

Using big data and economics to understand and improve wellbeing

Wellbeing and data are increasingly at the heart of government policy-making. In this *Insight*, we show how data, when combined with the underlying economics, can be used to improve wellbeing outcomes for New Zealanders. As a case study, we investigate whether increases in housing costs can have greater impacts on individuals with chronic health conditions (CHCs) compared to the rest of the population, in terms of where they choose to live.

We outline some exciting possibilities that our approach holds for improving policy and thus the lives of people.

Disclaimer

The results in this report are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI), managed by Statistic New Zealand.

The opinions, findings, recommendations, and conclusions expressed in this report are those of the author(s), not Statistics NZ.

Access to the anonymised data used in this study was provided by Statistics NZ under the security and confidentiality provisions of the Statistics Act 1975. Only people authorised by the Statistics Act 1975 are allowed to see data about a particular person, household, business, or organisation. The results in this report have been confidentialised to protect these groups from identification and to keep their data safe.

Careful consideration has been given to the privacy, security, and confidentiality issues associated with using administrative and survey data in the IDI. Further detail can be found in the Privacy impact assessment for the Integrated Data Infrastructure, available from www.stats.govt.nz.

Introduction

The government is focusing its policies on wellbeing, with the Minister of Finance set to deliver a 'wellbeing budget' on 30 May.

At the same time, 'big data' and data visualisation are radically changing the volume and type of information available to support policy-making.

This article highlights the role of economics in improving the use of big data in informing policy decisions that have a wellbeing focus.

Wellbeing

People's wellbeing comes from their satisfaction with different aspects of life, including health, housing and employment status.

The wellbeing of New Zealanders increases when they are freed from constraints on their (desired) choices.¹ The role of a wellbeing-focused policy should, therefore, be to identify and address constraints on individuals' wellbeing.

Wellbeing plus economics

Economic theory and techniques provide robust frameworks for identifying the significance of the constraints and estimating the performance of policy in improving wellbeing outcomes.

To understand the implications of policy decisions for the wellbeing of New Zealanders, we need to understand the

¹ This aspect of wellbeing is discussed in more detail in the NZIER Public Discussion Paper 2019/1 *Kia māia: Be bold: Improving the wellbeing of children living in poverty*.

differences in responses of different population groups to changes in their lives. All else equal, the response to a change in living circumstances is likely to be the same for individuals with similar features. If, however, we observe differences in the response of individuals, the drivers of these differences need to be identified and addressed.

The location of health services

The Minister of Health has identified “bringing health services closer to home” as one of the main priorities for the Ministry’s work programme.² The Ministry uses analyses of the performance of providers to gauge the productivity of the health services.³

However, the Ministry has not, to date, estimated health services quality at a granular household level, due to data limitations.

In this article, we introduce a method for overcoming the shortcomings in estimating the performance of the provided services.

Supply of health services is currently focused on population centres, with the services to be provided determined, in part, by the health needs of the local population. Some people with certain health conditions, however, may decide to live close to a health service provider, even though they would choose a different location if it had health services available. This may be particularly be the case for people with chronic health conditions that require ongoing specialist services.

If health services are to be provided where people live, rather than people living where there are health services, we need account for the ‘unobserved counterfactual’: where people would live if the location of health services was not an issue.

Enter economics

Economics predicts that some people will change location if rents increase. By combining an economic explanation of location choice with data on residency and health status, we have been able to construct a model that allows the unobserved counterfactual to be inferred.

Over the last decade, housing costs in New Zealand have increased significantly, in both the ownership and rental markets. For example, rental prices in Auckland increased

by 47% between 2006 and 2016.⁴ This increase, however, varies between suburbs.⁵

Economic research has shown that one response to increased rental costs is for tenants to move to cheaper locations, which normally means further away from town and city centres.

The response to higher rents will, however, depend on a range of factors including preferences and the availability of required amenities and facilities, like the availability of health services, social services and jobs.

In response to higher housing costs, if people with CHCs show significantly different choices from those without chronic conditions, then there are wellbeing and economic consequences for the users of health services – which will need to be carefully compared to the costs of providing the required services.

