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

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A final version (which has undergone a rigorous copy-edit and proofreading) will publish as part of a fuller account of the research in a forthcoming issue of the Health Services and Delivery Research journal.

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Scientific Summary

Background

There are inequalities in healthcare 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 healthcare 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 healthcare access and outcomes, which applies both nationally and at the local level of Clinical Commissioning Groups (CCGs). However, the NHS does not yet monitor these inequalities systematically and, in particular, lacks a method for detailed local monitoring of healthcare inequalities within CCG areas.

Objectives

- To develop indicators of socioeconomic inequality in healthcare access and outcomes at different stages of the patient pathway
- To develop methods for monitoring local NHS equity performance in tackling socioeconomic healthcare inequalities
- To track the evolution of socioeconomic healthcare 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 (i) reviewing existing indicators used by the NHS to monitor healthcare quality, (ii) consulting health indicator experts about technical feasibility, (iii) consulting a diverse range of NHS and public health experts about policy relevance through 1:1 conversations and an online expert survey, and (iv) 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 healthcare intervention, (3) likely impact on population health, (4) data availability at 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 healthcare 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 national and local levels:
(1) primary care supply: patients per full time equivalent general practitioner, need adjusted for age, sex and ill-health,
(2) primary care quality: composite score based on quality and outcomes framework 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 healthcare (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 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 datasets: practice level data on GP supply from the annual National Health Service General and Personal Medical Services (GMS) workforce census (Indicator 1), practice level data on primary care quality from the quality and outcomes

framework (Indicator 2), inpatient hospital data from hospital episode statistics (Indicators 3-6), mortality data from 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 datasets was the 2001 "lower super output area" (LSOA). The 2001 census defined 32,482 of these small area neighbourhoods to cover approximately 1,500 people each (minimum 1,000 and maximum 3,000). Indicators were produced using 2001 LSOAs then mapped to the updated LSOA geography from the 2011 census, resulting in 32,844 neighbourhoods which could be aggregated to clinical commissioning group level. We measured deprivation using a time-fixed deprivation score to ensure that time trends reflect real changes in healthcare 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 domain 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 (ADS) of GP-registered populations to map the number of GPs and quality scores provided at practice level 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 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, 5-15, 16-24, 25-39, 40-59, 60-74 and 75+ 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 6 standard deviations from the mean. This excluded less than 0.15 of one percent 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 clinical commissioning group 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" (RGI) 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 most indicators.

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 under-estimate 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 slope index of inequality gap of 1.45 percentage points (confidence interval 1.37 to 1.53) between the most and least deprived neighbourhood 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 (confidence interval 1.95 to 2.62).

- There was substantial “pro-rich” inequality in preventable hospitalisation, with an estimated inequality gap of 6.50 hospitalisations per 1,000 (confidence interval 6.40 to 6.59).

- There was substantial “pro-rich” inequality in repeat hospitalisation, with an estimated inequality gap of 6.97 percentage points of people hospitalised (confidence interval 6.85 to 7.09).

- There was substantial “pro-rich” inequality in amenable mortality, with an estimated inequality gap of 1.56 amenable deaths per 1,000 (confidence interval 1.50 to 1.62).

- There was substantial “pro-rich” inequality in overall mortality, with an estimated inequality gap of 5.17 deaths per 1,000 (confidence interval 5.03 to 5.31).

GP supply is a limited measure of primary care access, need in deprived neighbourhoods may be under-estimated due to lack of data on multi-morbidity, 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 healthcare outcomes in deprived neighbourhoods. So they over-estimate the extent of “pro-rich” inequality in healthcare outcomes for which the NHS can reasonably be held responsible.

Local equity findings in 2011/12

In 2011/12, over twenty percent of CCGs performed significantly differently on equity than the national benchmark for indicators (1) through (5), with at least ten percent better and ten percent worse. For indicator (6) Dying in Hospital, only eight percent of CCGs were significantly different from average – three percent worse and five percent better. For indicator (7) Amenable Mortality, eleven percent were significantly different from average – eight percent worse and three percent better. Finally, for indicator (8) Overall Mortality, seventeen percent were significantly different from the national average, but most of these were significantly worse – only three percent 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:

- Equity dashboards – a one page summary for decision makers at national and local levels, including an Excel tool that can display findings for any CCG in England
- Equity chartpacks – 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 PDF creating tool that can create slides for any CCG in England
- Equity custom graphs – a web based interactive chart tool that allows the user 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 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 – e.g. numbers of GPs, hospitalisations, deaths – as well as percentages, to help them interpret the size and importance of the inequality problem.

Conclusions

Implications for healthcare

1. NHS actions can have measurable impacts on socioeconomic inequality in both healthcare access and healthcare 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 healthcare outcomes, though the causal link between primary care inputs and healthcare outcomes has not been established in this study.
3. Our methods for monitoring healthcare 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 healthcare 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 healthcare and for evaluating the impacts of interventions on equity in healthcare

Research recommendations

Research is needed:

1. To investigate potential explanations for variation in healthcare equity performance between local NHS areas, so that healthcare managers can learn quality improvement lessons
2. To perform experimental and quasi-experimental evaluations of the impacts of complex interventions on socioeconomic inequalities in healthcare access and outcomes, including interventions to improve system-wide co-ordination between different specialties, healthcare settings and public services
3. To make international healthcare equity comparisons using these indicators of healthcare access and outcomes
4. To develop broader measures of primary care access and quality that go beyond GP supply and the aspects of quality captured by the quality and outcomes framework

5. To develop better measures of small area level need for primary care, by investigating how multiple morbidity and disadvantage combine to generate additional healthcare needs
6. To develop convincing methods for risk adjusting small area level healthcare outcomes for exogenous morbidity factors beyond the control of healthcare services
7. To develop methods for monitoring other social dimensions of healthcare inequality
8. To 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. To 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 healthcare outcomes.

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