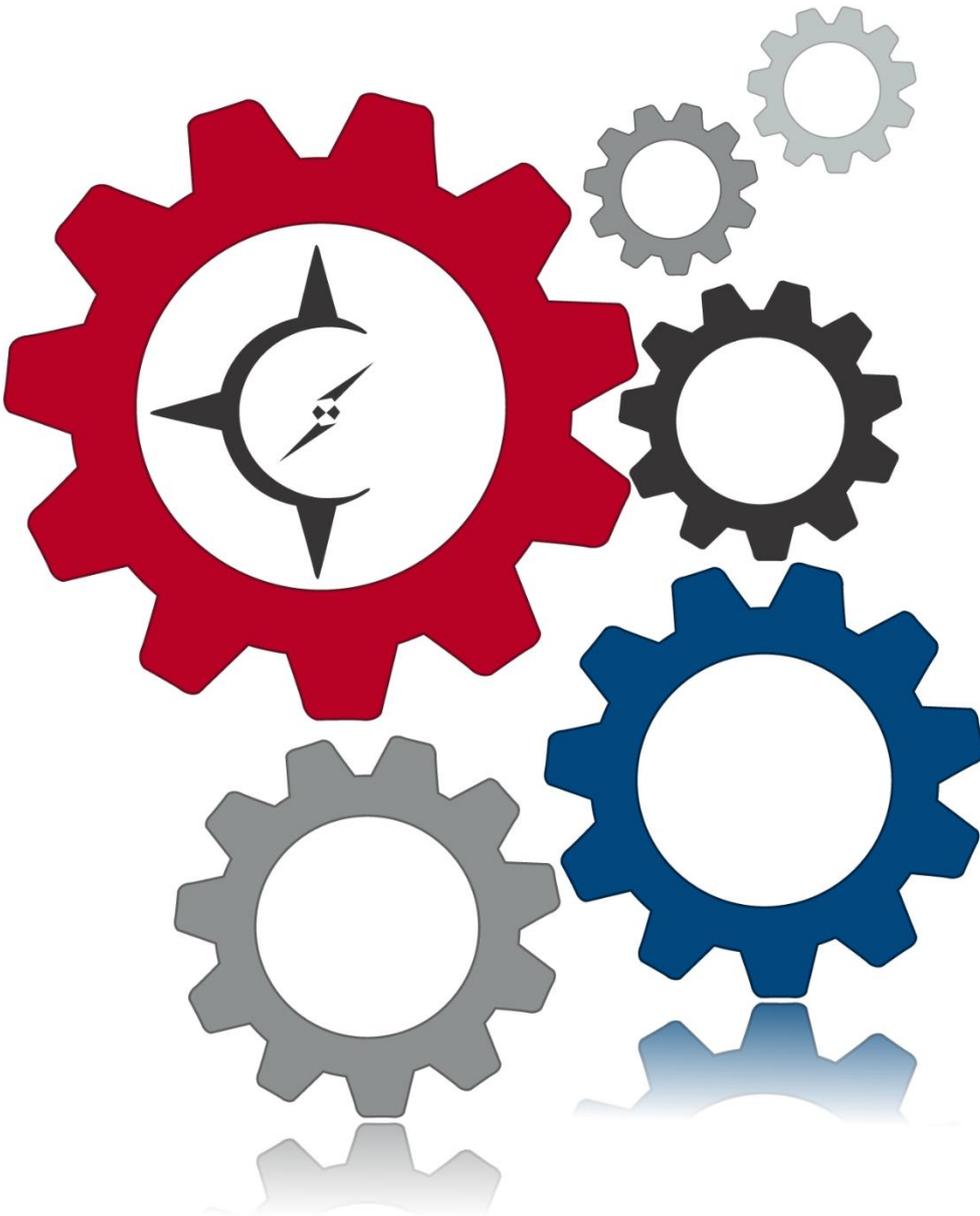# New Zealand Socio-economic Index 2018

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Abbreviations used in this report

ANU4	Australian National University occupational status scale 4
ANZSCO	Australian and New Zealand Standard Classification of Occupations
AUSEI	Australian Socio-economic Index
AUSEI06	Australian Socio-economic Index 2006
IDI	Integrated Data Infrastructure
ISEI	International Socio-economic Index
ISEI-88	International Socio-economic Index 1988
ISEI-08	International Socio-economic Index 2008
MELAA	Middle Eastern, Latin American and African
NZDep	NZDep index of deprivation
NZDep2006	NZDep index of deprivation 2006
NZDep2013	NZDep index of deprivation 2013
NZDep2018	NZDep index of deprivation 2018
NZSEI	New Zealand Socio-economic Index
NZSEI-13	New Zealand Socio-economic Index 2013
NZSEI-06	New Zealand Socio-economic Index 2006
NZSEI-91	New Zealand Socio-economic Index 1991
NZSEI-96	New Zealand Socio-economic Index 1996
NZSCO90	New Zealand Standard Classification of Occupations 1990
NZSCO95	New Zealand Standard Classification of Occupations 1995
SES	Socio-economic status
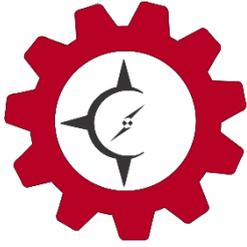
Executive summary

This report describes the construction and initial assessment of the New Zealand socio-economic index 2018 (NZSEI-18), which is an update of the New Zealand socio-economic index (NZSEI) using 2018 Census data. Both NZSEI-18 socio-economic scores (ranging from 10–90) and NZSEI-18 socio-economic groups (a six-group classification, NZSEI-18 quartiles and NZSEI-18 deciles) are described and evaluated.

Section 1 describes background to the NZSEI, outlines the theoretical model that underpins the scale, and details planned assessments of the scale. These assessments include checking the scale is applicable to key population subgroups, confirming that the scale shows expected socio-economic gradients with health and social measures, and ensuring that the extensive use of alternative data sources in the 2018 Census has not adversely affected the measure.

Section 2 describes the variables used to construct NZSEI-18 and cross-tabulates relevant demographic data from the 2018 Census against these variables.

Section 3 describes the construction of NZSEI-18. This was constructed using data for both full- and part-time workers, with income adjustments for those in part-time work. The beta values obtained during construction of NZSEI-18 are presented for each of the regression paths estimated, and comparisons with the NZSEI-13, the AUSEI06 and the international socio-economic index (ISEI) are made. The beta values for the education-occupation and the occupation-income paths were found to be very similar to the NZSEI-13, and close to the AUSEI06 and ISEI values. Pragmatic ways to divide NZSEI-18 scores into discrete categorical occupational socio-economic groups are described in this section. Four-group, six-group, and 10-group categorisations are described.

Section 4 describes three assessments of the finalised NZSEI-18.

First, a comparison between NZSEI-18 and the earlier NZSEI-13 showed that both scales classified occupations almost identically (correlation: $r > 0.99$).

Second, an assessment was undertaken of whether NZSEI-18 methodology assigns scores similarly for men and women, different ethnic groups, different regions, different birthplaces and by disability status. This showed that, despite some differences in average scores, occupations were classified very similarly by sex-specific, ethnic-specific, region-specific, birthplace-specific and disability-specific scales. This suggests that the NZSEI-18 applies to both sexes, these ethnic groups, workers in urban and rural settings, workers in Auckland and the rest of New Zealand, overseas-born and New Zealand-born workers and disabled and non-disabled workers.

Section 5 describes the validation of NZSEI-18 against six constructs – smoking, residential deprivation, housing tenure, hospitalisations, self-rated health and life satisfaction. These analyses revealed expected socio-economic patterning for each of these outcomes, with results strongest for smoking.

Section 6 uses a method for imputing NZSEI-18 scores when data on occupation are unavailable, based on the average NZSEI-18 score by age and education. An evaluation of this method against actual scores and validation of the method against health and socio-economic correlates is shown. These analyses indicated that this method of imputing scores is valid.

Section 7 outlines issues with the 2018 Census data and details additional checks undertaken on the NZSEI-18 to ensure these issues had not negatively affected the scale. These checks indicated that the NZSEI-18 measure is valid and reliable despite the extensive use of alternative data sources in the 2018 Census.

Section 8 concludes the report, with a summary of key findings and their implications, discusses suggested and planned future work, and details advantages and disadvantages of the scale.

Using NZSEI-18

While we recommend that users familiarise themselves with the theoretical underpinnings and methodology prior to using the scale, readers wishing to use NZSEI-18 without learning about its background and construction should see appendices III to V.

Appendix III presents a list of NZSEI-18 scores for each ANZSCO major (1-digit), sub-major (2-digit), and minor group (3-digit) occupation.

Appendix IV presents a list of NZSEI-18 groups for each ANZSCO minor group occupation.

Appendix V presents some brief notes on how to use NZSEI-18 and a table of 'imputed' NZSEI-18 scores to be used for individuals for whom there are no occupational data.
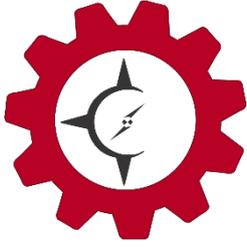
1. Introduction and background to the report

This report describes the construction of an updated version of the New Zealand socio-economic index (NZSEI), an occupation-based measure of socio-economic status (SES). The original version, NZSEI-91, was derived using 1991 Census data (Davis, et al., 1997). Since then there have been three follow-ups: the NZSEI-96 was derived using 1996 Census data (Davis, et al., 2003), the NZSEI-06 was derived using 2006 Census data (Milne, et al., 2013) and the NZSEI-13 was derived using 2013 Census data (Fahy, et al., 2017). This section describes the development of NZSEI, including some results from the most recent NZSEI-13, and outlines the issues to be tackled in the construction of NZSEI-18.

1.1 Development of NZSEI

Theoretical basis

SES is a multidimensional construct that measures access to the social and material resources which affect the position of individuals in society (Galobardes, 2006a). SES is related to a wide range of outcomes and is a key construct in health research in particular, as it has important effects on health outcomes through a range of different avenues (Gottlieb, 2014). These include but are not limited to; neighbourhood characteristics, housing quality, features of the work environment and terms of work, exposure to stressors, and health related knowledge (Braveman & Gottlieb, 2014). SES is often measured using education, income, housing conditions, and occupation, or some combination of these measures (Braveman & Gottlieb, 2014; Galobardes, 2006a).

The NZSEI is an occupation-based measure. Occupation may affect outcomes through many different mechanisms. Occupation is linked to both social standing and income, reflecting access to material resources and social privileges (Galobardes, 2006). Occupation may also affect health through more direct pathways, such as via working conditions, hazards (e.g. exposure to toxins) and workplace stressors (Galobardes, 2006a). One of the key advantages of occupation measures is that occupation data is commonly collected in routine collections (Galobardes, 2006a). The major disadvantage of occupation measures is that a large proportion of the population is not formally employed at any given time, including retired adults, students and those caring for family members (Galobardes, 2006a). A method of imputing NZSEI scores for those not in the labour market is described in Section 6.

The forerunner of NZSEI was the widely-used Elley-Irving scale (Elley & Irving, 1972; 1976; 1985; Irving & Elley, 1977), which assigned occupations into one of six SES groups based on equal weighting of the education level and income associated with each occupation. NZSEI represented an attempt to derive an occupation-based measure of SES for New Zealand that could be used both as a continuous or group measure and was grounded on a conceptual model that differed slightly from the Elley-Irving framework, as described in the 'Statistical algorithm' section below.

The framework used for NZSEI is the 'returns to human capital' model, which was first developed for the international socio-economic index (ISEI; Ganzeboom, et al., 1992). This model posits that there is a relationship between cultural capital (i.e. education) and material rewards (i.e. income) and that this relationship is mediated by occupation. More simply, the 'returns to human capital' model views occupation as the means by which one's education is converted into income. Thus, differences in occupation are likely to represent differences in life chances and opportunity, and on this basis occupation can be used to stratify individuals according to socio-economic status.

Statistical algorithm

Operationalising the 'returns to human capital' model involves specifying the path model developed for the ISEI by De Leeuw in an appendix to Ganzeboom, et al. (1992). Regression equations are estimated in which the effect of education on income is assumed to be entirely mediated by occupation. The effect of age is controlled in analyses because of its confounding relationship with education and income (i.e. older people tend to have fewer qualifications but higher incomes). The model is represented in Figure 1.

Figure 1. Representation of the NZSEI path model
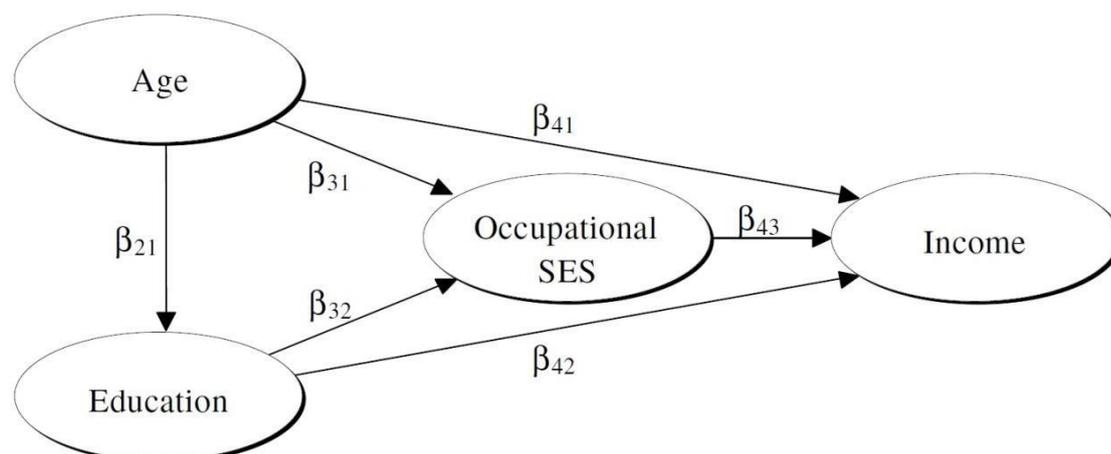
The arrows linking the variables are represented in the algorithm as regression coefficients. The model as a whole is represented by a series of linear regression equations. The analysis is run at the occupational, rather than the individual, level. The assumption that the effect of education on income is entirely mediated through occupation is implemented by setting β_{42} to zero. Values of the unobserved occupational score are then estimated – together with the remaining beta coefficients – by minimising the residual sum of squares. This minimisation essentially produces occupational scores with the least 'error' (in estimating the effect of education on income through occupation) and can be thought of as representing an optimal weighting of education and income, controlling for age. Occupation scores are then scaled to range from 10–90 (to match the ISEI). Note that the approach taken by the NZSEI algorithm contrasts with the Elley and Irving approach, in that for the Elley and Irving occupational SES scales the weighting of education and income is not optimised but is instead made equal.

