Examining the Health Legacy of the NHS: Short- and Long-Term Effects on Infant Mortality and Adult Health Outcomes

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Abstract

This paper examines both the short- and long-term health impacts of the introduction of the National Health Service (NHS) in the United Kingdom in 1948. The NHS revolutionized the healthcare landscape by providing universal healthcare free at the point of use. We examine the effects of the NHS's provision of free hospital access for childbirth on children born just before and after its implementation. Using a Regression Discontinuity Design (RDD), we analyze both infant mortality rates at the time of the NHS implementation and health outcomes measured at later ages (45 to 80), including self-reported health, BMI, and obesity rates. Our study uniquely incorporates genotypic data to capture and correct for survival bias, which has been previously overlooked. By using polygenic indices (PGIs), we enhance the precision of our estimates and account for the influence of genetic predispositions on health outcomes. Our findings indicate that the NHS significantly improved infant mortality rates in the short-run and self-reported health, BMI, and obesity rates in the long-run. The inclusion of PGIs revealed variations in health benefits based on genetic predispositions, highlighting their role in adjusting for survival bias.

Introduction

The implementation of the National Health Service (NHS) in the United Kingdom (UK) in 1948 represented a landmark in healthcare policy, offering universal access to medical services free at the point of use. This paper investigates both the short- and long-term health effects of the NHS's introduction on children born before and after its establishment, with a particular focus on how genetic predispositions might mediate these effects. Notably, this study is the

first to account for the survival bias associated with the NHS's implementation by utilizing genotypic data from individuals. This same genotypic information is employed to adjust for survival bias and to capture larger and more precisely estimated long-term effects.

Context and Hypothesis

Prior to the NHS, healthcare in the UK operated on a fee-for-service basis or through limited free services from voluntary hospitals and local authorities under the Poor Law, facing substantial financial constraints. Workers had partial coverage through the National Insurance Act 1911, but this was limited in scope and excluded dependents. Limited free care was available through voluntary hospitals, local authority hospitals, public health programs, and free medical services for schoolchildren.

The NHS aimed to address these disparities by providing comprehensive healthcare to all UK citizens from birth, funded through general taxation. By centralizing funding and services, the NHS ensured that healthcare access was no longer dependent on financial means. At its launch in 1948, the NHS quickly achieved significant coverage, with 96% of the population registered with a GP by the end of the year. The NHS nationalized 2,835 hospitals, incorporated 388,000 beds, and expanded GP services, aiming to improve overall public health.

In this paper, we focus on the effects of the NHS during the period of birth because the Fetal Origins Hypothesis suggests that early life conditions significantly impact long-term health outcomes. This hypothesis posits that enhanced prenatal and early postnatal care can lead to substantial long-term health benefits. Consequently, we hypothesize that the NHS’s provision of free hospital access for childbirth resulted in notable short- and long-term health improvements.

Methodology

Following the NHS implementation on July 5th, 1948, all pregnant mothers in the UK gained access to medical assistance during childbirth. We exploit this discontinuity and implement a Regression Discontinuity Design (RDD) to estimate the short- and long-term health effects for children born just before and after the introduction of the NHS. Our main specification adopts a conservative approach using linear models, a fixed bandwidth (18 months), and triangular kernels. We assess the robustness of our findings to alternative specifications.

Short-Term Effects

Historical data from the Vision of Britain demonstrates that the NHS significantly reduced mortality rates among infants under the age of one. Infant mortality rates per 1,000 births decreased by 5.48 or 16.1% compared to the mean (99% confidence level). These findings are robust across various methodological approaches, including different bandwidths, polynomials, and kernels.

