The Older People's Index of Multiple Deprivation (OPIMD)

Brief Report

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Statistics New Zealand Disclaimer

These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is carefully managed by Stats NZ. For more information about the IDI please visit https://www.stats.govt.nz/integrated-data

The results are based in part on tax data supplied by Inland Revenue to Stats NZ under the Tax Administration Act 1994 for statistical purposes. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes, and is not related to the data's ability to support Inland Revenue's core operational requirements.

Introduction

Like most of the developed world, New Zealand has an ageing population. The 2013 census showed that 14.3% of the population was aged 65 and over and this increased to 15.2% in the 2018 census. The proportion of people aged 65 and over is projected to jump to 22% in 2032 [1]. It is becoming increasingly important to improve our understanding of the socio-economic realities of older people (defined here as people aged 65 and over), in part by developing tools that accurately measure their deprivation status.

There is strong evidence of social gradients in health outcomes among the population aged 65 and over, but the older population is largely excluded from standard measures of Socioeconomic position (SEP) and area deprivation, which typically use variables such as employment and education attainment that are more appropriate for working age people.

We searched the literature and held 4 consultation *hui* to identify deprivation variables that are appropriate for older people. We decided to use individual-level variables with binary values to measure deprivation because there is a high level of data suppression in area-level variables for older people. We developed 14 dichotomous socio-economic variables for 432,315 individuals aged 65 and over who had complete data for all variables, and one geographic variable that measures access to basic services. These same 15 variables were transformed into a simple deprivation self-assessment tool.

The Older People's Index of Multiple Deprivation (OPIMD) was developed using 2013 census data and administrative data from the same time period because many variables in the 2018 census have data quality issues. We plan to update the OPIMD after the 2023 census.

Area-based and individual-level indices

Most deprivation indices are area-based, partly because measures of very different aspects of deprivation, such as income and housing, can readily be combined at the area level, and partly because areas with populations big enough to minimize data suppression can be selected. Ideally, areas used for such purposes would have populations of around 1,000 because areas with larger populations will

obscure internal variation and areas with smaller populations will lead to significant data suppression as a result of rules designed to protect privacy and confidentiality.

Older people (aged 65 and over) comprised 14.3% of New Zealand's population at the 2013 census. So, on average, there would be about 143 people in an area of 1,000 people and this would lead to significant data suppression. For this reason, we decided to measure deprivation among older people at the individual level. This has a number of advantages, including the ability to measure each person's actual deprivation circumstances and avoiding the 'ecological fallacy' i.e. not everyone living in a deprived area is deprived. However, calculating deprivation at the individual level has limitations. Indicators of deprivation measure very different things (e.g. low income versus no longer having a driver licence) using different metrics, so options for combining them into a score for each individual are limited. To address this challenge, OPIMD indicators were designed to be binary (Yes/No) and factor analysis was used to combine indicators to form domains. Factor analysis requires complete data hence only individuals with complete data were included in the creation of final index.

Reference period for the OPIMD

Work began on the OPIMD in early 2017. The original plan was to develop preliminary indicators using data from the 2013 census, and then update those indicators with data from the 2018 census when they became available. When it became apparent that the 2018 census data would be late and unreliable, we decided to maintain 2013 as the reference period. The next update of the OPIMD will probably use data from the 2023 census. Non-census indicators (e.g. from the Ministries of Health and Social Development) are also centred around March 2013.

Data extraction and linking

All data for indicators were extracted in Statistics New Zealand's Integrated Data Infrastructure (IDI) and linked using snz-uid, the unique identifier of anonymised individuals in all IDI datasets. We created a research cohort of 552,951 older people and then linked their record in the various indicator datasets using snz_uid.

Population denominator

Our research cohort is defined as people aged 65 and over resident in NZ as at March 2013 who lived in private non-visitor dwellings and were present on census night. In the IDI, we created a denominator population for all OPIMD indicators of 552,951 usual residents aged 65 and over living in private dwellings and present on census night. This count is 54,087 fewer than the official census usual resident population count of people aged 65 years and over (607,038) because the census usual resident count includes 44,589 people with no household ID (most of them living in non-private dwellings) and 9,498 people who were absent on census night. We used the census area table, rather than the Address Notification Table, to link individuals to their usual residential address because the majority of our

indicators use census data and the former delivers a better result in these circumstances.