All iterations of the NZSEI have employed this algorithm to construct the NZSEI, using Census data for the corresponding year. The algorithm requires the mean age, income, and education levels for workers in each occupation. The requisite variables were treated in the following ways:

- Age was measured in years from 21–69.
- Income was calculated as the logged total income before tax from all sources.
- Education was converted into years of education, using a scale from the Ministry of Education.
- NZSEI-06 and NZSEI-13 (Fahy, et al., 2017; Milne, et al., 2013) classified occupations to the minor group level of the Australian and New Zealand Standard Classification of Occupations (ANZSCO; Australian Bureau of Statistics & Stats NZ, 2006) classification scheme. NZSEI-91 and NZSEI-96 (Davis, et al., 1997; Davis, et al., 2003) used the New Zealand Standard Classification of Occupations (NZSCO: Department of Statistics, 1992; Stats NZ, 1995), also classified to the minor group level.

Results of the occupational scoring exercise for 2013

By way of background, construction details and descriptive results are presented here for NZSEI-13 only. Readers are referred to Davis, et al. (1997; 2003) for construction details and descriptive results for NZSEI-91 and NZSEI-96, and to Milne, et al. (2013) for construction details and descriptive results for the NZSEI-06.

NZSEI-13 scores were derived by analysing data from 1,716,147 full- and part-time workers aged 21–69 years. Scores were initially calculated for the full-time workforce alone and then recalculated after adding in the part-time workforce. The incomes of part-time workers were inflated to a full-time equivalent. Final scores were assigned to 97 minor group (three-digit) occupations from ANZSCO and scaled to range from 10 (low SES) for Packers and Product Assemblers (minor group 832) to 90 (high SES) for Medical Practitioners (minor group 253). The results were also centred (so that the mean was around 50) by taking the square root of the original scores. NZSEI-13 scores for occupations at the sub-major group (two-digit) level of ANZSCO are presented in Table 1. Six SES 'groups' were determined from NZSEI-13 scores, in line with the Elley and Irving scale (see Table 2).

A comparison of the NZSEI-06 and NZSEI-13 scores revealed that NZSEI-13 assigned socio-economic scores to occupations very similarly to NZSEI-06 (the scores correlate at r = 0.99). The similarity in scores reflects the similarity in the relative influence of education and income in assigning socio-economic scores. The relative influence of education and income was also similar between NZSEI-13 and various international occupational socioeconomic indices (ISEI-88, ISEI-08, AUSE106, and ANU4).

NZSEI-13 was tested against 2013 Census data on smoking, housing tenure and residential deprivation to see if it could replicate known socio-economic patterns for these indicators. NZSEI-13 validated well against smoking, housing tenure, and residential deprivation, with results clearest for smoking and residential deprivation (Fahy, et al., 2017). Moreover, these patterns were apparent for both men and women of each major ethnic group.

To test the robustness of the NZSEI-13 scale, comparisons were undertaken between scales constructed separately for men and women, and for European, Māori, Pacific, Asian and Middle Eastern/Latin American/African (MELAA). These comparisons revealed some minor sex and ethnic differences, but overall the scale classified occupations similarly for men and women, and for these ethnic groups. Additionally, the robustness of the NZSEI-13 was tested using several subgroup classifications which had not been previously assessed: rural/urban, Auckland/rest of New Zealand, and NZ born/born overseas. These analyses also suggested similar socioeconomic structuring of occupations for these population subgroups, despite some minor differences in occupational scores.

Table 1. NZSEI-13 results aggregated at ANZSCO sub-major group (two-digit level)

ANZSCO code	ANZSCO sub-major group	NZSEI-13 aggregated score
11	Chief Executives, General Managers and Legislators	61
12	Farmers and Farm Managers	37
13	Specialist Managers	60
14	Hospital, Retail and Service Managers	43
21	Arts and Media Professionals	60
22	Business, Human Resource and Marketing Professionals	69
23	Design, Engineering, Science and Transport Professionals	69
24	Education Professionals	74
25	Health Professionals	76

ANZSCO code	ANZSCO sub-major group	NZSEI-13 aggregated score
26	ICT Professionals	68
27	Legal, Social and Welfare Professionals	73
31	Engineering, ICT and Science Technicians	55
32	Automotive and Engineering Trades Workers	37
33	Construction Trades Workers	32
34	Electrotechnology and Telecommunication Trades Workers	46
35	Food Trades Workers	25
36	Skilled Animal and Horticultural Workers	34
39	Other Technicians and Trades Workers	37
41	Health and Welfare Support Workers	51
42	Carers and Aides	31
43	Hospitality Workers	30
44	Protective Service Workers	47
45	Sports and Personal Service Workers	47
51	Office Managers and Program Administrators	48
52	Personal Assistants and Secretaries	45
53	General Clerical Workers	46
54	Inquiry Clerks and Receptionists	37
55	Numerical Clerks	50
56	Clerical and Office Support Workers	38
59	Other Clerical and Administrative Workers	47
61	Sales Representatives and Agents	47
62	Sales Assistants and Salespersons	34
63	Sales Support Workers	32
71	Machinery and Stationary Plant Operators	27
72	Mobile Plant Operators	19
73	Road and Rail Drivers	25
74	Storepersons	22
81	Cleaners and Laundry Workers	12
82	Construction and Mining Labourers	28
83	Factory Process Workers	17
84	Farm, Forestry and Garden Workers	24
85	Food Preparation Assistants	11
89	Other Labourers	19

Source: Fahy, et al., 2017

Table 2. Distribution of workforce over NZSEI groups, 2013 Census

Group	NZSEI-13 range	Percent of population
1	73–90	8.7
2	65–72	13.9
3	48–64	24.2
4	35–47	25.2
5	23–34	17.6
6	10–22	10.4

Source: Fahy, et al., 2017

1.2 Issues for resolution in NZSEI-18 study

Repeating subgroup analyses from previous NZSEI scales

Previous versions of the NZSEI scale examined the applicability of the NZSEI for different population subgroups. Systematic differences between groups may result in the overall scale capturing the socio-economic structuring of occupations more or less well for some groups. For example, ethnic-specific subscales tested for previous versions of the NZSEI scale have shown that workers who identify with an Asian ethnic group are assigned higher occupational scores, despite receiving less income (Fahy, et al., 2017; Milne, et al., 2013). This appears to be due to Asian workers having higher average levels of education within an occupation and is associated with a greater share of this population having been born overseas (Bolton, 2014; Fahy, et al., 2017; Milne, et al., 2013).

To construct subgroup-specific subscales, the NZSEI path coefficients estimated for the overall population are applied to data on the mean age, income and education level at the occupational level for each population subgroup. This produces NZSEI scores for each population subgroup which are relative to other subgroups within a subgroup set (e.g. the Asian-specific subgroup scores are relative to scores for the other ethnic groups). This allows for comparisons of average scores and differences in scores assigned to the same occupation. Similar socio-economic patterning of occupations across population subgroups indicates the overall scale will be appropriate for assigning socio-economic scores for the examined groups. It should be noted that the use of the overall betas to estimate subgroup scores assumes similar socio-economic relationships between education, income and occupation across groups.

Some form of gender and ethnic group specific subscales have been examined in all previous iterations of the NZSEI (Davis, et al., 1997; Davis, et al., 2003; Fahy, et al., 2017; Milne, et al., 2013). Gender and ethnicity are important dimensions of social stratification in New Zealand and there are well-known discrepancies in education and income levels across gender and ethnic groups. For NZSEI-18, separate subscales will be created for men and women, and for five Level 1 ethnic groups: European (70.9 percent of workers aged 21–69 identified as European), Māori (12.9 percent), Pacific (6.3 percent), Asian (15.7 percent) and MELAA (1.5 percent). The Other ethnic group (1.4 percent) will not be examined.

Importantly, ethnic groups are not mutually exclusive, and the extent to which individuals identify with more than one ethnic group differs across ethnic groups as well as by age. Among workers aged 21–69, identifying with at least two ethnic groups was most common among those who identified as Māori at 50.9 percent, followed by Pacific at 26.4 percent, MELAA at 11.8 percent, European at 10.7 percent and Asian at 4.7 percent. Those identifying with multiple ethnic groups tended to be younger.

The median age for workers aged 21–69 was 43 for those identifying with one ethnic group, 37 for those identifying with two ethnic groups and 32 for those identifying with three or more ethnic groups.

NZSEI-13 added several new subgroup analyses: urban and rural workers, Auckland workers and workers in the rest of New Zealand, as well as workers born overseas and workers born in New Zealand. These analyses will be repeated for NZSEI-18.

In 2018, 81.1 percent of workers aged 21–69 were living in urban areas, compared to 18.9 percent living in rural areas. Analyses conducted for NZSEI-13 demonstrated that there were important differences between these workforces in the distribution of education, income and occupations (Fahy, et al., 2017). Usual residence will be used to classify whether workers live in urban or rural areas. It should be noted that some workers may live in one type of area and commute to a different type of area for work. The following area categories were classified as urban: large urban areas, major urban areas, medium urban areas and small urban areas. The following area categories were classified as rural: rural other, rural settlement, inland water, inlet, and oceanic (there were only very small numbers of respondents in the latter three categories and hence rural and water areas were combined).

Just over a third of workers aged 21–69 in New Zealand lived in Auckland, at 34.1 percent in 2018. Compared to the rest of New Zealand, Auckland has a younger median age, is much more diverse ethnically with half of all migrants arriving in New Zealand living in the Auckland region, and has higher incomes but also a higher percent of income spent on housing (Stats NZ, 2015). Similarly to the analysis by rurality, analyses undertaken for the NZSEI-13 showed that income, education and occupation were distributed differently for Auckland workers compared to those living in the rest of New Zealand.

In 2018, almost a third of workers (32.8 percent) aged 21–69 were born overseas. Given overseas-born workers tend to have high levels of education but are often employed in low paying occupations (Bolton, 2014), it may be expected that there are differences in occupational structuring for workers born overseas and those born in New Zealand.

New analyses specific to NZSEI-18

Subgroup analysis by disability status
In addition to the subgroup analyses detailed above, separate NZSEI subscales will be constructed by disability status. Disabled people differ from non-disabled people on key characteristics relating to socio-economic status. Disabled people are less likely to be employed than disabled people and both the unemployment and underutilisation rates are substantially higher for disabled people than for non-disabled people (Stats NZ, 2020a). Disabled workers tend to work in less well-paid occupations and to work fewer hours per week on average (Stats NZ, 2017; 2020a), and are more likely to be self-employed than non-disabled workers (Stats NZ, 2017). Notably, while there is a large income gap between income for all sources for disabled people and non-disabled people overall, the income gap is smaller when comparing wages and salaries among those who are employed (Stats NZ, 2020a). Importantly, disabled people are less likely to have formal qualifications, and are older, on average (Stats NZ, 2020a).

The 2018 Census uses the Washington Group Short Set to identify people who are likely to be disabled (Stats NZ, 2020a). This scale assesses activity limitations across six domains: vision, hearing, walking or climbing steps, remembering or concentrating, washing or dressing, and communicating (Washington Group, 2016). These questions do not attempt to identify all people with disabilities (Washington Group, 2016). Instead, the aim is to use a limited set of questions on common functional limitations to identify a population more likely to be at risk of being disabled (Washington Group, 2016). This population can then be used to enable comparisons to the general population in key policy areas, such as access to employment, education and family life (Washington Group, 2016). This measure is therefore appropriate for broadly assessing whether the NZSEI-18 is applicable to disabled people who are in employment but should not be assumed to capture all disabled people.

It is important to note that as the 2018 Census questions do not classify all people with disabilities as disabled, counts based on this variable should not be taken as representing the percentage of the population with a disability (Stats NZ, 2020a). Disability prevalence estimates from the 2013 Disability Survey, which includes more comprehensive measures of disability, are far greater than prevalence

estimates of disability found using the Washington Group Short Set in the 2018 Census and recent Stats NZ surveys (Stats NZ, 2020a).

Additionally, there was considerable missing data for the variables assessing activity limitations in the 2018 Census, with 16.4 percent of records missing disability information among workers aged 21–69. Only 2.9 percent of workers aged 21–69 with disability information were classified as disabled in the 2018 Census. While this partially reflects the limited nature of the Washington Group Short Set and the lower employment levels among disabled people, it is possible that this low figure also partially reflects higher non-response to the 2018 Census among disabled workers (please see the next section for a discussion of response rates in the 2018 Census).

Examining the effect of alternative data in the 2018 Census
There were a number of operational issues with the 2018 Census which negatively impacted on response rates with particular impact on some population groups. Where it was possible and Stats NZ considered it justifiable to do so, missing Census data was supplemented from one or more of three alternative data sources:

  (i) administrative data (from the Integrated Data Infrastructure, IDI),
 (ii) the 2013 Census
(iii) nearest neighbour 'donor' imputation (that is, where a person that was similar to the person with missing census data was identified, and their data copied across; Stats NZ, 2019).

Records of all workers aged 21–69 with data on the four key variables (occupation, education, income and age) will be used to construct NZSEI-18. However, it is important to check that differences between data from alternative sources and data from 2018 Census forms will not affect the validity and reliability of the NZSEI-18. The quality of the occupation data was especially concerning, as 19.6 percent of records for this variable were imputed for workers aged 21–69. It is important to note that excluding records with supplemented data would have been problematic as Census non-response was not equally distributed throughout the population. In particular, those identifying with Māori and Pacific and – to a lesser extent – Asian ethnic groups, young adults, and those living in deprived neighbourhoods were more likely to have had their Census data supplemented with data from other sources. Excluding these records could lead to bias in the scale and to it performing poorly for these groups.

To check that the use of alternative data did not have a detrimental effect on the scale, two additional cohorts will be constructed based on data source. The first will consist of records whose data for occupation and income were sourced solely from 2018 Census forms. The second will consist of records where occupation and/or income was supplemented using additional data sources.

The construction of these cohorts will not take into account whether education data was supplemented, as the data sources indicator for education was split into two different variables in the 2018 Census file depending on whether the qualifications were school level or post-school level. This means it is difficult to determine whether an individual's education value was supplemented, as it would also depend on their highest qualification level. However, as most (around 80 percent) of workers who had occupation and/or income supplemented from alternative sources also had education supplemented, the failure to identify whether education data was supplemented with alternative data sources should have little impact on the constructed cohorts.

In addition, individual NZSEI scales will be constructed for each of these groups, allowing the relationships between education, occupation and income to vary across groups. The validity of each of the individual scales will be checked against smoking and NZDep2018 to ensure that the Census data and alternative data scales show the expected socioeconomic patterning.

