comprising 100,000 or more people, both to facilitate quality improvement and to improve transparency through public reporting.
4. Currently, the most useful indicators for local NHS equity monitoring are primary care supply, primary care quality and preventable hospitalisation.
5. National NHS monitoring of change over time in NHS equity can usefully be done using a much wider range of indicators of health-care access and outcomes, including disease-specific indicators.
6. Equity indicators are more useful to decision-makers if they are presented together on the same page, alongside average performance indicators, and accompanied by graphs showing the underlying inequality patterns.
7. Variants on our equity indicators could be used for international comparisons of equity in health care and for evaluating the impacts of interventions on equity in health care.

Research recommendations

Research is needed to:

1. investigate potential explanations for variation in health-care equity performance between local NHS areas, so that health-care managers can learn quality improvement lessons
2. perform experimental and quasi-experimental evaluations of the impacts of complex interventions on socioeconomic inequalities in health-care access and outcomes, including interventions to improve system-wide co-ordination between different specialties, health-care settings and public services
3. make international health-care equity comparisons using these indicators of health-care access and outcomes
4. develop broader measures of primary care access and quality that go beyond GP supply and the aspects of quality captured by the QOF
5. develop better measures of small-area-level need for primary care, by investigating how multiple morbidity and disadvantage combine to generate additional health-care needs
6. develop convincing methods for risk-adjusting small-area-level health-care outcomes for exogenous morbidity factors beyond the control of health-care services
7. develop methods for monitoring other social dimensions of health-care inequality
8. improve these indicator methods, for example, by refining and adding indicators, decomposing national inequality into between-area and within-area components, and exploring the use of statistical process control methods, direct standardisation methods and non-linear functional forms
9. develop sources of small-area-level data on the supply, utilisation, quality and outcomes of public and private social care and other goods and services that may influence health-care outcomes.

Funding

Funding for this study was provided by the Health Services and Delivery Research programme of the National Institute for Health Research.

Health Services and Delivery Research

ISSN 2050-4349 (Print)

ISSN 2050-4357 (Online)

This journal is a member of and subscribes to the principles of the Committee on Publication Ethics (COPE) (www.publicationethics.org/).

Editorial contact: nihredit@southampton.ac.uk

The full HS&DR archive is freely available to view online at www.journalslibrary.nihr.ac.uk/hsdr. Print-on-demand copies can be purchased from the report pages of the NIHR Journals Library website: www.journalslibrary.nihr.ac.uk

Criteria for inclusion in the *Health Services and Delivery Research* journal

Reports are published in *Health Services and Delivery Research* (HS&DR) if (1) they have resulted from work for the HS&DR programme or programmes which preceded the HS&DR programme, and (2) they are of a sufficiently high scientific quality as assessed by the reviewers and editors.

HS&DR programme

The Health Services and Delivery Research (HS&DR) programme, part of the National Institute for Health Research (NIHR), was established to fund a broad range of research. It combines the strengths and contributions of two previous NIHR research programmes: the Health Services Research (HSR) programme and the Service Delivery and Organisation (SDO) programme, which were merged in January 2012.

The HS&DR programme aims to produce rigorous and relevant evidence on the quality, access and organisation of health services including costs and outcomes, as well as research on implementation. The programme will enhance the strategic focus on research that matters to the NHS and is keen to support ambitious evaluative research to improve health services.

For more information about the HS&DR programme please visit the website: <http://www.nets.nihr.ac.uk/programmes/hsdr>

This report

The research reported in this issue of the journal was funded by the HS&DR programme or one of its preceding programmes as project number 11/2004/39. The contractual start date was in January 2013. The final report began editorial review in December 2015 and was accepted for publication in March 2016. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HS&DR editors and production house have tried to ensure the accuracy of the authors' report and would like to thank the reviewers for their constructive comments on the final report document. However, they do not accept liability for damages or losses arising from material published in this report.