Previous studies

Most previous studies of geographical inequalities in health have looked at inequality from the perspective of differences between health conditions in different geographic units.⁶ While this work provides a description of the people most in need for health services (and the wider segregation between population groups’ health outcomes), it does not provide an understanding of the drivers of the described health inequalities. This *Insight* article is the first study that considers individuals’ dependencies on health services by looking at individuals’ responses to higher costs of locating nearby supplied health services.

This study

In this study, we calculate the duration of occupancy of a household in an area, distinguishing between households that include an individual who experiences a chronic condition and those who do not. The conditions included are: diabetes, cancer, traumatic brain injury, stroke, acute myocardial infarction, chronic obstructive pulmonary disease, gout and chronic heart disease.

Data on occupancy comes from a dataset containing 78,225,000 movements during 2000-2016. Data on health conditions comes from Stats NZ’s IDI. We have combined these two datasets to undertake a rich study of the issue.

² Ministry of Health. Annual Report for the year ended 30 June 2012 including the Director-General of Health’s Annual Report on the State of Public Health. Wellington: Ministry of Health, Page 15.

³ Ministry of Health. 2013. DHB Provider Arm Productivity: Technical Methodology. Wellington: Ministry of Health.

⁴ This is based on MBIE’s Rental bond data: <https://www.mbie.govt.nz/building-and-energy/tenancy-and-housing/rental-bond-data/>.

⁵ For example, while annual rent change between 2018 and 2019 in Parnell, Auckland is 7.7%, in the same period there has been no change in rent prices in Eden Terrace. Source: <https://www.qv.co.nz/property-trends/rental-analysis>.

⁶ For example, see: Pearce, J. and Dorling, D. 2006. Increasing geographical inequalities in health in New Zealand, 1980–2001. *International Journal of Epidemiology*, 35(3), 597-603.

Details of the methodology, the results table and a technical description of the results are contained in the Appendix.

Results

Our headline result is that the impact of having a CHC on length of stay in the current residence is positive (and statistically significant). Those with health conditions stay in their place significantly longer than those who do not have any CHCs. This is consistent with the literature.

We also find that the impact of experiencing higher rents on length of stay is negative (and significant). This suggests that an increase in rents triggers people to move.

When we combine these two effects – having a CHC and experiencing higher rents – we find that those with CHCs behave differently towards an increase in higher rents and stay in their current place for longer than those without health conditions.

We then tested whether distance to hospitals affects the decision to move.⁷ The results show that for people with CHCs, distance to hospital does not affect their length of stay significantly. This suggests that people with CHCs will stay closer to a hospital in the face of higher rents.

Lastly, we distinguish between the length of stay for different health conditions. Our results suggest that people who have had a stroke or suffered a traumatic brain injury, or who have diabetes and cancer stay at their current residency for a longer period compared to the other CHCs.

Conclusion

This *Insight* shows how combining economic explanations for behaviour, in this case location choice, with large datasets can better inform policy.

In this case study, we compared the responses of individuals with and without CHCs to an increase in rent prices. The results of studying approximately 78 million movements between 2000 and 2016 suggest that the movements of individuals with CHCs are limited by the accessibility of hospitals. This implies that they do not respond to higher rent prices by moving out from the more expensive areas that are located nearby supplied health services.

Understanding the demand for health services is a case of unobserved counterfactual that could be captured by using detailed individual level data. A correct understanding of the areas of demand needs careful definition of the counterfactual scenario: where people with chronic health conditions would have resided if the

health services were provided equally around the country?

This has clear implication for the Minister of Health's policy of "bringing health services closer to home". For example, the location of services should be based on the effect of rents on location choice, as well as more standard considerations like population health status and cost of provision.

Possible extension

The value add of this paper is that it introduces a methodology based on economic theory and uses available big data to inform policy aimed at maximising wellbeing outcomes.

Possible extensions of the analysis of CHCs choice of location could include the income levels of households, their distance to job locations, and the distance from town centres. How behaviour changes before and after the onset of a CHC could also be included, after accounting for the changes due to age and other socioeconomic features.