In addition to the variables needed to construct the NZSEI-18, other variables used for subgroup and validation analyses were also affected by non-response. These variables have either had data supplemented or have large amounts of missing data. These variables are identified where applicable throughout the text and are also detailed in Section 7, which assesses the impact of the use of alternative data.

Extension of NZSEI to individuals outside the labour market
To allow NZSEI scores to be assigned to those outside of the labour market, the NZSEI-06 and NZSEI-13 scales calculated imputed scores using the mean NZSEI scores for each age by education level category. The imputed scores correlated with the actual scores and validated against health and socioeconomic correlates. This method will be extended to the NZSEI-18 with minor modification.

1.3 Planned validation of NZSEI-18

Validation with health outcomes

The NZSEI-13 was validated against one health behaviour: smoking. We will replicate this analysis in the current study. As discussed in Section 1.2, many variables in the 2018 Census were supplemented with data from alternative sources to mitigate issues with non-response. It is worth noting that only 83.5 percent of workers aged 21–69 had regular smoking information from 2018 Census forms. The remainder had regular smoking data from the 2013 Census (8.6 percent) or regular smoking data had been imputed (7.9 percent). As levels of smoking have been decreasing through time, it is likely using historical data for smoking may overstate the level of smoking to some extent (2018 Census External Data Quality Panel, 2019). The imputation method used for regular smoking should accurately reproduce the population level of smoking and distribution of smoking by key characteristics (2018 Census External Data Quality Panel, 2019). It will misclassify some individuals, however. Importantly, Māori, Pacific, MELAA and young people were especially likely to have had their smoking data supplemented with alternative data sources, and data quality for these groups may be lower than for the overall population (2018 Census External Data Quality Panel, 2019).

As was the case in 2013, data on other health indicators are not available from the 2018 Census. Unlike earlier versions of the NZSEI, we are able to use the Integrated Data Infrastructure (IDI) to access a wider range of outcomes with which to validate the NZSEI-18. The IDI is a database containing administrative and survey data that is linked at the individual level (Stats NZ, 2013). We will access two additional health outcomes using the IDI: any hospitalisations during 2018 from the Ministry of Health publicly funded hospital discharges data set and self-rated health from the 2018 General Social Survey. The publicly funded hospital discharges data set will be linked to the 2018 Census at the individual level. The General Social Survey will be analysed as a stand-alone data set. This survey collected occupation data, which was coded using the ANZSCO scheme. This allows NZSEI-18 scores to be assigned to individuals. All models using General Social Survey data will be adjusted to take into account the survey's complex sampling design.

Validation with correlates of SES

The NZSEI-13 was also validated against other correlates of SES, including housing tenure and an area-based measure of deprivation, the New Zealand Index of Deprivation (NZDep). These analyses will be repeated for validating the NZSEI-18. Housing tenure was classified into renting (not owning and not holding in a family trust) or not renting (either holding in a family trust or owning or partly owning) the home that the respondent lives in. Due to issues with non-response in the 2018 Census, 16.9 percent of workers aged 21–69 were missing data on this variable. We will also validate the NZSEI-18 against life-satisfaction which was measured as part of the 2018 General Social Survey.

Deprivation

Area based measures can be thought of as measuring the SES of an area, and may have independent effects on outcomes above individual SES (Galobardes, 2006b). These measures are often constructed by aggregating information for individuals or households (e.g. proportion of individuals unemployed, proportion of households which are overcrowded) within an area unit to classify small areas along a continuum of deprivation (Galobardes, 2006b). These measures are often used to allocate public resources and are sometimes used as a proxy for individual SES (Galobardes, 2006b).

In New Zealand, the New Zealand Indices of Deprivation are a series of socio-economic scales based on deprivation levels in area units that have been developed for each of the 1991–2018 Censuses. These are called NZDep91, NZDep96, NZDep2001, NZDep2006, NZDep2013 and NZDep2018, respectively (Crampton, et al., 1997; Salmond, et al., 1998; Salmond & Crampton, 2002; Salmond, et al., 2007; Atkinson, et al., 2014; Atkinson, et al., 2019). NZDep2018 used 9 variables to classify area units, which related to internet access, income, means tested benefits, unemployment, lack of qualifications, renting, living in a single-parent family, overcrowding, and dampness and mould (Atkinson, et al., 2019). NZDep2018 was calculated using Statistical Area 1 (SA1) geographical units, which typically encompass around 100 to 200 people (Atkinson, et al., 2019). In the scale version of these indexes, each SA1 (or meshblocks for previous NZDep scales) in New Zealand was assigned a score from 1 (least deprived) to 10 (most deprived), with roughly the same number of SA1s in each of the 10 categories (Atkinson, et al., 2019).

The NZSEI-13 validated well against the NZDep2013, and it is expected that the NZSEI-18 will validate well against the NZDep2018. Specifically, we expect to find an 'SES-gradient', whereby lower NZSEI-18 scores are expected to be associated with increasing levels of deprivation.

1.4 Summary

NZSEI-18 will be constructed using 2018 Census data and the methodological approach adopted in the development of its predecessor, NZSEI-13. However, additional checks will be carried out to investigate the impact of the use of alternative data sources on the scale.

Validation of NZSEI-18 will focus on smoking, deprivation, housing tenure, hospitalisations, self-rated health and life-satisfaction. As with NZSEI-13, we will try to derive socio-economic scores for the economically inactive and others for whom no occupational data are recorded. The construction and assessment of NZSEI-18 are described in the following sections of this report.
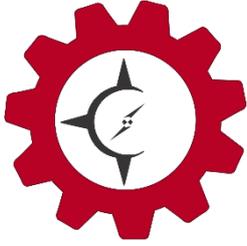
2. NZSEI-18 dataset

This section presents tabulated and cross-tabulated data on the 2018 Census variables used to construct NZSEI-18: education, income, and occupation. These variables will be compared against data from the 2013 Census used for the most recent NZSEI (NZSEI-13), and cross-tabulated against sex, ethnicity, rurality, region (Auckland versus the rest of New Zealand), country of birth and disability status using 2018 Census data. It should be noted that the data from the 2018 Census includes both full-time and part-time workers aged 21–69.

2.1 Summary

Education

As with the previous NZSEI versions, Census data on educational qualification need to be converted into years of education for the NZSEI-18 statistical algorithm. The conversion for the 2018 Census is the same as for 2013 and is shown in Table 3.

Table 3. Educational classifications converted to years of education, 2018 Census

Highest qualification	Years of education
Doctorate degree	20
Master's degree	18
Post-graduate and honours degree	17
Bachelor's degree and level 7 qualification	16
Level 6 diploma	14.5
Level 5 diploma	13.5
Level 4 certificate gained post-school	12.5
Level 3 certificate gained post-school	11.5
Level 2 certificate gained post-school	11.5
Level 1 certificate gained post-school	11.5
Overseas secondary school qualification	12
Level 3 or 4 certificate gained at school	13
Level 2 certificate gained at school	12
Level 1 certificate gained at school	11
No school qualifications	10

Source: *Stats NZ, 2018 Census*

Table 4 shows the distribution of male and female workers by highest education qualification for the 2018 Census. The percentage of women with university degrees was greater than for men (37.8 percent vs. 27.5 percent). Women were less likely than men to have no formal qualifications (9.3 percent vs. 12.9 percent).

Table 4. Highest qualification and years of education, workers aged 21–69 years, 2013 and 2018 Censuses

2018 Census (Percent)				2013 Census (Percent)			
Highest Qualification	**Men**	**Women**	**Total**	**Highest qualification**	**Men**	**Women**	**Total**
Doctorate degree	1.1	1.0	1.0	Doctorate degree	1.1	0.8	1.0
Master's degree	4.4	5.1	4.7	Master's degree	3.6	3.8	3.7
Post-graduate and honours degree	6.3	9.3	7.7	Post-graduate and honours degree	3.3	5.0	4.1
Bachelor's degree and level 7 qualification	15.8	22.5	19.0	Bachelor's degree and level 7 qualification	15.7	21.6	18.6
Level 6 diploma	4.8	5.8	5.3	Level 6 diploma	4.3	7.0	5.6
Level 5 diploma	6.4	5.4	5.9	Level 5 diploma	5.5	5.4	5.5
Level 4 certificate	13.7	7.0	10.5	Level 4 certificate gained post-school	17.2	6.6	12.0
Level 3 certificate	10.6	10.1	10.3	Level 3 certificate gained post-school	1.9	2.5	2.2
Level 2 certificate	9.4	9.7	9.6	Level 2 certificate gained post-school	0.9	1.0	1.0
Level 1 certificate	9.5	9.7	9.6	Level 1 certificate gained post-school	0.3	0.4	0.4
Overseas secondary school qualification	5.2	5.1	5.2	Overseas secondary school qualification	5.8	5.8	5.8
				Level 3 or 4 certificate gained at school	5.9	5.6	5.8
				Level 2 certificate gained at school	8.6	10.0	9.3
				Level 1 certificate gained at school	10.6	12.7	11.6
No school qualifications	12.9	9.3	11.2	No school qualifications	15.3	11.7	13.6
Total	100	100	100	Total	100	100	100

Source: Stats NZ, 2013 and 2018 Censuses

Table 4 also shows the distribution of workers by highest education qualification for the 2018 and 2013 Censuses. There were some small changes to the highest qualification distribution for New Zealanders from 2013 to 2018. The 2018 Census showed an increase in the percentage of workers classified as having a post-graduate/honours degree/bachelor's degree (from 4.1 percent to 7.7 percent), and a decrease in the percentage with no school qualifications (from 13.6 percent to 11.2 percent). The small change in the categorisation of school qualifications in this report compared to its predecessors (which is discussed in Section 6), makes it slightly more difficult to compare trends in these qualifications. There is a notable decrease in Level 1 certificates (from 12.0 percent to 9.6 percent) and a slight decrease in Level 2 certificates (from 10.3 to 9.6) between 2013 and 2018, and an increase in Level 3 certificates (from approximately 8 percent to 10.3 percent).

Income

Table 5 shows the income distribution for male and female full- and part-time workers as recorded in the 2018 Census. Note that this includes income from all sources, not just income from paid employment. Among workers, proportionately more women (61.7 percent) than men (41.7 percent) were in the bottom half of the income distribution (up to $50,000 per year). The largest percentage of women (14.1 percent) reported earning between $40,001 and $50,000, whereas the largest percentage of men (18.0 percent) reported earning between $70,001 and $100,000.

Table 5. Percentage of workers in various income bands, workers aged 21–69 years, 2013 and 2018 Censuses

Income ($NZ)	2018 Census Recorded Income (Percent)			2013 Census Recorded Income (Percent)		
	Men	Women	Total	Men	Women	Total
Nil income	0.3	0.3	0.3	0.4	0.3	0.4
Loss	0.3	0.5	0.4	0.3	0.5	0.4
1–5,000	1.6	2.8	2.1	1.4	3.0	2.2
5,001–10,000	1.8	3.5	2.6	1.8	4.2	3.0
10,001–15,000	2.5	4.9	3.6	2.6	5.8	4.1
15,001–20,000	3.2	6.4	4.7	3.3	7.0	5.1
20,001–25,000	3.3	6.7	4.9	3.9	7.8	5.8
25,001–30,000	3.9	7.2	5.5	5.2	8.4	6.7
30,001–35,000	4.5	7.0	5.7	6.2	8.1	7.1
35,001–40,000	6.5	8.2	7.3	8.3	8.9	8.6
40,001–50,000	13.6	14.1	13.9	14.6	13.9	14.3
50,001–60,000	13.2	11.5	12.4	12.7	10.3	11.5
60,001–70,000	10.7	8.3	9.5	9.8	7.6	8.8
70,001–100,000	18.0	11.8	15.0	15.4	9.3	12.5
100,001–150,000	9.9	4.5	7.4	8.3	3.2	5.8
150,001 or more	6.6	2.2	4.5	5.5	1.5	3.6
Total	100	100	100	100	100	100

Source: Stats NZ, 2013 and 2018 Censuses

The income distribution for the 2013 and 2018 Censuses are also compared in Table 5. Fewer of the workforce reported earning up to $20,000 per year in 2018 (13.9 percent) compared with 2013 (15.2 percent). Additionally, a greater percentage of the full- and part-time workforce combined in 2018 earned more than $50,000 (48.8 percent) compared with 2013 (42.2 percent). Inflation from quarter 1 2013 to quarter 1 2018 was 5.6 percent (Reserve Bank of New Zealand, 2020). Given the relatively low level of inflation over this period, the shift towards a greater share of the population reporting income within higher income bands (i.e. those above $50,001) does not appear to have been entirely driven by inflation. It is important to note that the use of supplemental data for income in the 2018 Census may have affected the time series for income to some extent (2018 Census External Data Quality Panel, 2019).

Table 6 shows the distribution of income split by gender and work-time status. As expected, a greater share of full-time workers than part-time workers reported incomes towards the higher end of the income distribution. Differences in the distribution of income by gender remained evident when split by work-time status.

Table 6. Percentage of workers in various income bands by gender and work-time status, workers aged 21–69, 2018 Census

2018 Census recorded income (Percent)

Income ($NZ)	Men full-time	Women full-time	Men part-time	Women part-time
Nil income	0.3	0.2	0.7	0.4
Loss	0.2	0.3	1.0	1.0
1–5,000	1.0	1.2	7.3	6.7
5,001–10,000	1.0	1.4	9.3	8.6
10,001–15,000	1.4	1.9	12.8	12.1
15,001–20,000	2.0	3.0	14.3	14.8
20,001–25,000	2.5	4.1	10.7	13.2
25,001–30,000	3.4	5.8	8.1	10.6
30,001–35,000	4.4	6.9	5.6	7.2
35,001–40,000	6.7	9.1	5.3	6.2
40,001–50,000	14.3	16.9	7.2	7.2
50,001–60,000	14.0	14.3	5.1	4.5
60,001–70,000	11.4	10.6	3.4	2.8
70,001–100,000	19.4	15.5	4.6	2.9
100,001–150,000	10.7	5.9	2.5	1.1
150,001 or more	7.0	2.8	2.3	0.7
Total	100	100	100	100

Source: Stats NZ, 2018 Census

For the NZSEI-18 statistical algorithm, the log of total income from all sources will be used, so a mid-point in each income band was assigned using data on actual income supplied by Stats NZ. An income mid-point is the estimated median value for incomes within each of the specified bands. These mid-points were calculated using data from the Household Labour Force Survey, and were rounded to the nearest $1,000 to reduce disclosure risk. Individuals reporting zero or negative incomes were given a value of $100 so the log of income could be determined. The mid-points assigned to the income bands are shown in Table 7.

