# The 2018 New Zealand Index of Multiple Deprivation (IMD18)

Indicators for social and health research in New Zealand

## **Brief report**

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#### Statistics New Zealand Disclaimer

The results in this paper are not official statistics, they have been created for research purposes from the Integrated Data Infrastructure (IDI), managed by Statistics New Zealand. The opinions, findings, recommendations, and conclusions expressed in this paper are those of the author(s) not Statistics NZ or the University of Auckland. Access to the anonymised data used in this study was provided by Statistics NZ in accordance with 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 and the results in this paper have been confidentialised to protect these groups from identification. 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 assessment for the Integrated Data Infrastructure impact available from www.stats.govt.nz. The results are based in part on tax data supplied by Inland Revenue to Statistics NZ under the Tax Administration Act 1994. This tax data must be used only for statistical purposes, and no individual information may be published or disclosed in any other form, or provided to Inland Revenue for administrative or regulatory purposes. Any person who has had access to the unit-record data has certified that they have been shown, have read, and have understood section 81 of the Tax Administration Act 1994, which relates to secrecy. 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

There is extensive evidence highlighting the association between area-based measures of deprivation and a number of social and health outcomes Mapping areas of relative deprivation is a powerful way to demonstrate geographical inequalities. However, while grouping areas into quintiles of deprivation provides a map that is easy to interpret, there is potential for users to incorrectly assume that the drivers of deprivation are the same for areas in the same quintile. The causes and consequences of deprivation are multifaceted so it is necessary to use data relating to multiple aspects of disadvantage in order to gain the most complete picture of deprivation possible.

The 2018 Index of Multiple Deprivation (IMD18) is an update of the 2013 version of the IMD for New Zealand. The New Zealand indices follow a methodology developed in the UK, particularly the Scottish Government's Scottish Index of Multiple Deprivation (SIMD) 2012. The IMD18 measures relative disadvantage in 6181 neighbourhood-level data zones across New Zealand and for 7 domains of deprivation (Employment, Income, Crime, Housing, Health, Education and Access to services). Figure 1 outlines the indicators included in each domain and how they are combined.

The purpose of the IMD18 suite of tools is to inform resource allocation, policy development, community advocacy, clinicians and researchers so that the causes and consequences of deprivation can be addressed more effectively. The IMD18 can be used to analyse health and social phenomena, identify service delivery gaps, allocate resources, and target disadvantage. Furthermore the IMD18 enables effective analysis for targeting of policies and funding, where the aim is to tackle or take account of area concentrations of deprivation.

In addition to this Brief Technical Report, the University of Auckland has published online interactive maps to aid in the dissemination of the IMD18. Visitors to the <u>IMD18 website</u> can download the IMD18 as a spreadsheet or shapefile and access interactive maps to look at the deprivation profile of a particular area (neighbourhood, DHB, Territorial Authority, etc.) or to explore a particular dimension of deprivation such as education or housing. Additional resources will be made available at the IMD18 website in due course.

Another measure of deprivation used widely in NZ is the NZDep2018 Index of Deprivation (Atkinson J, 2019). NZDep is derived from census variables that are only produced every 5 years. Users are unable to easily deconstruct and isolate different indicators to understand the association between a given health or social outcome and different categories of deprivation since NZDep provides just one overall measure of deprivation. The New Zealand Indices of Multiple Deprivation (IMD13 and IMD18) were developed specifically in response to both an increasingly uncertain future of national census surveys and to maximise the increasing availability of routine electronic health and social data, allowing us to measure deprivation more directly and more frequently.



Figure 1. Developing the NZ Indices of Multiple Deprivation 2018: An overview of indicators, domains and weights. Adapted from Figure 4.2 SIMD 2012 Methodology, in Scottish Index of Multiple Deprivation 2012. Edinburgh: Scottish Government (Crown copyright 2012).

#### What is the 2018 New Zealand Index of Multiple Deprivation?

The 2018 New Zealand Index of Multiple Deprivation is a set of tools for identifying concentrations of deprivation in NZ. Originally funded by the Health Research Council of New Zealand and updated in 2018 with the support of the Auckland Medical Research Council, the IMD18 uses data routinely collected by many government agencies to populate 29 indicators of deprivation. Most of the data were obtained from the Integrated Data Infrastructure (IDI). The indicators are grouped into seven domains of deprivation, which can be used separately or combined to explore associations between health or social outcomes for small geographical areas known as data zones. The IMD18 and the 2018 data zones are freely available as downloadable spreadsheets or ArcGIS shapefiles. The IMD18 provides a relative ranking for each data zone for each domain of deprivation from 1 (least deprived) to 6181 (most deprived). For mapping purposes, ranks are grouped into quintiles with Q5 representing the 20% most deprived data zones in NZ.