People living in Non-Private Dwellings

As mentioned above, there were 44,589 people aged 65 and over with no household ID at the March 2013 census. A total of 33,708 of these people were living in Non-Private Dwellings (NPD), the majority (88.8%) in rest homes (Aged Residential Care).

Data for this group are often of poor quality. For example, 23.62% (7,068) of older people living in Aged Residential Care (ARC) did not answer the census question about income sources, compared to only 6.28% (37,500) of older people in private dwellings. In addition, many of the OPIMD's 15 indicators are not relevant to people who live in non-private dwellings. For example, the overcrowding and renting indicators are not relevant to people living in rest homes, and the income indicators aren't relevant to the significant proportion of people who are eligible for the Residential Care Subsidy because their assets and income are below certain thresholds. For example, a single person is eligible for the RCA if their total assets are less than $236,335. The income threshold is different for each type of income.

Since many indicators are not relevant for people living in NPDs and the data are poor, we discussed alternative approaches such as giving people in rest homes and other care facilities a fixed 'Dependency' score to reflect the fact that they are no longer able to live independently. The key criterion for admission to Aged Residential Care is an interRAI assessment that finds that a person can no longer live independently. However, these 'Dependency' scores would be equal and arbitrary, so we decided that people living in Non-Private Dwellings would be excluded from the analysis. Moreover, at the time of analysis, interRAI data was not available to researchers in the IDI.

Couples

SNZ's official statistics show that 50.1% of people aged 65 and over live in 'couple only' households[1]. For indicators such as living in a low-income household, having no access to the Internet, and poor access to services, both members of a couple will receive the same score (either deprived or not deprived) in the OPIMD because they live in the same household. For indicators that measure health or assets, scores may vary from one partner to the other. It could be argued that the health status of one member of a couple may impact the other. However, to implement a measure to capture this, we would need to link people in couples and then develop a methodology to classify them as 'indirectly deprived' by some quantum, which would not only be difficult to measure, but also difficult to justify.

[1] http://nzdotstat.stats.govt.nz/

Exploring potential indicators of deprivation

We discussed potential indicators and domains of deprivation at four *hui* in August and November 2018. Two *hui* were held at the Manawa Ora Centre in Tauranga, one at Te Karaiti te Pou Herenga Waka in Mangere and one at the Home League of the Salvation Army in New Lynn, Auckland. At the *hui*, we gave brief presentations about what deprivation is and how it is usually measured. We then explained why we need to develop some different measures of deprivation for older people, and asked participants to discuss what should be measured if we wish to capture deprivation among older people. Results were quite consistent. According to participants, the most important things to measure were low income, poor health and limited connectedness (in the top 4 for all meetings). Poor housing was in the top 5 for three out of four meetings. The least important things to measure were limited education and dependency (in the bottom 5 for all meetings). No assets, deprived neighbourhood, limited education, dependency and forced to work, were in the bottom 5 for three out of four meetings.

We then obtained data for potential indicators and explored their viability in terms of their ability to:

- measure particular forms of deprivation as directly as possible
- be up-to-date
- be capable of being updated on a regular basis
- be statistically robust
- be available for the whole of New Zealand in a consistent form

Data variable review

We investigated more than 40 potential socio-economic indicators in 13 domains:

1. Caregiving
2. Connectedness
3. Dependence
4. Education
5. Employment
6. Environment/social context
7. Health
8. Housing
9. Income
10. Mobility
11. Occupation
12. Tenure
13. Wealth

This 'long list' was whittled down to 6 domains and 15 indicators by eliminating indicators that were not viable for reasons such as a lack of robust data (e.g. Are you homeless?) or because they were not meaningful for people aged 65 and over (e.g. Do you have no formal qualifications?).

Geographical access to services

A single OPIMD indicator measures geographical access to the 8 basic services shown in Table 1. Other services such as places of worship were considered but they lacked nationally consistent data.