Table 7. Income bands and assigned mid-points, 2018 Census

Income bands ($NZ)	Mid-points
Nil income	100
Loss	100
1–5,000	1,000
5,001–10,000	8,000
10,001–15,000	12,000
15,001–20,000	18,000
20,001–25,000	23,000
25,001–30,000	27,000
30,001–35,000	32,000
35,001–40,000	38,000
40,001–50,000	45,000
50,001–60,000	55,000
60,001–70,000	65,000
70,001–100,000	81,000
100,001–150,000	120,000
150,001 or more	213,000

Source: *Stats NZ, Household Labour Force Survey 2017/2018*

To incorporate data for part-time workers, defined as those working fewer than 30 hours per week, into the construction of NZSEI-18, an adjustment to their income was necessary. Using the same method used for NZSEI-96, NZSEI-06 and NZSEI-13 (Davis, et al., 2003; Fahy, et al., 2017; Milne, et al., 2013), the median number of weekly hours worked by full-time workers was calculated (median = 40 hours) and the income of part-time workers inflated to a full-time equivalent, by multiplying them by 40 and dividing by the number of hours worked.

As previously noted, income from all sources was used for constructing the NZSEI, as income from main occupation only is not available in the Census. Among those aged 21–69, part-time workers were more likely than full time workers to report more than one income source (43.0 percent compared to 28.1 percent). A slightly larger percentage of part-time workers reported receiving income from their own business (24.7 percent compared to 19.7 percent) and a slightly lower percentage of part-time workers reported receiving income from wages or salaries as employees (77.2 percent compared to 86.0 percent). A greater share of part-time workers reported receiving income from NZ superannuation, pensions and benefits.

To guard against over-inflation of part-time incomes (e.g. where part-time incomes are unusually large for the hours worked), part-time workers whose implied hourly incomes were either smaller than the first percentile or larger than the ninety-ninth percentile for full-time workers were excluded from the analysis (as has been done for previous versions of the NZSEI).

Table 8 shows the adjusted income variable transformed back into income bands for men and women to demonstrate the impact of inflating part-time incomes. This shows that the income adjustment has shifted the income distribution upwards for both men and women while largely maintaining income

patterns by gender. As income values must be positive to allow them to be logged, respondents who reported no income or negative income were assigned a mid-point of $100. This means that none of the adjusted incomes were in the nil income or loss categories. Appendix VI presents adjusted income in bands by major group occupation and for the other population subgroups examined in this report.

Table 8. Percentage of workers in various income bands after income adjustments, workers aged 21–69 years

2018 Census

Adjusted Income (Percent)

Income ($NZ)	Men	Women	Total
1–5,000	2.0	2.6	2.3
5,001–10,000	1.1	1.5	1.3
10,001–15,000	1.4	1.7	1.6
15,001–20,000	2.3	3.3	2.8
20,001–25,000	2.7	4.1	3.4
25,001–30,000	3.6	5.7	4.6
30,001–35,000	4.4	6.5	5.4
35,001–40,000	7.0	9.7	8.3
40,001–50,000	14.0	16.0	14.9
50,001–60,000	13.6	13.1	13.4
60,001–70,000	11.0	9.8	10.4
70,001–100,000	18.9	15.5	17.3
100,001–150,000	10.8	6.9	9.0
150,001 or more	7.1	3.4	5.4
Total	100	100	100

Occupation

For the 2018 Census, individuals provided details about their occupation. Those working more than one job provided details about their primary occupation only (i.e. the occupation in which they worked the most hours).

The distribution of workers aged 21–69 by occupation at the minor and major group levels is displayed in Appendix I. The number of people in each minor group category ranged from over 93,000, in the Sales Assistants and Salespersons category (621), to just below 2,500 people, in the Textile, Clothing and Footwear Trades Workers category (393).

Sex differences in the number of workers in each occupation were apparent. At the major group level, there was a clear male excess (ratio > 1.5) for four groups:

- Machinery Operators and Drivers (male: female ratio = 6.7)
- Technicians and Trades Workers (male: female ratio = 4.2)
- Labourers (male: female ratio = 1.7)
- Managers (male: female ratio = 1.7)

There was also a clear female excess (ratio > 1.5) for three groups:

- Clerical and Administrative Workers (female: male ratio = 3.6)
- Community and Personal Service Workers (female: male ratio = 2.2)
- Sales Workers (female: male ratio = 1.5)

There was also a slight female excess for:

- Professionals (female: male ratio = 1.3).

Within the major groups, men and women also tended to be concentrated in particular types of occupations. For instance, among Professionals, women were more prevalent in education (except for Tertiary Teaching), health therapy, and nursing occupations. By contrast, men were more prevalent among Air and Marine Transport Professionals, Engineering Professionals, and Business and Systems Analysts and Programmers.

Age

Age, in years, is included as a control variable as it is negatively associated with education (younger workers have higher qualifications) but positively correlated with income (older workers earn more). As with the previous scales (NZSEI-91, NZSEI-96, NZSEI-06 and NZSEI-13) analyses will be restricted to those aged 21–69. Those under the age of 21 years are not included because of the likelihood that young workers first entering the workforce may take on occupations that do not reflect their education and skill level. Those over the age of 69 years are excluded because very few of this group (13.7 percent) are in the workforce. Despite eligibility for New Zealand Superannuation beginning at age 65, it is relatively common for those aged 65–69 to be in the workforce (42.2 percent were employed in 2018), and hence this age group has been included in the construction of NZSEI-18.

2.2 Selected demographic data

This section provides tabulations and cross-tabulations of demographic data from the 2018 Census to provide context for the analyses conducted in subsequent sections of the report.

Income and occupation

Table 9 shows the income distribution for workers in each major group of occupations in 2018. Managers and Professionals were the two groups with the highest percentage of members earning over $100,001 – 26.6 percent and 19.3 percent, respectively. Managers also had the highest percentage of members earning $70,001 and over (46.0 percent), closely followed by Professionals (44.1 percent). At the lower end of the income distribution, 27.5 percent of Community and Personal Service Workers and 28.2 percent of Labourers reported incomes lower than $20,001.

Table 9. Income by occupation, workers aged 21–69 years, 2018 Census

Total income ($NZ)	Occupation, major group (Percent)							
	Managers	Professionals	Technical and Trades Workers	Community and Personal Service Workers	Clerical and Administrative Workers	Sales Workers	Machinery Operators and Drivers	Labourers
Nil	0.6	0.2	0.3	0.2	0.1	0.2	0.3	0.4
Loss	0.5	0.2	0.3	0.4	0.5	0.4	0.3	0.8
1–5,000	0.9	1.2	1.8	4.3	1.7	3.1	1.8	5.1
5,001–10,000	1.2	1.7	2.0	5.2	2.4	4.5	1.9	5.3
10,001–15,000	1.6	2.1	2.7	7.5	3.4	6.2	2.9	7.4
15,001–20,000	2.3	2.5	3.8	9.9	4.6	7.8	4.0	9.2
20,001–25,000	2.6	2.7	4.3	9.8	5.3	8.0	4.3	8.6
25,001–30,000	3.2	3.0	5.3	9.6	6.1	8.6	5.4	8.9
30,001–35,000	3.6	3.1	6.3	8.6	6.3	8.6	6.7	8.9
35,001–40,000	5.1	4.2	8.9	9.2	8.8	9.6	10.3	10.2
40,001–50,000	11.1	10.3	17.5	12.3	19.3	14.8	19.8	14.5
50,001–60,000	11.2	12.5	16.0	8.0	16.6	9.2	16.1	9.2
60,001–70,000	9.9	12.2	11.7	5.6	10.2	5.6	11.1	5.0
70,001–100,000	19.5	24.7	13.9	6.9	10.3	7.2	12.3	5.0
100,001–150,000	15.2	12.0	4.1	2.1	3.0	3.5	2.3	1.1
150,001 or more	11.3	7.3	1.1	0.5	1.3	2.6	0.6	0.4
Total	100	100	100	100	100	100	100	100

Source: Stats NZ, 2018 Census

Income and ethnicity

For this and subsequent ethnic comparisons, we will show results for five major Level 1 ethnic groups: European, Māori, Pacific, Asian, and MELAA. Please note that these ethnic groups are not mutually exclusive and hence direct comparisons between these groups are not entirely valid (Cormack & Robson 2010). Furthermore, there are notable differences between the age structures for different ethnic groups in New Zealand which may contribute to differences in the distribution of both income and education, as younger workers tend to be more educated but receive less income. For example, among workers aged 21–69, the median age for Māori (median = 40 years), Pacific (37 years), Asian (35 years) and MELAA (35 years) ethnic groups were considerably lower than that for the European ethnic group (45 years). Please note that the median age for Māori and Pacific ethnic groups is considerably lower for the overall population than for the population of workers aged 21–69.

Table 10 shows the incomes of workers aged 21–69 years for each major ethnic group. For the European ethnic group, the largest percentage of workers reported incomes between $70,001 and $100,000. For each other ethnic group, the largest percentage of workers reported incomes between $40,001

and $50,000. The percentages of each ethnic group reporting incomes of $50,000 or less (approximately the lower half of the income distribution) were 46.3 percent for European, 61.6 percent for Māori, 65.5 percent for Pacific, 62.0 percent for Asian, and 60.3 percent for MELAA.

Table 10. Income distribution by ethnicity, workers aged 21–69 years, 2018 Census

Total income ($NZ)	Ethnicity (Percent)					
	European	Māori	Pacific	Asian	MELAA	Total
Nil income	0.3	0.3	0.3	0.3	0.4	0.3
Loss	0.3	0.4	0.6	0.6	0.6	0.4
1–5,000	1.5	2.2	4.0	4.1	4.5	2.1
5,001–10,000	2.2	2.7	3.2	4.3	4.8	2.6
10,001–15,000	3.2	4.6	4.0	4.6	5.6	3.6
15,001–20,000	4.3	6.9	5.5	5.1	5.9	4.7
20,001–25,000	4.6	6.5	5.5	5.2	5.7	4.9
25,001–30,000	5.1	7.0	6.4	5.8	5.9	5.5
30,001–35,000	5.1	6.8	7.4	6.9	6.2	5.7
35,001–40,000	6.6	8.7	10.3	8.9	7.5	7.3
40,001–50,000	12.9	15.1	18.2	16.3	13.3	13.9
50,001–60,000	12.4	12.4	13.5	12.0	11.0	12.4
60,001–70,000	10.1	8.7	8.3	8.2	7.6	9.5
70,001–100,000	16.8	11.8	9.2	11.0	12.3	15.0
100,001–150,000	8.7	4.1	2.6	4.7	6.1	7.4
150,001 or more	5.7	1.9	0.9	2.0	2.7	4.5
Total	100	100	100	100	100	100

Source: Stats NZ, 2018 Census

Education and ethnicity

The distribution of workers aged 21–69 years by highest qualification and ethnic group is presented in Table 11. The distribution of highest qualification varied considerably by ethnic group. For example, university qualifications were held by 52.9 percent of MELAA workers, 52.2 percent of Asian workers, 31.0 percent of European workers, 17.9 percent of Māori workers, and 15.3 percent of Pacific workers. A greater percentage of Māori and Pacific workers had no school qualifications, at 18.6 percent and 18.8 percent respectively, compared to 10.7 percent for European, 5.7 percent for Asian, and 4.7 percent for MELAA workers.

Occupation and ethnicity

The percentage of each ANZSCO occupation (at the major group level) by ethnic group is given in Table 12. A disproportionate share of European workers were Managers, at 20.9 percent of European workers. Conversely, only 9.9 percent of Pacific workers were Managers. Professionals were particularly common among those identifying with a MELAA ethnic group, at 28.4 percent of MELAA workers, compared to only 17.9 and 15.1 percent of Māori and Pacific workers, respectively. There were similar distributions across ethnic groups for Technicians and Trades Workers, Community and Personal Service Workers, and Clerical and Administrative Workers. Sales workers were somewhat overrepresented

among workers identifying with an Asian ethnic group at 10.6 percent. A disproportionate share of Māori and Pacific workers were Machinery Operators and Drivers, at 9.5 percent and 12.9 percent, respectively, and Labourers, at 17.8 percent and 18.6 percent, respectively.

Table 11. Highest qualifications by ethnicity, workers aged 21–69 years, 2018 Census

Highest qualification	Ethnicity (Percent)					
	European	Māori	Pacific	Asian	MELAA	Total
Doctorate degree	1.1	0.3	0.2	1.1	3.6	1.1
Master's degree	4.3	1.9	1.4	8.8	9.7	4.3
Post-graduate and honours degree	8.2	3.7	2.7	9.1	10.6	8.2
Bachelor's degree and level 7 qualification	17.4	12.0	11.0	33.1	29.0	17.4
Level 6 diploma	5.7	3.7	3.1	5.0	4.3	5.7
Level 5 diploma	5.9	6.7	6.1	5.7	5.1	5.9
Level 4 certificate	11.6	13.2	10.7	4.2	6.0	11.6
Overseas secondary school qualification	3.1	0.3	6.7	15.6	14.3	3.1
Level 3 certificate	10.3	15.1	17.1	6.9	7.5	10.3
Level 2 certificate	10.8	12.0	11.8	2.7	3.1	10.8
Level 1 certificate	11.0	12.4	10.5	2.0	2.0	11.0
No school qualifications	10.7	18.6	18.8	5.7	4.7	10.7
Total	100	100	100	100	100	100

Source: Stats NZ, 2018 Census

Table 12. Occupation by ethnicity, workers aged 21–69 years, 2018 Census

Major group	Occupation	Ethnicity (Percent)				
		European	Māori	Pacific	Asian	MELAA
1	Managers	20.9	13.9	9.9	15.8	13.9
2	Professionals	25.8	17.9	15.1	25.6	28.4
3	Technicians and Trades Workers	12.2	11.9	11.4	13.2	13.9
4	Community and Personal Service Workers	8.3	11.4	12.1	9.5	11.3
5	Clerical and Administrative Workers	11.9	10.4	11.5	9.7	8.6
6	Sales Workers	7.6	7.2	8.4	10.6	7.5
7	Machinery Operators and Drivers	5.1	9.5	12.9	5.1	4.4
8	Labourers	8.2	17.8	18.6	10.6	11.9
Total	Workers with specified occupations	100	100	100	100	100

Source: Stats NZ, 2018 Census

Income and rurality

Table 13 shows the income distribution for workers aged 21–69 years by whether they lived in urban or rural areas. There were only slight differences in income between workers who lived in urban areas and those who lived and rural areas. In both urban and rural areas, the largest percentage of workers reported incomes between $70,001 and $100,000, followed by $40,001 to $50,000. The percentage of workers in each area reporting incomes of more than $70,001 was 27.0 percent for urban areas, and 26.4 percent for rural areas.