This report presents independent research funded by the National Institute for Health Research (NIHR). The views and opinions expressed by authors in this publication are those of the authors and do not necessarily reflect those of the NHS, the NIHR, NETSCC, the HS&DR programme or the Department of Health. If there are verbatim quotations included in this publication the views and opinions expressed by the interviewees are those of the interviewees and do not necessarily reflect those of the authors, those of the NHS, the NIHR, NETSCC, the HS&DR programme or the Department of Health.

© Queen's Printer and Controller of HMSO 2016. This work was produced by Cookson *et al.* under the terms of a commissioning contract issued by the Secretary of State for Health. This issue may be freely reproduced for the purposes of private research and study and extracts (or indeed, the full report) may be included in professional journals provided that suitable acknowledgement is made and the reproduction is not associated with any form of advertising. Applications for commercial reproduction should be addressed to: NIHR Journals Library, National Institute for Health Research, Evaluation, Trials and Studies Coordinating Centre, Alpha House, University of Southampton Science Park, Southampton SO16 7NS, UK.

Published by the NIHR Journals Library (www.journalslibrary.nihr.ac.uk), produced by Prepress Projects Ltd, Perth, Scotland (www.prepress-projects.co.uk).

Health Services and Delivery Research Editor-in-Chief

Professor Jo Rycroft-Malone Professor of Health Services and Implementation Research, Bangor University, UK

NIHR Journals Library Editor-in-Chief

Professor Tom Walley Director, NIHR Evaluation, Trials and Studies and Director of the EME Programme, UK

NIHR Journals Library Editors

Professor Ken Stein Chair of HTA Editorial Board and Professor of Public Health, University of Exeter Medical School, UK

Professor Andree Le May Chair of NIHR Journals Library Editorial Group (EME, HS&DR, PGfAR, PHR journals)

Dr Martin Ashton-Key Consultant in Public Health Medicine/Consultant Advisor, NETSCC, UK

Professor Matthias Beck Chair in Public Sector Management and Subject Leader (Management Group), Queen's University Management School, Queen's University Belfast, UK

Professor Aileen Clarke Professor of Public Health and Health Services Research, Warwick Medical School, University of Warwick, UK

Dr Tessa Crilly Director, Crystal Blue Consulting Ltd, UK

Dr Eugenia Cronin Senior Scientific Advisor, Wessex Institute, UK

Ms Tara Lamont Scientific Advisor, NETSCC, UK

Professor Elaine McColl Director, Newcastle Clinical Trials Unit, Institute of Health and Society, Newcastle University, UK

Professor William McGuire Professor of Child Health, Hull York Medical School, University of York, UK

Professor Geoffrey Meads Professor of Health Sciences Research, Health and Wellbeing Research and Development Group, University of Winchester, UK

Professor John Norrie Health Services Research Unit, University of Aberdeen, UK

Professor John Powell Consultant Clinical Adviser, National Institute for Health and Care Excellence (NICE), UK

Professor James Raftery Professor of Health Technology Assessment, Wessex Institute, Faculty of Medicine, University of Southampton, UK

Dr Rob Riemsmma Reviews Manager, Kleijnen Systematic Reviews Ltd, UK

Professor Helen Roberts Professor of Child Health Research, UCL Institute of Child Health, UK

Professor Jonathan Ross Professor of Sexual Health and HIV, University Hospital Birmingham, UK

Professor Helen Snooks Professor of Health Services Research, Institute of Life Science, College of Medicine, Swansea University, UK

Professor Jim Thornton Professor of Obstetrics and Gynaecology, Faculty of Medicine and Health Sciences, University of Nottingham, UK

Professor Martin Underwood Director, Warwick Clinical Trials Unit, Warwick Medical School, University of Warwick, UK

Please visit the website for a list of members of the NIHR Journals Library Board:
www.journalslibrary.nihr.ac.uk/about/editors

Editorial contact: nihredit@southampton.ac.uk