Table 1. Counts of facilities for 8 service classes showing nearest 1 or 3 and % weight.

Counts of facilities for 8 service classes, showing nearest 1 or 3			
Service class	**Count**	**Nearest**	**% of weight**
1. Supermarket	958	3	21.13
2. GP and A&E	1190	3	21.12
3. Service station	1362	3	20.45
4. Hospital	159	1	9.27
5. Emergency Department	38	1	8.12
6. Library	404	3	7.68
7. Community, social, recreational space	10965	3	6.63
8. Ambulance station	233	1	5.61

We measured the distance along the road network to the nearest three (or nearest one) facilities using ArcGIS software and its Network Analyst Extension. We used the *three* nearest services where people are likely to exercise choice because of better prices, loyalty, suitability, or the importance of the relationship with a particular provider. We used the nearest *one* where choice is unlikely to be a factor. Travel distances to the nearest service(s) were converted to a continuous 'relative accessibility' score using a Gaussian function [2] as described for previous deprivation research[3]. Relative accessibility scores were ranked, inverse normal transformed, and combined using factor analysis to form area level access scores and ranks. Access ranks were rescaled to match the number of people with complete data.

Final selection of indicators

Many older people had missing information for one or more indicators, mostly because they didn't answer certain census questions. Factor analysis requires that every individual must have a score for every indicator. For this reason, indicators with a high proportion of information missing were dropped. The final OPIMD was created with 15 indicators organised into 6 domains, as shown in Figure 1. It uses data from 432,135 individuals (78.15% of 552951), the 'OPIMD population'. This is the version that makes best use of the deprivation measures we developed.

Figure 1. OPIMD domains and indicators of deprivation with data source

Older Person's Index of Multiple Deprivation (OPIMD)		
6 domains	**15 indicators**	**Data source**
Income	1. Did you receive an income-tested supplementary benefit in Sept 2013?	MSD
Income	2. Did you live in a low income (<$34,680pa) household in March 2013 (60% of the 2013 median)?	Census
Income	3. Did you receive a Main Benefit in March 2013?	IR
Housing	4. Did you live in a household that was overcrowded in March 2013?	Census
Housing	5. Did you live in a household that paid rent or mortgage in March 2013?	Census
Housing	6. Did you live in a household that never used heating fuels in March 2013?	Census
Health	7. Did you have 3 or more hospitalisations in the 5 years between 2011 and 2015 (excluding for falls or for cancers)?	MoH
Health	8. Were you prescribed 5 or more long-term medicines in 2 consecutive quarters 1 Sep-30 Nov 2012 and 1 Dec 2012-28 Feb 2013?	MoH
Health	9. Did you have 2 or more falls between 2011 and 2015 for which an ACC claim was accepted?	ACC
Health	10. Have you had one or more cancer diagnosis registered in the Cancer Register (coverage period 1995-2015)?	MoH
Assets	11. Did you not own or partly own the dwelling you usually lived in, nor hold it in a family trust, in March 2013?	Census
Assets	12. Did you earn no income from assets (a business, a rental, savings, investments, etc.) in the 12 months to March 2013?	Census
Connectedness	13. Did you live in a household that had no access to the Internet in March 2013	Census
Connectedness	14. Did you live alone in March 2013?	Census
Access	15. Did you live in an area with poor access to relevant basic services in 2013?	Multiple