Table 13. Income distribution by rurality, workers aged 21–69 years, 2018 Census

Total income ($NZ)	Urban (Percent)	Rural (Percent)
Nil income	0.2	0.7
Loss	0.4	0.7
1–5,000	2.2	2.0
5,001–10,000	2.6	2.7
10,001–15,000	3.6	3.8
15,001–20,000	4.7	5.1
20,001–25,000	4.8	5.3
25,001–30,000	5.4	5.8
30,001–35,000	5.7	5.6
35,001–40,000	7.4	7.0
40,001–50,000	14.0	13.2
50,001–60,000	12.4	12.1
60,001–70,000	9.5	9.5
70,001–100,000	15.1	14.6
100,001–150,000	7.5	6.9
150,001 or more	4.4	4.9
Total	100	100

Source: Stats NZ, 2018 Census

Education and rurality

The distribution of workers aged 21–69 years by rurality and highest qualification at the time of the 2018 Census is presented in Table 14. In rural areas, the largest percentage of workers reported no school qualifications (14.0 percent). Conversely, in urban areas, the largest percentage of workers reported bachelor's degree and level 7 qualifications (20.1 percent) as their highest qualification. In rural areas, only 23.2 percent of workers had university degrees or higher, compared to 34.4 percent in urban areas.

Table 14. Highest qualifications by rurality, workers aged 21–69 years, 2018 Census

Highest qualification	Urban (Percent)	Rural (Percent)
Doctorate degree	1.1	0.7
Master's degree	5.1	2.8
Post-graduate and honours degree	8.1	5.8
Bachelor's degree and level 7 qualification	20.1	14.0
Level 6 diploma	5.2	5.7
Level 5 diploma	5.8	6.4
Level 4 Certificate	10.0	12.9
Overseas secondary school	5.6	3.1
Level 3 Certificate	10.4	10.0
Level 2 Certificate	9.1	11.6
Level 1 Certificate	8.9	13.1
No school qualifications	10.6	14.0
Total	100	100

Source: Stats NZ, 2018 Census

Occupation and rurality

The distribution of ANZSCO major group occupations for workers aged 21–69 years by whether they lived in urban or rural areas is shown in Table 15. Professionals were more common among urban workers at 25.8 percent compared to 17.9 percent for rural workers. To a lesser extent, this was also the case for Community and Personal Service Workers (9.3 percent compared to 7.2 percent), Clerical and Administrative Workers (11.5 percent compared to 9.8 percent), and Sales Workers (8.5 percent compared to 5.4 percent). A disproportionate share of rural workers were Managers (28.7 percent compared to 16.7 percent) and Labourers (13.2 percent compared to 9.6 percent).

Table 15. Occupation by rurality, workers aged 21–69 years, 2018 Census

Major group	Occupation	Urban (Percent)	Rural (Percent)
1	Managers	16.7	28.7
2	Professionals	25.8	17.9
3	Technicians and Trades Workers	12.5	11.6
4	Community and Personal Service Workers	9.3	7.2
5	Clerical and Administrative Workers	11.5	9.8
6	Sales Workers	8.5	5.4
7	Machinery Operators and Drivers	6.0	6.2
8	Labourers	9.6	13.2
Total	Workers with specified occupations	100	100

Source: Stats NZ, 2018 Census

Income and region

Table 16 shows the income distribution for workers aged 21–69 years living in Auckland, in comparison to the rest of New Zealand. The percentage of workers in each region reporting incomes of above $100,000 was 14.6 percent for Auckland, and 10.5 percent for the rest of New Zealand.

Table 16. Income distribution by region, workers aged 21–69 years, 2018 Census

Total income ($NZ)	Auckland (Percent)	Rest of New Zealand (Percent)
Nil income	0.3	0.3
Loss	0.4	0.4
1–5,000	2.5	1.9
5,001–10,000	2.9	2.5
10,001–15,000	3.5	3.7
15,001–20,000	4.1	5.1
20,001–25,000	4.1	5.4
25,001–30,000	4.6	5.9
30,001–35,000	5.1	6.0
35,001–40,000	6.8	7.6
40,001–50,000	13.5	14.0
50,001–60,000	12.3	12.4
60,001–70,000	9.6	9.5
70,001–100,000	15.7	14.7
100,001–150,000	8.7	6.7
150,001 or more	5.9	3.8
Total	100	100

Source: Stats NZ, 2018 Census

Education and region

The distribution of workers aged 21–69 years by region and highest qualification at the time of the 2018 Census is presented in Table 17. In Auckland, 8.4 percent of workers had no school qualifications, compared with 12.5 percent for workers elsewhere in New Zealand. A greater share of Auckland workers had university level qualifications at 40.1 percent, compared to workers elsewhere in New Zealand of whom 28.6 percent had university level qualifications.

Table 17. Highest qualifications by region, workers aged 21–69 years, 2018 Census

Highest qualification	Auckland (Percent)	Rest of New Zealand (Percent)
Doctorate degree	1.1	1.0
Master's degree	6.3	3.9
Post-graduate and honours degree	9.0	7.1
Bachelor's degree and level 7 qualification	23.8	16.6
Level 6 diploma	5.2	5.3
Level 5 diploma	5.7	6.1
Level 4 Certificate	8.3	11.6
Overseas secondary school	7.6	3.9
Level 3 Certificate	10.0	10.5
Level 2 Certificate	7.7	10.5
Level 1 Certificate	7.0	10.9
No school qualifications	8.4	12.5

Source: *Stats NZ, 2018 Census*

Occupation and region

The distribution of ANZSCO major group occupations for workers aged 21–69 years by whether they lived in Auckland or the rest of New Zealand is presented in Table 18. Most occupations were similarly distributed, at least at the major group level. However, Professionals were more common among workers living in Auckland at 27.3 percent compared to 23.0 percent for workers in the rest of New Zealand. A greater share of workers in the rest of the country were Labourers, at 11.8 percent compared to 7.1 percent.

Table 18. Occupation by region, workers aged 21–69 years, 2018 Census

Major Group	Occupation	Auckland (Percent)	Rest of New Zealand (Percent)
1	Managers	19.0	18.7
2	Professionals	27.3	23.0
3	Technicians and Trades Workers	11.6	12.7
4	Community and Personal Service Workers	8.3	9.3
5	Clerical and Administrative Workers	11.9	10.9
6	Sales Workers	8.8	7.5
7	Machinery Operators and Drivers	5.9	6.1
8	Labourers	7.1	11.8
Total	Workers with specified occupations	100	100

Source: *Stats NZ, 2018 Census*

Income and country of birth

Table 19 shows the income distribution of workers aged 21–69 years by whether they were born in New Zealand or were born in another country. For New Zealand-born workers, the largest percentage of workers reported incomes between $70,001 and $100,000. However, for workers born overseas, the largest percentage of workers reported incomes between $40,001 and $50,000. The percentages of each group reporting incomes of $20,000 or less were 12.7 percent for workers born in New Zealand, and 16.2 percent for workers born outside of New Zealand.

Table 19. Income distribution by country of birth, workers aged 21–69 years, 2018 Census

Total income ($NZ)	New Zealand-born (Percent)	Overseas-born (Percent)
Nil income	0.3	0.3
Loss	0.4	0.5
1–5,000	1.6	3.3
5,001–10,000	2.2	3.5
10,001–15,000	3.4	4.0
15,001–20,000	4.8	4.6
20,001–25,000	5.0	4.8
25,001–30,000	5.5	5.4
30,001–35,000	5.5	6.0
35,001–40,000	7.1	7.7
40,001–50,000	13.6	14.3
50,001–60,000	12.6	11.8
60,001–70,000	9.9	8.8
70,001–100,000	15.7	13.8
100,001–150,000	7.5	7.1
150,001 or more	4.8	4.0
Total	100	100

Source: Stats NZ, 2018 Census

Education and country of birth

The distribution of workers aged 21–69 years by country of birth and highest qualification at the time of the 2018 Census is presented in Table 20. The percentage of New Zealand-born workers with no school qualifications is twice as high as for overseas-born workers, at 13.3 percent and 6.6 percent respectively. Additionally, a higher percentage of overseas-born workers had university level qualifications, at 35.6 percent compared to 26.4 percent for workers born in New Zealand.

Table 20. Highest qualifications by country of birth, workers aged 21–69 years, 2018 Census

Highest qualification	New Zealand-born (Percent)	Overseas-born (Percent)
Doctorate degree	0.6	1.9
Master's degree	3.0	8.4
Post-graduate and honours degree	6.3	10.9
Bachelor's degree and level 7 qualification	16.5	24.5
Level 6 diploma	5.1	5.6
Level 5 diploma	6.0	5.7
Level 4 Certificate	12.3	6.5
Overseas secondary school	0.2	15.8
Level 3 Certificate	11.9	7.0
Level 2 Certificate	12.2	3.9
Level 1 Certificate	12.6	3.2
No school qualifications	13.3	6.6
Total	100	100

Source: Stats NZ, 2018 Census

Occupation and country of birth

The distribution of ANZSCO major group occupations for workers aged 21–69 years by country of birth is presented in Table 21. Most occupations were similarly distributed, at least at the major group level. However, Managers were slightly over-represented among New Zealand-born workers at 19.7 percent compared to 17.0 percent, while workers born overseas were disproportionately more likely to be Professionals at 27.5 percent compared to 23.1 percent for workers born in New Zealand.

Table 21. Occupation by country of birth, workers aged 21–69 years, 2018 Census

Major group	Occupation	New Zealand-born (Percent)	Overseas-born (Percent)
1	Managers	19.7	17.0
2	Professionals	23.1	27.5
3	Technicians and Trades Workers	12.1	12.7
4	Community and Personal Service Workers	8.7	9.5
5	Clerical and Administrative Workers	11.8	10.1
6	Sales Workers	7.8	8.3
7	Machinery Operators and Drivers	6.5	5.1
8	Labourers	10.3	9.9
Total	Workers with specified occupations	100	100

Source: Stats NZ, 2018 Census

Income and disability status

Table 22 shows the income distribution for disabled workers and non-disabled workers aged 21–69 years. There were substantial differences in the income distribution between disabled workers and non-disabled workers. While 52.0 percent of non-disabled workers reported incomes above $50,000, only 38.2 percent of disabled workers reported incomes above $50,000. Furthermore, while the largest percentage of non-disabled workers reported earning between $70,000 and $100,000, for disabled workers the largest percentage of workers reported earning $40,001–$50,000.

Table 22. Income distribution by disability status, workers aged 21–69 years, 2018 Census

Total income ($NZ)	Disabled (Percent)	Non-disabled (Percent)
Nil income	0.9	0.3
Loss	1.0	0.5
1–5,000	3.0	1.9
5,001–10,000	3.2	2.3
10,001–15,000	4.8	3.1
15,001–20,000	6.9	3.9
20,001–25,000	6.6	4.5
25,001–30,000	6.6	5.2
30,001–35,000	6.7	5.4
35,001–40,000	8.3	7.2
40,001–50,000	13.9	13.5
50,001–60,000	11.8	12.5
60,001–70,000	8.4	9.9
70,001–100,000	11.2	16.1
100,001–150,000	4.4	8.3
150,001 or more	2.4	5.2
Total	100	100

Source: Stats NZ, 2018 Census

Education and disability status

The distribution of highest qualification for disabled and non-disabled workers aged 21–69 years is presented in Table 23. A greater share of non-disabled workers held university level qualifications than disabled workers, at 34.6 percent and 18.8 percent, respectively. A larger share of disabled workers did not have any qualifications at 22.9 percent, compared to 10.8 percent for non-disabled workers.

Table 23. Highest qualifications by disability status, workers aged 21–69 years, 2018 Census

Highest qualification	Disabled (Percent)	Non-disabled (Percent)
Doctorate degree	0.6	1.2
Master's degree	2.6	5.2
Post-graduate and honours degree	4.3	8.5
Bachelor's degree and level 7 qualification	11.3	19.7
Level 6 diploma	4.8	5.7
Level 5 diploma	5.4	5.3
Level 4 Certificate	11.5	9.9
Overseas secondary school	4.5	5.6
Level 3 Certificate	10.0	9.4
Level 2 Certificate	10.0	9.3
Level 1 Certificate	12.1	9.4
No school qualifications	22.9	10.8
Total	100	100

Source: *Stats NZ, 2018 Census*

Occupation and disability status

Table 24 shows the distribution of major group occupations for disabled and non-disabled workers aged 21–69. There were large differences in the distribution of major group occupations for these groups. In particular, disabled workers were more likely to be labourers than non-disabled workers at 15.4 percent compared to 8.9 percent. Disabled workers were less likely to be professionals at 16.1 percent compared to 19.8 percent for non-disabled workers, and managers at 16.1 percent compared to 19.8 percent.

Table 24. Occupation by disability status, workers aged 21–69 years, 2018 Census

Major group	Occupation	Disabled (Percent)	Non-disabled (Percent)
1	Managers	16.1	19.8
2	Professionals	17.4	26.2
3	Technicians and Trades Workers	13.1	11.9
4	Community and Personal Service Workers	10.4	8.5
5	Clerical and Administrative Workers	10.9	11.6
6	Sales Workers	8.4	7.7
7	Machinery Operators and Drivers	8.3	5.4
8	Labourers	15.4	8.9
Total	Workers with specified occupations	100	100

Source: *Stats NZ, 2018 Census*

2.3 Summary and discussion

This section presents tabulated and cross-tabulated data on the 2018 Census variables used to construct NZSEI-18: education, income, and occupation. Higher education and income levels were reported in 2018 compared with 2013.

Higher incomes were associated with higher qualification levels, being male, identifying with a European ethnicity, living in Auckland, being New Zealand-born and not being disabled. Higher qualification levels were associated with being female, identifying with Asian and MELAA ethnicities, living in an urban location, living in Auckland, having been born overseas and not being disabled.