#### New Zealand data zones 2018

In response to the need for a standard neighbourhood level geography, a customised geographical base called data zones was developed in 2013 and updated in 2018. The 2018 version is comprised of 6,181 data zones and can be downloaded from www.fmhs.auckland.ac.nz/imd18/data-zones18

Data zones are not intended to reflect the true extent of actual communities; rather they are an intermediate geography between Census meshblocks and Census Area Units that facilitates small-area analyses of health and social data at a scale small enough to be statistically robust while also conveying a sense of neighbourhood. In suburban areas data zones are just a few streets long and a few streets wide.

2018 data zones exclude oceanic or coastal inlet areas and are comprised of 29,516 SA1 areas (4.78 SA1s per data zone on average) and 52,843 meshblocks (8.55 MBs per data zone on average). They mostly nest within 2013 datazone boundaries and nest within higher geographical units such as General Electoral Districts, Territorial Authorities, District Health Boards (DHB) and Regions.

#### Constructing 2018 data zones

In order to maintain a target population range for 2018 data zones of between 500 and 1200, any 2013 data zones with very low populations were merged with neighbours where possible and those with very high populations were split where possible. Where it was necessary to merge adjacent 2013 data zones because of low populations, the new DZ boundary is comprised of the perimeter of the joined DZs. No meshblocks were split. Combining was not possible for 49 data zones with very low populations (ranging from 399 to 499) due to unsuitable neighbouring data zones, and splitting was not possible for 2 data zones with very high populations (1272 and 1284). 2018 data zones have an average population of 761.

## Indicators and Domains of Deprivation

The IMD18 consists of seven domains of deprivation (employment, income, crime, housing, health, education and access to services). Multiple deprivation "is a combination of more specific forms of deprivation which can be more or less directly measurable" (Townsend, 1987). The following section describes the seven domains and their corresponding indicators. Most indicators focus on March 2018 to coincide with the 2018 census. Key stakeholders such as topic-experts and data managers at multiple government agencies were engaged to help identify and refine potential indicators.

## The Employment Domain

The Employment Domain provides insights into enforced exclusion from employment. 'Employment deprived' people are defined as working age people who want to work but are unable to do so. The Employment Domain uses data from the Ministry of Social Development (MSD) to measure the proportion of working age (aged 15-64) people in each neighbourhood who were receiving Jobseeker Support at a rate of \$44.99 per day or less in March 2018. Proportions for data zones were ranked in order of increasing employment deprivation from 1 (least employment deprived) to 6181 (most employment deprived).

The \$44.99 per day payment threshold is designed to exclude Jobseekers Support recipients who were sole parents with dependent children aged 14-17. This group of people are not eligible for Sole Parent Support but were probably caring for their children at least part-time and thus did not strictly fit our of 'Employment deprived'. They are captured in the Income Domain.

## The Income Domain

The Income Domain uses two indicators to capture the extent of income deprivation in a neighbourhood by measuring the financial assistance provided by the State to those whose income is insufficient. One indicator measures financial assistance provided to beneficiaries by the Ministry of Social Development (MSD) in the form of income-tested benefits and Working for families (WFF) Tax Credits. The other indicator measures financial assistance provided to working people by Inland Revenue in the form of WFF tax Credits, Child Tax Credits and Paid Parental Leave.

Both indicators measure dollars paid per 1000 population in the week ending March 31<sup>st</sup> 2018. The summed totals for each data zone were ranked in order of increasing income deprivation. Calculating the population-weighted level of income support provided by the State in each neighbourhood is preferable to using claimant counts because the former reflects the different dollar values of benefits.

## The Crime Domain

The Crime Domain was constructed using data from the NZ Police's Recorded Crime Victimisation Statistics (RCVS) dataset, which counts victims for the following seven major offence types (% of total victimisations):

- 0.7% Homicide and Related Offences
- 18.6% Assault
- 2.3% Sexual Assault
- 0.2% Abduction and Kidnapping
- 1.4% Robbery, Extortion and Related Offences
- 26.4% Unlawful Entry with Intent/Burglary, Break and Enter
- 51.1% Theft and Related Offences

Counts of victimisation were collected after 30 days of investigation as recommended by Statistics New Zealand (2016), by which time most offences have been confirmed. Victimisations were allocated to data zones using the meshblock of the scene of the offence. An overall victimisation rate (per 1,000) was calculated for each data zone and then ranked in order of increasing victimisations.