Combining indicators into domains

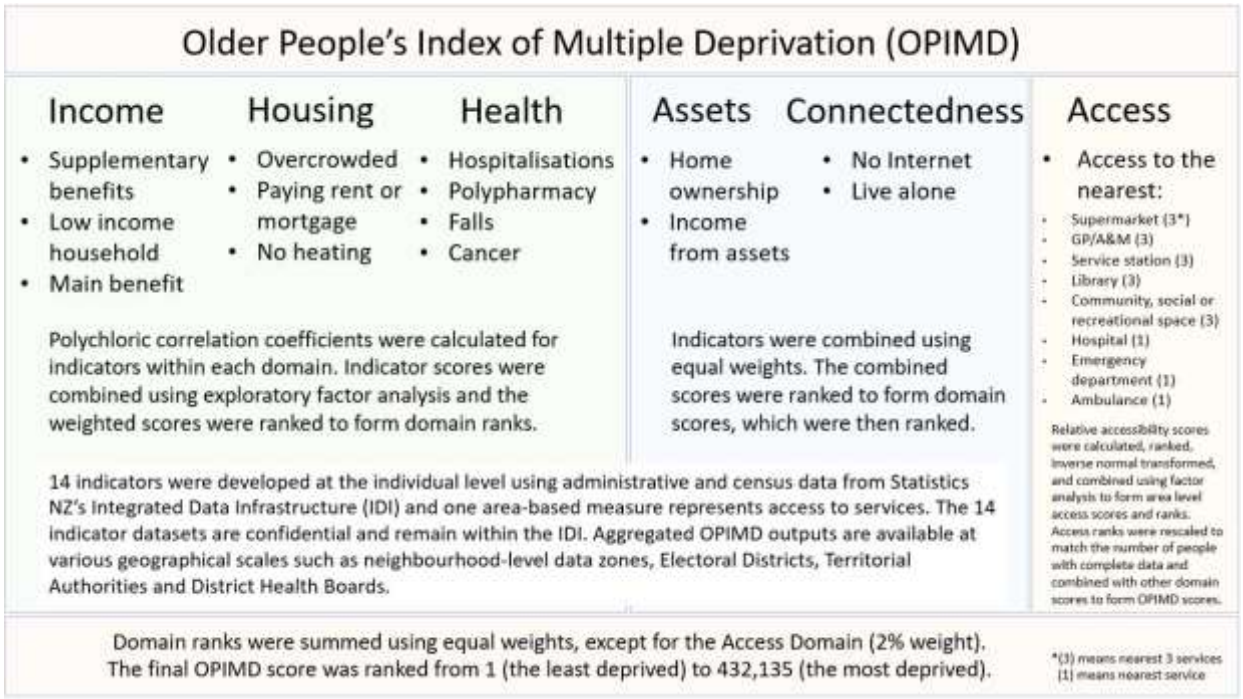
Two different methods were used to combine indicators into domains. For the Income, Housing and Health Domains, indicator scores were combined using exploratory factor analysis and the weighted scores were ranked to form domain ranks. For the Assets and Connectedness Domains, their two indicators were combined using equal weights because they both contribute important information to the concept of asset and connectedness deprivation. The combined scores were ranked to form domain scores, which were then ranked. Alternative approaches

to equal weighting would be subjective, as there is no theoretical basis for quantifying the relative importance of these indicators nor how well they measure asset and connectedness deprivation. The combination of the eight indicators in the Access Domain is described above.

Combining domain ranks into overall deprivation scores for individuals

Domain ranks were summed using equal weights, except for the Access Domain, which was given 2% of the total weight. The Access Domain is commonly given a low weight in indices of multiple deprivation (e.g. 9% in the Scottish Index of Multiple Deprivation) because it is usually weakly and negatively associated with other domains of deprivation. The final OPIMD score was ranked from 1 for the least deprived individual to 432,135 for the most deprived individual aged 65 and over with complete data for 15 indicators. The OPIMD is shown in Figure 2.

Figure 2. The Older People's Index of Multiple Deprivation (OPIMD)



Outputs

The OPIMD consists of deprivation ranks for 432,135 older people living in private dwellings who have complete data for 15 indicators. However, ranks for individuals can't be released publicly due to privacy considerations. The primary publicly available OPIMD outputs are online interactive maps and a deprivation self-assessment tool that people aged 65 and over can use to assess their deprivation status relative to other older people in NZ. These outputs are available online at www.fmhs.auckland.ac.nz/opimd13 For more information, please contact Assoc Prof Daniel Exeter at d.exeter@auckland.ac.nz