A number of factors distinguished different occupation groups (at the ANZSCO major group level):

- Managers were more likely to be male, identify with a European ethnicity, live in a rural setting, be New Zealand-born and to not be disabled.
- Professionals were more common among those of MELAA ethnicities, those who live in urban areas – particularly Auckland, those who were born overseas and those who are not disabled.
- Technicians and Trades Workers were more likely to be male. Community and Personal Service Workers were more likely to be female.
- Clerical and Administrative Workers were more likely to be female and to live in an urban setting.
- Sales Workers were more likely to be female and were slightly over-represented among those identifying with an Asian ethnicity.
- Machinery Operators and Drivers were more likely to be male and were more common among those identifying as Māori or Pacific. Labourers were also more common among those with Māori and Pacific ethnicities, those who live in a rural setting, those who live outside of Auckland, and those who are disabled.
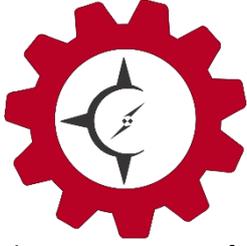
3. Construction of the NZSEI-18 scale

The construction of the NZSEI-18 scale is presented in this section. This section reports the methods used to inflate the incomes of part-time workers to their full-time equivalent before their inclusion in analyses, and an assessment of the extent to which incomes for self-employed workers are understated. Finally, the division of NZSEI-18 scores into SES groups is described.

3.1 Statistical algorithm used in the construction of NZSEI-18 scale

The 'returns to human capital' model used to construct NZSEI-18 was represented by the following linear regression equations. The variables income (I), age (A), and education (E) were normalised to have mean zero and variance one. The variable occupation is denoted O. Although conceptually the regressions could be done at the individual level, the fact that the Os are the same for each individual in a given occupational group means that the calculations can be (and are) carried out using only the sizes, means, and standard deviations of each occupational group.

$$I = \beta_{41}A + \beta_{42}E + \beta_{43}O + e_4 \qquad (1)$$

$$O = \beta_{31}A + \beta_{32}E + e_3 \qquad (2)$$

$$E = \beta_{21}A + e_2 \qquad (3)$$

The construction of the NZSEI-18 assumes that the effect of education on income is entirely mediated through occupation. This is implemented by setting β_{42} to zero, and then estimating the values of the unobserved values of occupational scores together with the remaining beta coefficients by minimising the residual sum of squares,

$$\sigma_N^2 = \|I - (\beta_{41}A + \beta_{43}O)\|^2 + \|O - (\beta_{31}A + \beta_{32}E)\|^2 + \|E - \beta_{21}A\|^2.$$

The coefficient β_{21} can be estimated by minimising the last summand alone, i.e. by fitting the regression of E on A, so the last term can be ignored when estimating the other quantities. These were found by the following iterative process:

1. Start with an initial guess for the occupational scores (e.g. the average of the A and E scores, renormalised to have mean zero and variance one).
2. For these fixed values of O, minimise the first two terms of σ_N^2 over the betas. This amounts to fitting the regressions (1) and (2).
3. For these fixed betas, find the values of O that minimise:
$\|I - (\beta_{41}A + \beta_{43}O)\|^2 + \|O - (\beta_{31}A + \beta_{32}E)\|^2$

   If O_i is the occupational score of the ith group, this amounts to setting:

   $$O_i = \left((\beta_{31} - \beta_{41}\beta_{43})\overline{A_i} + \beta_{32}\overline{E_i} + \beta_{43}\overline{I_i}\right)/(1 + \beta_{43}^2),$$

   where $\overline{A_i}$, $\overline{E_i}$, and $\overline{I_i}$ are, respectively, the mean age, education, and income for the ith occupational group.

4. Re-standardise the Os to have mean of 0 and standard deviation of 1 at the individual level. This is achieved by weighting occupations by the proportion of people in each respective occupation (note all individuals in the ith group have the same value of O.)
5. Repeat steps 2 & 3 until convergence.

The beta values we report are those obtained at the conclusion of the iterative process.

3.2 Assessment of potential understatement of income of self-employed workers

Numerous reports suggest self-employed workers underestimate their incomes, primarily through deliberate underreporting to reduce their tax burden and by blurring the lines between business and private expenses (e.g. Bradbury, 1997; Cabral & Gemmell, 2018; Pissarides & Weber, 1989). Incomes for self-employed workers may also be more volatile and difficult to accurately report, leading to greater levels of misreporting for this group (Bradbury, 1997; Cabral & Gemmell, 2018). A recent study by Cabral and Gemmell (2018) used household expenditure data to estimate that households with self- employed workers in New Zealand underreport their incomes by about 20 percent on average to Inland Revenue, and underreport their household incomes by about 11 percent to the Household Economic Survey. It was suggested that there is less incentive for households to underreport income to surveys as doing so will not reduce the amount of tax paid (Cabral & Gemmell, 2018). The NZSEI is based on personal income, rather than household income, and we are not aware of any studies which have examined underreporting of personal income to national censuses.

There was no evidence of income underreporting among self-employed workers when Census 2006 data was analysed for the construction of the NZSEI-06 (Milne, et al., 2013) or when Census 2013 data was analysed for the construction of the NZSEI-13 (Fahy, et al., 2017). To determine whether the income of self-employed workers was underestimated in the 2018 Census, the mean incomes reported by workers in each minor (three-digit) occupation group were compared by self-employment status. It should be noted that an individual was classified as self-employed if they reported receiving income from operating their own business, regardless of whether this was their main job. This may mean that when we are assessing the relative incomes of self-employed workers versus non self-employed workers by occupation, the occupations some self-employed workers were classified into may not match the occupation they are self-employed in. We are unable to assess the extent to which this occurred. Reported income sources were used to classify self-employment in preference to reported employment status due to issues with the quality of the employment status variable in the 2018 Census (employment status was imputed for 17.3 percent of workers aged 21–69). The inflated incomes of part-time workers were included using the method described above.

The number of self-employed and non self-employed workers for each minor (three-digit) occupation group are shown in Appendix II. The mean income differences – expressed as a percentage of the overall mean income for each occupation group – are shown in Figure 2, ordered from the occupation group with the largest mean income to the group with the smallest mean income for non self-employed workers relative to self-employed workers.

Figure 2 shows that self-employed workers report greater mean incomes than non self-employed workers for the majority (86 out of 97, or 89 percent) of occupation groups. For some occupation groups, mean incomes were substantially higher for self-employed workers, e.g. self-employed workers reported mean incomes that were more than 30 percent higher than non self-employed workers for six occupation groups:

- Legal Professionals (51 percent higher)
- Information and Organisation Professionals (36 percent higher)
- Medical Practitioners (36 percent higher)

- Insurance Agents and Sales Representatives (33 percent higher)
- Plumbers (31 percent higher)
- Glaziers, Plasterers and Tilers (30 percent higher).

In contrast, there were only three occupation groups for which the mean incomes of non self-employed workers were more than 10 percent higher than the mean income of self-employed workers: Chief Executives, General Managers and Legislators (19 percent higher), Automobile, Bus and Rail Drivers (16 percent higher) and Air and Marine Transport Professionals (13 percent higher). While this analysis does not directly measure the degree to which self-employed workers underestimate their incomes, given that self-employed workers reported greater incomes for most occupation groups, this indicates little evidence of underestimation. This mirrors the findings for 2006 and 2013 (Fahy, et al., 2017; Milne, et al., 2013). As such, and like NZSEI-06 and NZSEI-13, no inflation of incomes for self-employed workers will be undertaken for the NZSEI-18. Thus, the finalised scale will include the incomes of full-time workers and equalised incomes of part-time workers.

Figure 2. Difference between self-employed and non self-employed incomes for minor group occupations

Minor group occupation (n=97),
ranked according to difference (%) between self-employed & non self-employed incomes
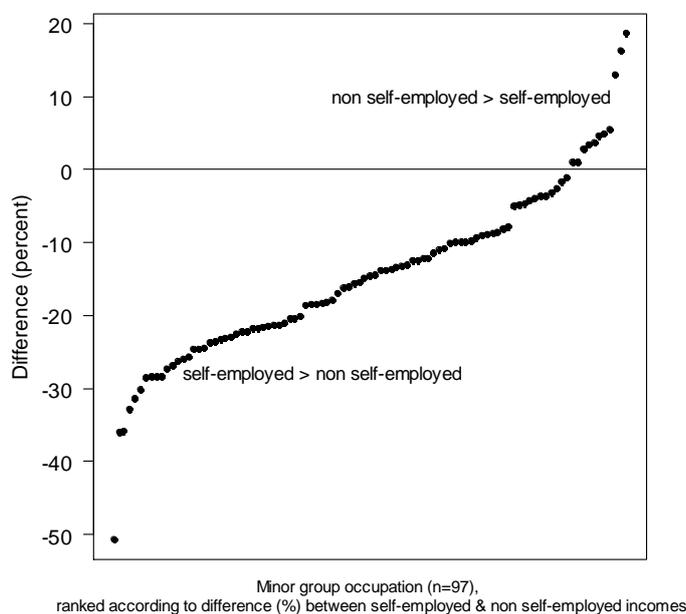
Source: Stats NZ, 2018 Census

3.3 NZSEI-18 scores

Using the algorithm described in Section 3.1, NZSEI-18 scores were derived at the minor group (three-digit) level of ANZSCO for the full-time and part-time workforce, where part-time incomes have been inflated as described in Section 3.2. The results for each occupational classification were first scaled from 10–90 (10 being the lowest socio-economic score and 90 the highest), and centred. Centring the scale ensures that the effect of a specified point difference in NZSEI scores (e.g. a 10-point difference) is roughly equivalent at any point of the NZSEI distribution, which is beneficial for interpreting analyses.

Previous versions of the NZSEI used a square root transformation (i.e. raising to the power of 0.5) to centre the scores in an attempt to achieve a mean of around 50 (e.g. the NZSEI-13 had a mean of 46). To ensure perfect centring, the 2018 scores were centred by raising the scores to a power that gave a mean of exactly 50 (this power was 0.55 using the 2018 data).

NZSEI-18 scores at the sub-major (two-digit) and major (one-digit) levels of ANZSCO were calculated as the mean of the constituent minor group occupational scores, weighted by the number of people in each occupation. Appendix III provides the full major group (one-digit), sub-major group (two-digit), and minor group (three-digit) NZSEI-18 scores for the finalised scale (including both full- and part-time workers).

The regression coefficients (beta values) for the associations between income, education, and socio-economic status for the NZSEI-18 final scale are shown in Table 25. Relevant beta values for NZSEI-91, NZSEI-96, NZSEI-06, NZSEI-13, and three international scales (ANU4, AUSEI06, and ISEI-88) are also included in the table for comparison. The beta values for the NZSEI-18 are 0.545 for β_{32} (the path from education to socio-economic status) and 0.306 for β_{43} (the path from socio-economic status to income). These coefficients are very similar to those obtained for NZSEI-13. The path coefficients are also comparable to those obtained for three international scales: ANU4 (Jones & McMillan, 2001) and AUSEI06 (McMillan, et al., 2009) from Australia, and the multinational ISEI-88 (Ganzeboom & Treiman, 1996) and ISEI-08 (Ganzeboom, 2010). However, as in the 2006 and 2013 versions of the NZSEI, the NZSEI-18 path coefficients are very different to those obtained for NZSEI-96 and NZSEI-91. The reason for this discrepancy is still not apparent.

Table 25. Comparison of beta values, NZSEI-18, NZSEI-13, NZSEI-06, NZSEI-96, NZSEI-91, ANU4, AUSEI06, ISEI-88 and ISEI-08

Scales	β_{32} (education-SES)	β_{43} (SES-income)
NZSEI-18	0.545	0.306
NZSEI-13	0.570	0.313
NZSEI-06	0.572	0.299
NZSEI-96	0.251	0.789
NZSEI-91	0.230	0.790
ANU4[1]	0.630	0.300
AUSEI06[1]	0.650	0.350
ISEI-08[2]	0.568	0.288
ISEI-88[1]	0.582	0.465

(1) *From McMillan, et al., 2009*
(2) *From Ganzeboom, 2010*

Note: *AUSEI06 – Australian socio-economic index 2006*
ANU4 – Australian National University occupational status scale 4
ISEI-88 – International socio-economic index 1988
ISEI-08 – International socio-economic index 2008

3.4 Overall effect of including part-time workers

A comparison of the major group (one-digit) NZSEI-18 scores for full-time workers, and full-time and part-time workers combined, is shown in Table 26. The difference between NZSEI-18 scores between full-time workers, and full-time and part-time workers combined, was minimal for all major group occupations (none of the differences were more than two points).

There was only a 0.5 point difference in the mean between the scale for full time workers and the scale including both full and part-time workers (full-time workers' mean score across occupations = 50.5, full- and part-time workers' mean score = 50.0). There were few changes in relative occupational rank at the sub-major group level between the two scales, and those changes that did occur were small. Of 43 sub-major group occupations:

- 26 did not change rank
- 13 changed rank by one place
- 4 changed rank by two places.

Table 26. NZSEI-18 scores, full-time workers, and full-time and part-time workers combined

Major group	Occupation	NZSEI-18 full-time workers	NZSEI-18 full-time and part-time workers
1	Managers	59	58
2	Professionals	74	74
3	Technicians and Trades Workers	42	41
4	Community and Personal Service Workers	45	43
5	Clerical and Administrative Workers	51	50
6	Sales Workers	45	43
7	Machinery Operators and Drivers	32	31
8	Labourers	25	23

3.5 Dividing NZSEI-18 scores into socio-economic groups

As with previous NZSEI scales, users have the option of assigning individuals to discrete socio-economic groups, rather than (or as well as) to scores on a continuous scale. As for the NZSEI-06 and NZSEI-13 scales, three different groupings of the NZSEI-18 scale are suggested for use by researchers:

- a six-group classification
- a four-group classification representing quartiles
- a 10-group classification representing deciles.

Cut-points for these different socio-economic status (SES) groupings are shown in Table 27. Following the Elley-Irving scales (e.g. Elley & Irving, 2003), the predecessor to the NZSEI scales, and the NZSEI-06 and NZSEI-13 (Fahy, et al., 2017; Milne, et al., 2013) cut-points for the six-group classification were chosen so that roughly 10 percent, 15 percent, 25 percent, 25 percent, 15 percent, and 10 percent of the population are in groups 1 to 6 (highest to lowest SES), respectively. Thus, combining groups 1 and 2 into one group, leaving groups 3 and 4 as is, and combining groups 5 and 6 into one group, maps directly onto the four-group (quartile) classification. The 10-group classification was chosen to enable direct comparisons with NZDep scales. A full list of SES groupings for all minor group (three-digit) occupations is shown in Appendix IV.

Table 27. Suggested SES group divisions, six, four (quartile), and 10 (decile) groups

Six group			Quartiles		Deciles	
SES group	NZSEI-18 range	Percent of population	SES group	NZSEI-18 range	SES group	NZSEI-18 range
1	75–90	10.0	1	67–90	1	75–90
2	67–74	13.9	2	50–66	2	70–74
3	50–66	25.1	3	38–49	3	66–69
4	38–49	26.8	4	10–37	4	57–65
5	28–37	15.1			5	50–56
6	10–27	9.0			6	47–49
					7	40–46
					8	34–39
					9	28–33
					10	10–27

3.6 Summary and discussion

This section presented details on the construction of NZSEI-18. To create the scale, part-time workers were incorporated into the dataset by inflating part-time incomes to a full-time equivalent. The inclusion of part-time workers made little difference to the scores of occupational groups, with only a few (small) changes in the rank of occupations.