The techniques we have used have multiple possible applications in other areas of policy. For example:

- Identifying the demand for services, including health services, when the counterfactual case (the perfect alignment of health services with demand for it) has not been experienced.
- Tracking the changes in performance of the supply of services with the demand for it over time.

This Insight was written by Eilya Torshizian at NZIER, May 2019.

For further information please contact Eilya at eilya.torshizian@nzier.org.nz or 022 156 4529

NZIER | (04) 472 1880 | econ@nzier.org.nz | PO Box 3479 Wellington

NZIER Insights are short notes designed to stimulate discussion on topical issues or to illustrate frameworks available for analysing economic problems. They are produced by NZIER as part of its self-funded Public Good research programme. NZIER is an independent non-profit organisation, founded in 1958, that uses applied economic analysis to provide business and policy advice to clients in the public and private sectors.

While NZIER will use all reasonable endeavours in undertaking contract research and producing reports to ensure the information is as accurate as practicable, the Institute, its contributors, employees, and Board shall not be liable (whether in contract, tort (including negligence), equity or on any other basis) for any loss or damage sustained by any person relying on such work whatever the cause of such loss or damage.

⁷ We derive these by geocoding the Ministry of Health's public hospitals data. Retrieved from: <https://www.health.govt.nz/your-health/certified-providers/public-hospital>

Appendix Methodology

We estimate the following equation:

$$LS_{ir,t} = \alpha + \beta \cdot CHC_{ir,t} + \gamma \cdot CHC_{ir,t} \times PG_{ir,t} + \theta \cdot PG_{ir,t-1} + \varepsilon_{ir,t}$$

$$CHC_{ir,t} = 1 \text{ if individual } i \text{ has CHC; } 0 \text{ otherwise}$$

where $LS_{ir,t}$ is the length of stay of individual i at area r who moves at time t , $CHC_{ir,t}$ is the dummy variable equal to one if individual i has CHC and 0 otherwise, $PG_{ir,t}$ is the growth rate in the area that individual i lives (r) and $\varepsilon_{ir,t}$ is the random error term. In a second estimation, we add interactions between $CHC_{ir,t}$, $PG_{ir,t-1}$ and distance from hospitals, to understand the impact of increases in rents for people with CHC (compared to those without CHCs) at different distances from hospitals.

While the increase in the price of houses consists of both the consumption and the investment values of housing, rental value is a good measure of the consumption value of housing. We use the rental values of houses over the period 2000-2016. Then we calculate the growth in the average rental values for the small geographic units (Meshblocks).

Data

The source of rental data is Tenancy Bond Data by Ministry of Business, Innovation and Employment (MBIE). For the changes in addresses we use the addresses database provided by Stats NZ. For investigating health conditions, we use the chronic health conditions data provided by Ministry of Health.

Results

In the first column of Table 1, we illustrate the impact of higher rents for people with CHCs versus others (CHCs & Higher rents). The (statistically significant) positive correlation (0.014) implies that for people with CHC, an increase in rents is associated with longer stay in the current residence (compared to those without CHCs). In the second column, we distinguish between the impact of distance from hospital, for people with a CHC and others. The results suggest that the response to higher rents at a longer distance to hospitals is a shorter stay in the residence (-0.547). People with CHCs, however, do not change their distance to hospital in response to higher rents (statistically insignificant effect).

Table 1 Impact of CHCs and higher rents on length of stays

	1	2
Output:	CHC	+Distance
CHCs	0.833*** (0.003)	0.82*** (0.005)
CHCs & Higher rents	0.014** (0.007)	0.016*** (0.007)
Higher rents	-0.004*** (0.000)	-0.006*** (0.000)
Higher rents & Distance from Hosp (ln)		-0.547*** 0.0595
CHC & Higher rents & Distance from Hosp (ln)		-0.13 (0.117)
Constant	3.579*** (0.000)	3.596*** (0.000)
Number of observations	60,600,000	60,600,000

*p<0.1, ** p<0.05, *** p<0.01; Standard errors reported in parentheses.

Source: NZIER (2019)