## The Housing Domain

This domain comprises of four indicators derived from 2018 census data: the proportion of the household population living in overcrowded households, rented accommodation, damp dwellings, and dwellings lacking basic amenities. Exploratory factor analysis using the maximum likelihood method was then applied to the four ranked indicators, generating the following weights:

- 24% Overcrowding
- 35% Rented
- 25% Dampness
- 16% Lacking basic amenities

Indicator scores were weighted and combined to form housing deprivation scores, which were then ranked.

## The Health Domain

The purpose of the Health Domain is to identify areas with a higher than expected level of ill-health or mortality using routinely collected data from the Ministry of Health. Exploratory factor analysis using the maximum likelihood method was then applied to the five ranked indicators, generating the following weights:

- 9% Emergency Department admissions to hospital
- 59% Acute Hospitalisations related to respiratory diseases with a social gradient
- 13% Acute Hospitalisations related to infectious diseases with a social gradient
- 14% Standardised Mortality Ratio
- 5% Registrations for cancers with a social gradient

Indicator scores were weighted and combined to form health deprivation scores, which were then ranked.

## The Education Domain

The Education Domain consists of five indicators. Three indicators use Ministry of Education data and measure the proportion of school leavers who; left before they were 17 years old; left without an NCEA level 2 equivalent; did not enrol in any level of tertiary studies within 3 years of leaving school. The other two indicators use data from the 2018 census and measure the proportion of youth (15-24 years) Not in Education, Employment or Training (NEET) and the proportion of the working age population without a formal qualification. Exploratory factor analysis using the maximum likelihood method was then applied to the five ranked indicators, generating the following weights:

- 15% School leavers <17 years old
- 11% School leavers without NCEA L2
- 6% School leavers not enrolling into tertiary studies
- 44% Working age people without qualifications
- 24% Youth not in Education Employment or Training

Indicator scores were weighted and combined to form education deprivation scores, which were then ranked.

#### The Access Domain

The Access domain measures the cost and inconvenience of accessing basic services. The geographic co-ordinates of supermarkets and general stores, primary health care providers, service stations, early-childhood centres and primary and intermediate schools were obtained. The distance to the nearest three localities of a given service was then measured. This distance was converted to a score following a negative exponential distribution, to prevent outliers having a disproportionate effect on the overall score. The scores of the three nearest localities for each services were summed and ranked. Exploratory factor analysis using the maximum likelihood method was then applied to the five ranked indicators, generating the following weights:

- 20% Supermarkets
- 21% GPs and A&M
- 24% Service stations
- 16% Early childhood centres
- 19% Primary and intermediate schools

Indicator scores were weighted and combined to form access deprivation scores, which were then ranked.

#### Combining domain scores

Domain ranks were transformed to an exponential distribution to prevent high ranks in one domain 'cancelling out' low ranks in another. These values were then combined using weights that reflect the relative importance of each domain in representing the key determinants of socioeconomic deprivation, the adequacy of their indicators and the robustness of the data that they use. The weights used in 2018 (Figure 1) were the same as the weights for the 2013 IMD (see below) because most of the 29 indicators were either identical or were measuring the same dimension of deprivation slightly differently. Two new indicators for

dampness and amenities have strengthened the 2018 Housing Domain but its 9% weighting still seems reasonable until improved measures of housing suitability, quality, affordability and security become available. The 2018 employment and income indicators are slightly different because the 2013 welfare reforms led to significant changes to benefit categories. However they aim to measure the same aspects of employment and income deprivation.

The weights used in the original 2013 IMD were derived as follows. Given Townsend's [Townsend (1987)13: p.131] observation that although *"people experiencing some form of deprivation may not all have low income, people experiencing multiple or single but very severe forms of deprivation are in almost every instance likely to have very little income and little or no other resources", the Income and Employment (the means to generate income) Domains were given the highest weights at 28% each. The Health and Education Domains have the second highest weights (14%), followed by Housing (9%), and Crime (5%). The Access Domain was given the lowest weight (2%). The weights for each domain are presented here in Table 1.* 

Domain	Weights	% of overall weight	
Employment	12	28	
Income	12	28	
Health	6	14	
Education	6	14	
Housing	4	9	
Crime	2	5	
Geographic access	1	2	
Total	42	100%	

Table 1: Weights used for combining domains in the original IMD13

Combined overall IMD18 scores for each data zone were ranked from 1, the least deprived, to 6181, the most deprived, and then further classified into quintiles (Q1 is the least deprived and Q5 is the most deprived) and deciles to facilitate use of the IMD and its domains in research and policy.