As in NZSEI-13, no income-adjustment was undertaken for self-employed workers because there was little evidence to suggest that the incomes of self-employed workers were underestimated.

Three different convenience 'splits' in the hierarchy were suggested for use by researchers who wish to assess socio-economic status as a categorical variable. These splits were:

- a six-group classification
- a four-group classification representing quartiles
- a 10-group classification representing deciles.

4. Assessing the finalised NZSEI-18

Section 4 presents the results of four tests of the stability and validity of the finalised NZSEI-18. These include:

(i) a comparison between NZSEI-18 and the previous NZSEI-13

(ii) an assessment of whether NZSEI-18 methodology assigns scores similarly for men and women, and similarly for different ethnic groups

(iii) an assessment of whether NZSEI-18 methodology assigns scores similarly for those living in urban and rural areas; those living in Auckland and those living elsewhere in New Zealand; those born in New Zealand and those born overseas; and disabled workers and non-disabled workers.

(iv) an assessment of the construct validation of NZSEI-18 in relation to health and other socio-economic indicators.

4.1 Comparison between NZSEI-18 and NZSEI-13

Figure 3 shows a comparison between NZSEI-18 and NZSEI-13 scores assigned to workers using data from the 2018 Census.

Figure 3. NZSEI-13 scores versus NZSEI-18 scores (ANZSCO minor group)
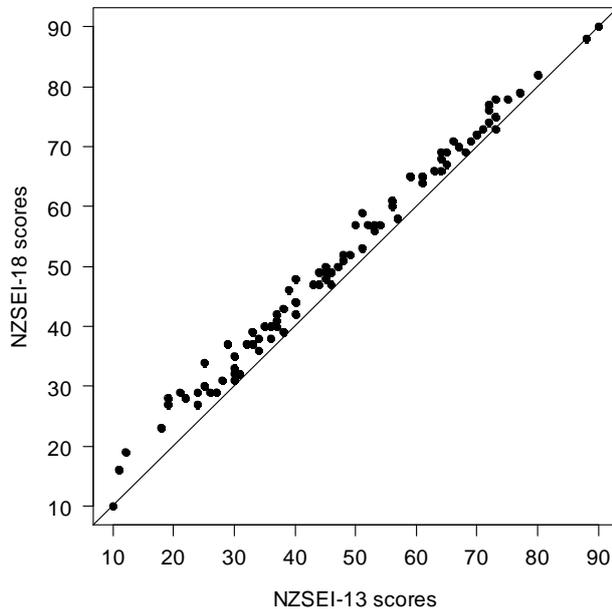
Note: The diagonal line represents the point of equivalent value for NZSEI-13 and NZSEI-18 scores.

The overall correlation between the two scales was 0.996, indicating very high correspondence between the scales. The slightly different transformation applied to the 2018 NZSEI scores meant the mean NZSEI-18 score was slightly higher than the mean NZSEI-13 score (50.0 compared to 46.2). Consequently, none of the minor group occupations had a lower score in 2018 than in 2013. The difference between NZSEI-18 and NZSEI-13 scores was minimal for most minor occupations, for example, two-thirds of the occupations changed by no more than four points (the difference in the mean scores between NZSEI-18 and NZSEI-13). Larger changes were apparent among some minor occupations, including:

- Food Trades Workers (9 points)
- Food Process Workers (9 points)
- Accommodation and Hospitality Managers (8 points)
- Personal Carers and Assistants (8 points)
- Contract, Program and Project Administrators (8 points)
- Mobile Plant Operators (8 points)
- Truck Drivers (8 points)
- Retail Managers (7 points)
- Arts Professionals (7 points)
- Cleaners and Laundry Workers (7 points).

A further 18 occupations changed by five points and four changed by six points. Overall, these differences are fairly minor. The high correspondence between the scales can be attributed to the fact that both had almost the same path coefficients (see Table 25), and both measure the same occupation groups.

4.2 Analyses by sex

Separate analyses by sex were conducted to test the stability of the scale for men and women.

To assess the possibility that the associations between education, income, and occupation may differ for men and women (e.g. the unequal and gendered distribution of caretaking responsibilities may result in some women taking on occupations below their qualifications), the model coefficients for the overall NZSEI-18 scale, presented in Table 25, were used to calculate separate scales for men and women. The minor group (three-digit) sex-specific NZSEI-18 scores are shown in Figure 4.

Figure 4. Comparison of male and female NZSEI-18 scores (ANZSCO minor group)
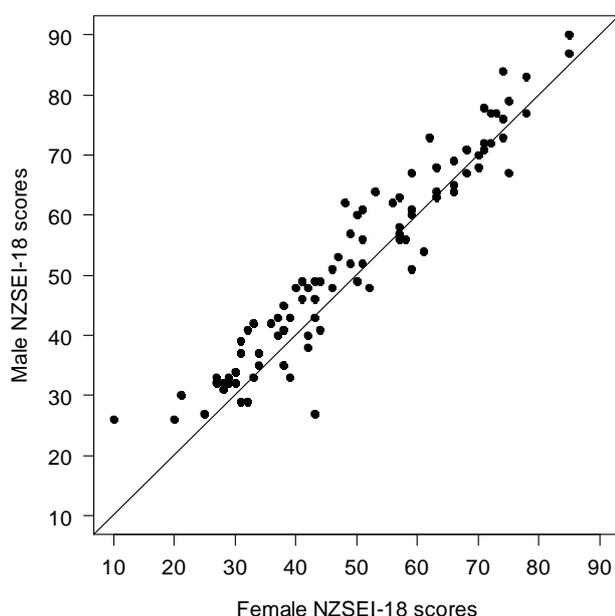
Note: Model estimates were used for both male and female scores.

The figure shows that men were assigned higher scores for most (66 out of 97) occupations, and for seven occupations the difference was 10 points or greater. Women were assigned scores at least 10 points greater than men for only one occupation: Animal Attendants and Trainers, and Shearers (ANZSCO minor group code 361) were assigned a score of 43 for women and 27 for men. There was a 2.8 point difference in mean male and female scores across occupations (male mean = 52.2, female mean = 49.4). Despite this difference, male and female scores correlated at r = 0.96, suggesting that the socio-economic structuring of occupations was very similar for both sexes.

When this analysis was repeated separately for full and part-time workers the mean difference by gender for full-time workers (difference in means = 3.4) was greater than for part-time workers (difference in means = 1.5). This means that the part-time work-status of a large share of women may have reduced the observed gap between male and female socioeconomic scores for the same occupation.

To investigate reasons for the higher scores assigned to men, Figure 5 compares the mean income, years of education, and age for men and women by minor group (three-digit) occupation. This shows that while there were few differences by occupation between men and women in years of education and age, men reported consistently higher incomes for most occupations, suggesting it was primarily because of the income differential that men were assigned higher scores on the sex- specific NZSEI-18 scale. The income differential between men and women was greater for higher paying occupations.

Figure 5. Mean values for income, years of education, and age, men compared with women for each occupation (ANZSCO minor group)
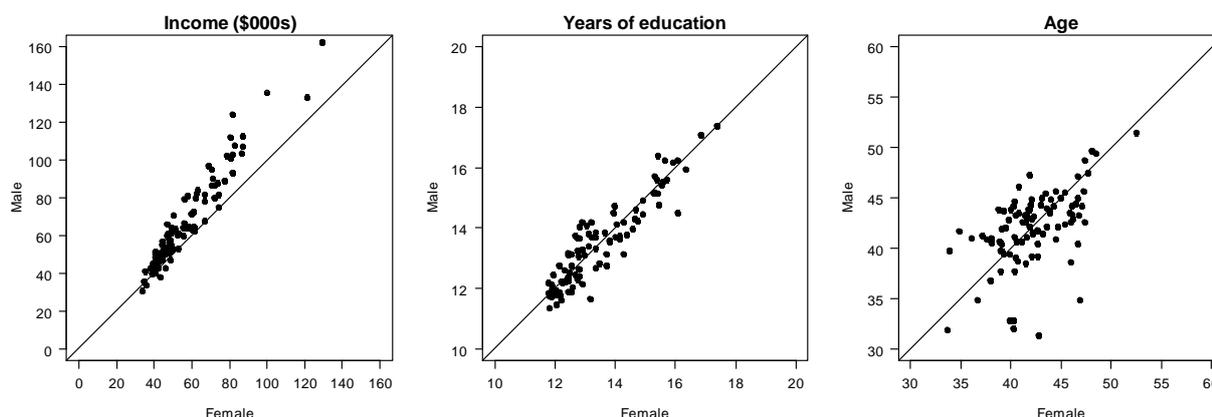
Source: Stats NZ, 2018 Census

The absolute and percentage differences between men and women in education and income by socio-economic group is shown in Table 28.

Table 28. Differences in mean income and years of education, men compared with women, within SES groups

| SES Group | Mean income ($) | | Difference in income between sexes (M-W) | | Mean education (years) | | Difference in education between sexes (M-W) | |
	Men	Women	Percent (M-W)/W	$ (M-W)	Men	Women	Percent (M-W)/W	Years (M-W)
1	109,500	88,000	24	21,500	16.1	15.9	1	0.2
2	84,900	70,100	21	14,800	15.0	15.2	-1	-0.2
3	78,700	64,800	21	13,900	13.8	13.8	0	0.0
4	57,200	48,800	17	8,400	12.9	12.7	1	0.1
5	47,500	42,200	13	5,300	12.2	12.3	-1	-0.1
6	44,100	39,300	12	4,800	12.0	12.1	-1	-0.1

Average incomes were substantially greater for men (compared with women) for all socio-economic groups. This difference was larger – both in absolute and percentage terms – for higher socio-economic groups. For example, while the income difference between men and women was $4,800 (12 percent) for workers in SES group 6, it was $21,500 (24 percent) for workers in SES group 1. There were very few differences in the average education levels between men and women across socio-economic groups.

4.3 Analyses by ethnicity

In order to determine the applicability of NZSEI-18 to different ethnic groups in New Zealand, the model coefficients from Table 25 were used to calculate separate scales for each of the five major ethnic groups: European, Māori, Pacific, Asian, and MELAA. Figure 6 shows ethnic-specific NZSEI-18 scores for each ethnic group by minor group (three-digit) occupation (shown as a series of cross-tabulations). It should be noted that as these ethnic groups are not mutually exclusive, direct comparisons between these groups are not entirely valid (Cormack & Robson, 2010). Younger age groups and those identifying with a Māori or Pacific ethnic group are more likely to identify with multiple ethnic groups.

Figure 6 shows that for most occupations Asian (mean score across occupations = 60.9) and MELAA (mean score = 60.8) workers were assigned higher NZSEI-18 scores than all other ethnic groups. European workers (mean score = 55.5) were assigned higher scores than either Māori (mean score = 48.6) or Pacific workers (mean score = 46.5), for all occupations.

NZSEI-18 scores for Māori and Pacific workers, and Asian and MELAA workers were similar for most occupations. Pairwise correlations between ethnic-specific scores were all r ≥0.92, suggesting the socio-economic structuring of occupations was similar for each ethnic group. It was noteworthy, however, that the pairwise correlations between Asian and MELAA workers and all other ethnic groups were lower (r = 0.92 – 0.95) than the pairwise correlations among European, Māori, and Pacific workers (all correlations r ≥ 0.97).

Figure 6. NZSEI-18 scores (ANZSCO minor group), comparison of ethnic groups
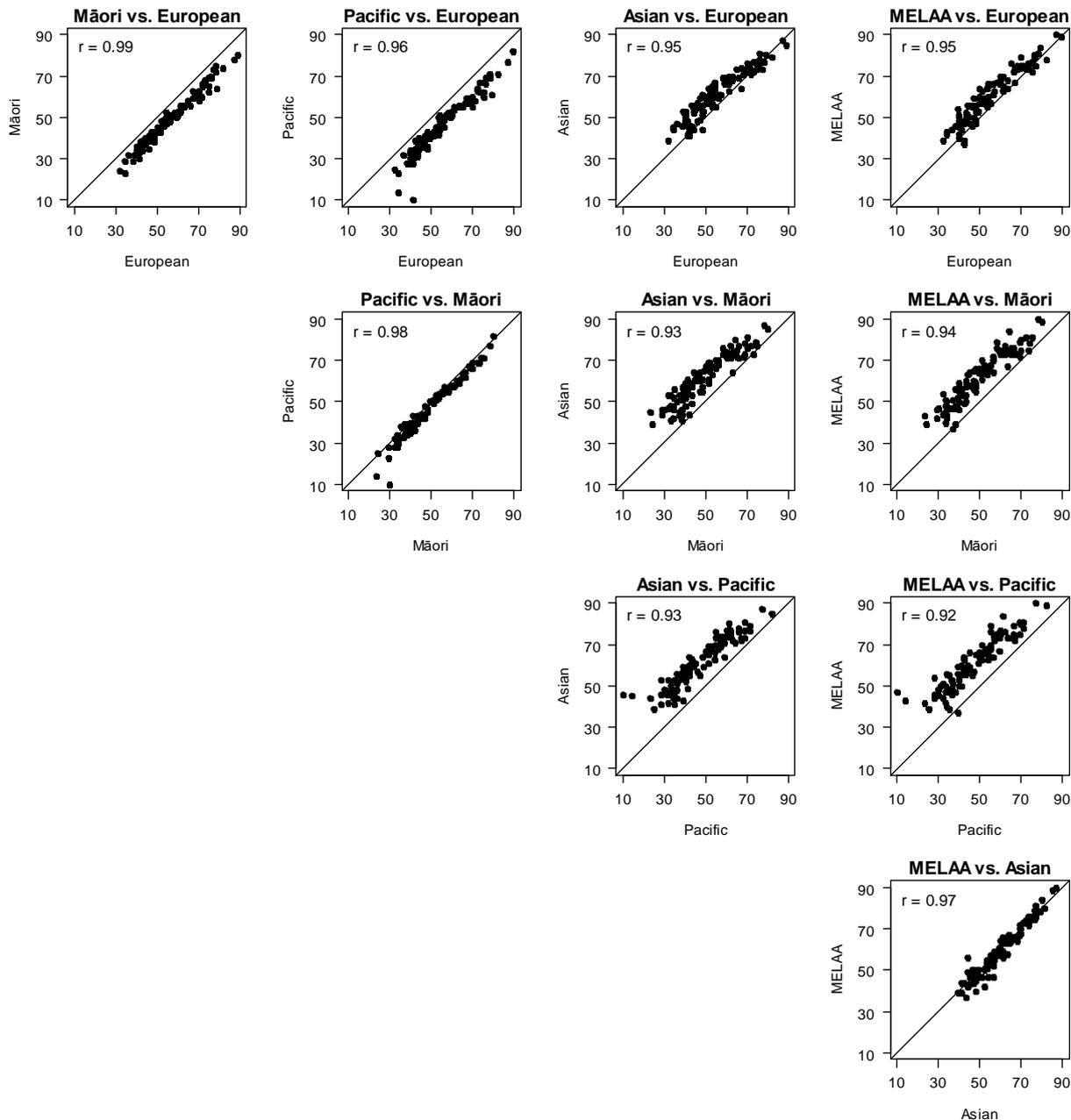
To investigate reasons for the patterns of ethnic differences in NZSEI-18 scores, Figure 7, Figure 8 and Figure 9 compare the mean income, years of education, and age, respectively, for each ethnic group by minor group (three-digit) occupation (shown as a series of cross-tabulations).