Interactive maps

The OPIMD website has an online atlas that allows users to view and interact with maps of deprivation among older people in NZ. The maps include filters, data selection, tables, line plots and histograms. You can zoom into an area of interest to see its deprivation profile, filter by a particular level of deprivation, explore different domains of deprivation, or compare Data Zones, General Electoral Districts, Territorial Authorities or District Health Boards. Online interactive maps of the OPIMD are available at www.fmhs.auckland.ac.nz/opimd13/opimd13maps

A deprivation self-assessment tool for older people

OPIMD indicators are dichotomous, and this allows them to be transformed into a simple deprivation self-assessment tool. People aged 65 and over can receive a deprivation rank and decile relative to other older people in NZ simply by answering 14 Yes/No questions and entering their residential address into a geocoder for a geographical access score. The 14 questions are the same as the 14 indicators of income, housing, health, assets and connectedness deprivation (see Figure 1).

Investigating associations between the OPIMD and indicators of health and social wellbeing

Smoking

We assessed the OPIMD against smoking behaviour among older people. Smoking rates among the OPIMD population (6.36% or 26,546/417513 OPIMD people who provided smoking information) were similar to the rates presented in official statistics i.e. 6.54% or 35,976/549,777 people aged 65 and over who provided smoking information. However, the proportion of the OPIMD population who did not provide smoking information (3.38% or 14,623/432,136) was much lower than in official statistics (9.43% or 57,258/607,035), probably because our OPIMD population had complete data for all indicators and thus were more likely to answer census questions.

Analysis of smoking rates by OPIMD decile showed that the proportion of regular smokers within each decile generally increases with deprivation, as shown in Table 2. There was a weak association between the OPIMD and regular smoking (0.07306, $p<0.0001$), possibly because smoking rates among people aged 65 and over are low.

Table 2. Counts and proportions of regular smokers by OPIMD decile

OPIMD decile	Regular smoker		Total
	n	row %	N
1	1368	3.24	42174
2	1545	3.67	42099
3	2043	4.86	42030
4	1872	4.47	41907
5	2655	6.35	41802
6	2550	6.11	41745
7	2928	7.04	41607
8	3324	8.02	41448
9	3627	8.75	41439
10	4638	11.24	41262
Total	26547	6.36	417513

Deprivation

We compared the OPIMD to two other measures of deprivation at the data zone level. We compared the median OPIMD rank for individuals in each data zone with the data zone's IMD13 rank and its population weighted average NZDep13 [4] rank. We used population weighting for NZDep13 because the customized meshblock dataset that it is built on is not publicly available.

Index of Multiple Deprivation (IMD13)

Only 15.28% of OPIMD decile 10 people lived in IMD13 decile 10 areas. For OPIMD decile 1 people, there was more agreement, with 21.07% of people living in IMD13 decile 1 areas. There was a weak to moderate significant positive association between individual-level deprivation among older people as measured by the OPIMD and area-level deprivation as measured by the IMD13 (0.30835, $p<0.0001$).

New Zealand Index of Deprivation (NZDep13)

Only 15.37% of OPIMD decile 10 people lived in NZDep13 decile 10 areas, while 20.47% of OPIMD decile 1 people lived in NZDep13 decile 1 areas. There was a weak to moderate significant positive association between individual-level deprivation among older people as measured by the OPIMD and area-level deprivation as measured by NZDep13 (0.30859, $p<0.0001$).

We did not expect the association between the OPIMD and the two other measures of deprivation to be particularly strong for a number of reasons. Older people comprise only 14.3% of the total population. Some data zones have no or very few older people, while data zones that include retirement villages have a high proportion of older people. Also, we needed to use the median OPIMD rank in each data zone for area-wise comparisons of indices, even though the median does not capture the diversity within an area. Some of the disagreement between the OPIMD and the two area-level indices may be ascribed to the fact that the methodologies are different, with their respective deprivation measures not

measuring the same things, and also to the ecological fallacy, which explains that not all people living in a deprived area are themselves deprived.

Summary

The OPIMD provides a more accurate view of deprivation among the older population in New Zealand compared to measures of deprivation for the general population. Our vision is for the OPIMD to be widely used for community advocacy, research, policy and resource allocation, providing a more consistent approach to reporting and monitoring the social climate of New Zealand.

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