## Validation

We rigorously assessed and mapped indicator and domain scores as they were produced and explored domain distributions, outliers and unusual patterns. We then tested the association between the IMD18 and its domains and cigarette smoking using data from the 2018 census. The Income, Education and Employment Domains had the strongest associations with regular smoking (in that order) and the Access Domain had a weak negative association (see Table 2). Table 2: The correlation between % regular smokers and the IMD18 and its domains:

Spearman Correlation Coefficients, $N = 6181$						
Prob >  r  under HO: Rho=0						
% regular smokers	Rank NZIMD18	Rank Employment	Rank Income	Rank Crime		
	0.84046	0.74438	0.81775	0.40444		
	<.0001	<.0001	<.0001	<.0001		
	Rank Housing	Rank Health	Rank Education	Rank Access		
	0.56221	0.50124	0.84079	-0.02064		
	<.0001	<.0001	<.0001	0.1046		

We also tested the association between the IMD18 and the population weighted average NZDep18 for each data zone (0.9022 p <.0000) and the association between the IMD18 and the IMD13 (0.92667 p <.0001).

## **Strengths and Limitations**

The IMD18 not only measures overall deprivation more comprehensively than existing census-based deprivation indices, it also allows users to explore the 'deprivation profile' of an area in terms of the seven domains of deprivation. Another key strength is that the seven domains can be used individually or together. For example, a health researcher might choose to exclude the Health Domain to avoid circularity if she/he was assessing a health outcome. In addition, the use of routine administrative datasets mitigates issues of bias associated with self-reported data obtained from the census. Furthermore the IMD18 can be updated regularly to remain relevant to societal changes since administrative information is routinely collected.

## Not everyone living in a deprived area is deprived

The IMD18 is not designed to be used as a measure of an individual's wellbeing. It is an area-based measure designed to identify small area concentrations of multiple deprivation. Not everyone living in a deprived area is deprived, and not all deprived people live in deprived areas. In addition, the IMD18 is not designed to convey *how much* more deprived one data zone is than another, nor to suggest whether or not an area is affluent.

The IMD18 can be used to compare all of the data zones in NZ from the least to the most deprived, or to compare large geographical areas (e.g. the *rohe* of your *iwi* or your DHB) by looking at the proportion of the most deprived data zones contained in those areas using an appropriate threshold such as the most deprived 10% or 20%. It can also be used to identify areas that may be deprived in specific domains (e.g. education) even if they are not considered 'deprived' in the overall index.

## **Geographical Variations in Deprivation in New Zealand**

There are clear geographical variations in the distribution of deprivation between the North and South Islands (Figure 2) according to the IMD18. Only 9.04% (134/1483) of data zones in the South Island are severely deprived i.e. among NZ's 20% most deprived (Q5) data zones, compared to 23.46% (1102/4697) of data zones in the North Island.



The distribution of deprivation in New Zealand using the IMD18

Figure 2. IMD18 deprivation in the North and South Islands

There are also variations in the distribution of the IMD18's domains, suggesting that the underlying causes of deprivation are inconsistent throughout NZ. Taking housing deprivation as an example, only 8.36% (124/1483) of data zones in the South Island are among NZ's 20% most housing deprived (Q5), whereas in the North Island, 23.65% (1111/4697) of data zones are Q5 housing deprived (Figure 3).



The distribution of housing deprivation in New Zealand using the IMD18

Figure 3. Housing deprivation in the North and South Islands

Figure 4 shows that there is more education deprivation in the North Island. In the South Island, 16.52% (245/1483) of data zones are among NZ's 20% most education deprived (Q5), while in the North Island, the value is 21.10% (991/4697).



The distribution of education deprivation in New Zealand using the IMD18

Figure 4. Education deprivation in the North and South Islands

The predominance of dark purple in Figure 5 shows that access deprivation affects all rural areas. Access to services is much better in urban areas but towns and cities are hard to see on a large scale map. The South Island has a higher proportion of severely access deprived data zones with 27.78% (412/1483) of data zones among NZ's 20% most access deprived (Q5). By contrast 17.52% (823/4697) of North Island data zones are Q5 access deprived.



The distribution of access deprivation in New Zealand using the IMD18

Figure 5. Access deprivation in the North and South Islands

Online <u>interactive maps of IMD18</u> allow you to look at the deprivation profile of a particular area or to explore a particular dimension of deprivation.

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