Survival Bias

These large estimates suggest that a significant proportion of children who did not survive prior to the NHS survived after its implementation. It is reasonable to assume that these children were less fit at birth and might have died from conditions such as hypoxia, infections, and other birth-related complications. Nonetheless, being born in hospital facilities increased their chances of survival. We capture the direction of this survival bias by comparing the prevalence of polygenic indices in individuals born before and after the NHS. Using the nationally representative sample from the English Longitudinal Study of Ageing (ELSA) and applying a RDD approach, we find that post-NHS, there is a higher prevalence of individuals with higher loads in Polygenic indexes (PGIs) associated with 'worse' phenotypes, such as migraine or chronic pain, while there is a lower proportion of those with 'better' phenotypes, such as general cognition, educational attainment, and IQ. The effect sizes are large ranging 30-40% of a standard deviation and significant at the 95% confidence level. These results remain robust across different bandwidths and kernels, quadratic fits, multiple hypothesis testing, and comparisons of observed versus randomized treatments.

Long-Term Effects

To explore the longer-term impacts, we examine health outcomes measured between ages 45 and 80. Our findings indicate that the NHS led to improvements in self-reported health, BMI scores, and obesity rates. However, results related to ever having been diagnosed with heart problems were noisy and difficult to interpret. Interestingly, we find that including PGIs as control variables helps correct for survival bias and enhances precision. For example, in a model without controls, the estimate for self-reported health has an effect size of -0.16, which is statistically insignificant. Adding basic demographic controls, such as gender, age, and parental education levels, increases the effect size to -0.23, though it remains imprecisely estimated. When PGIs are included, the effect size nearly doubles to -0.33, with improved precision making it statistically significant at the 95% confidence level.

Similarly, BMI has an initial effect size of -1.27, which is not statistically significant. After accounting for demographics and genetics, the effect size increases to -1.42, becoming significant at the 95% confidence level. For obesity, the effect size increases modestly from -0.14 to -0.15, with the p-value improving proportionally from 0.05 to 0.04. Results for being diagnosed with heart problems are more variable and difficult to interpret; the effect size drops from 0.04 to -0.10, with the p-value changing from 0.62 to 0.014. Overall, these results suggest that incorporating genetic information helps account for part of the survival bias and improves estimate accuracy. These findings are robust across different bandwidths and kernels, quadratic fits, and methods for extracting health outcomes. Additional sanity checks, including placebo outcomes, further confirm that the results are not driven by random fluctuations or the data structure.

Gene by environment interaction

Finally, we conduct a gene-by-environment analysis by interacting the treatment variable from our RDD model with PGIs specific to each health outcome. For BMI and obesity outcomes,

we use the PGI for BMI, while for the outcome of ever experiencing health problems, we use the PGI for arterial carotid disease. Unfortunately, there is no PGI for self-reported health with sufficient predictive power, so this variable is excluded from our analysis.

Our results indicate that the main effect sizes reported previously remain consistent when including the interaction with PGIs, using a binary measure of PGIs indicating high values above one standard deviation. In the case of being diagnosed with heart conditions, the effect size increases to -0.16 and becomes statistically significant. Moreover, the interaction terms show significant results in the opposite direction, suggesting that the health benefits of the NHS were less pronounced for individuals with a high genetic predisposition to these conditions.

Overall, the results are robust across different bandwidths and kernels, and the inclusion of a continuous measure of PGIs. However, the robustness checks do not yield the cleanest estimates, necessitating careful interpretation of this part of the results. This is likely due to the small sample size, as large samples are typically required to accurately capture gene-by-environment interactions.

Next Steps

We are currently in the process of applying for access for the Understanding Society Databases and the UK Biobank. Both databases include a large sample of individuals that were born before and after the implementation of the NHS and rich genetic measures. Our objective is to replicate the current results with these different samples.

Discussion

Our work demonstrates that the implementation of the NHS had significant short- and long-term health benefits. In the short term, it reduced infant mortality rates. In the long term, it improved self-reported health and anthropometric measures such as BMI and obesity. However, we did not find evidence supporting broader long-term effects on the medical diagnosis of heart problems. Importantly, we show that PGIs can be used for correcting for survival bias which can lead to larger and more precisely estimations even with small sample sizes.