Figure 7 shows that European workers reported higher incomes than every other ethnic group, especially for higher paying occupations. Māori and MELAA workers reported slightly higher incomes than Asian workers for most occupations, and particularly for low paying occupations. Māori workers reported slightly higher incomes than Pacific and MELAA workers for most occupations. For low paying occupations, Pacific workers reported higher incomes than MELAA workers; however, for high paying occupations this relationship was reversed.

Figure 7. Mean income ($000s) for ANZSCO minor group occupations, comparison of ethnic groups
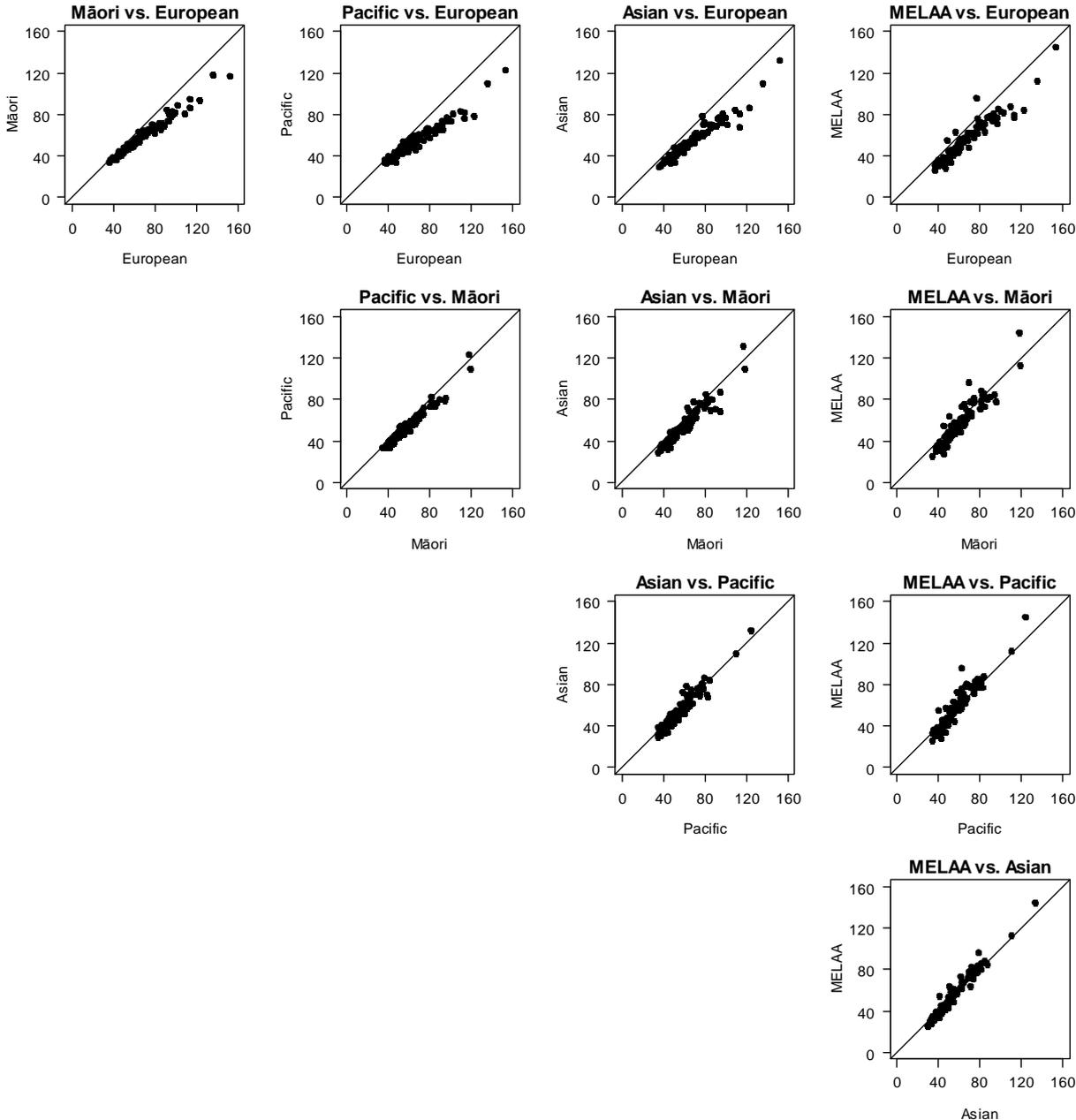
Source: *Stats NZ, 2018 Census*

Figure 8 shows that, across occupations, Asian and MELAA workers reported higher levels of education than other ethnic groups. European workers reported slightly higher levels of education than either Māori or Pacific workers. Similar levels of education across occupations were reported among Māori and Pacific workers, and among Asian and MELAA workers.

Figure 8. Mean years of education for ANZSCO minor group occupations, comparison of ethnic groups
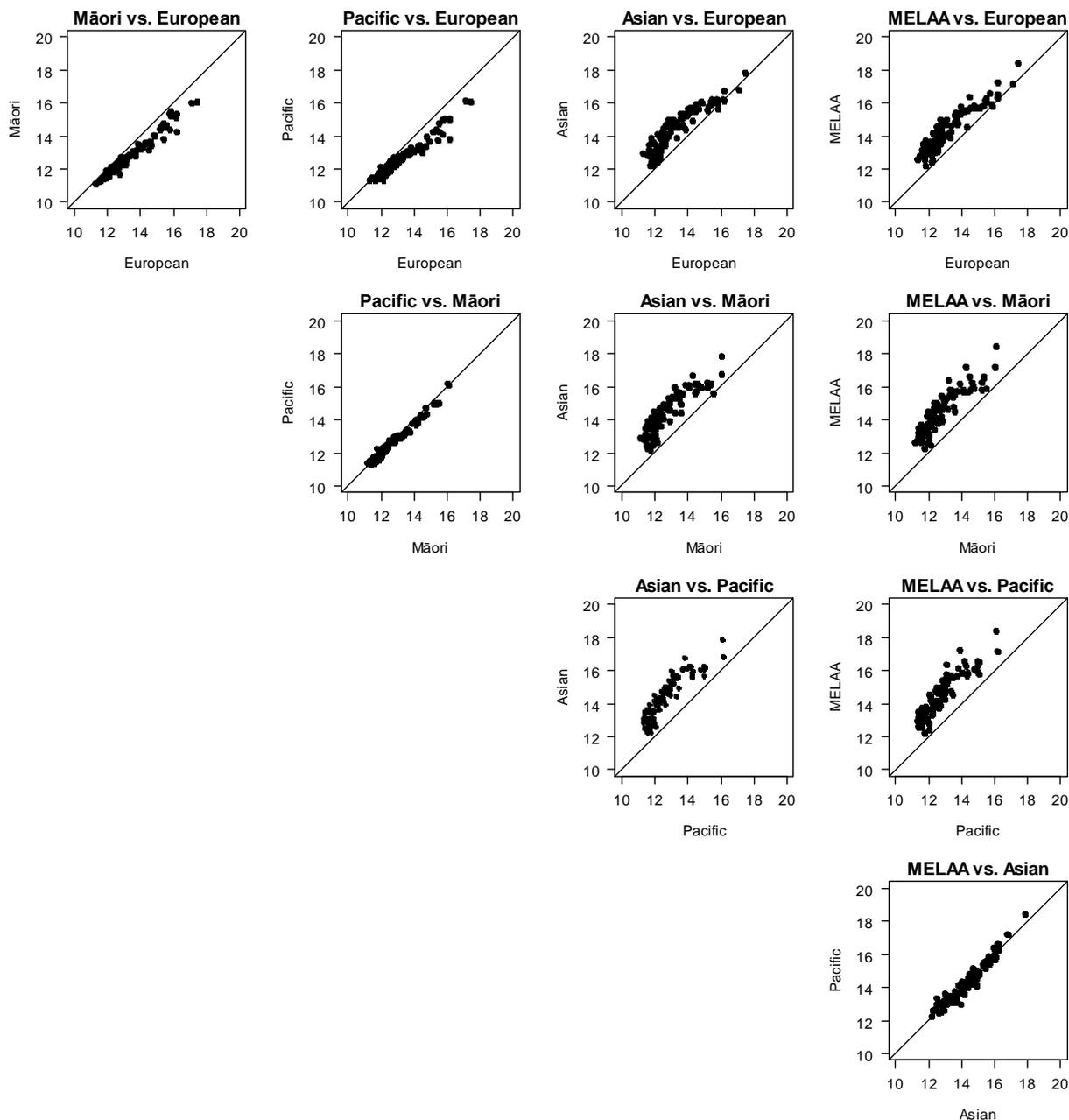
Source: *Stats NZ, 2018 Census*

Figure 9 shows that the European workforce was older than the Māori, Pacific, Asian, and MELAA workforces. The Māori workforce was older than the Pacific, Asian and MELAA workforces for most occupations, while the mean age was similar for most occupations for Pacific, Asian and MELAA workers.

Figure 9. Mean age (years) for ANZSCO minor group occupations, comparison of ethnic groups
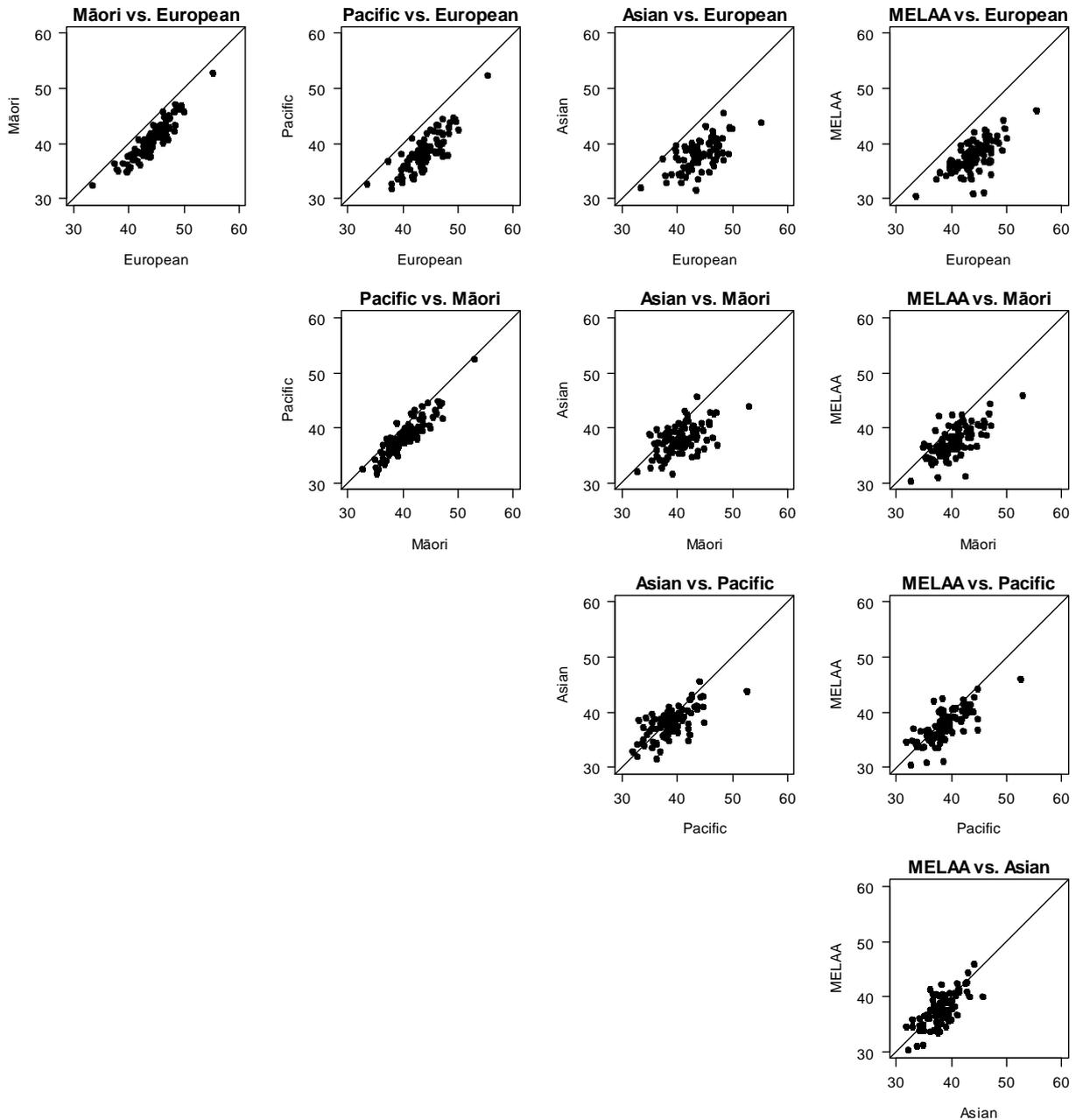
Source: Stats NZ, 2018 Census

Considered together, the pattern of findings shown in Figure 7, Figure 8, and Figure 9 suggest that it is primarily because of higher years of education in most minor group occupations that Asian and MELAA workers were assigned higher ethnic-specific NZSEI-18 scores than all other ethnic groups. Note that education contributes more to NZSEI-18 scores than income – the education-SES path (β_{32} = 0.545) is nearly double the SES-income path (β_{43} = 0.306). Moreover, a comparison of Figure 7 and Figure 8 shows that education differences between Asian and MELAA workers and workers in other ethnic groups are larger than the income differences between Asian and MELAA workers and workers in other ethnic groups. Therefore, it seems likely that higher years of education explain the high ethnic-specific NZSEI-18 scores for Asian and MELAA workers.

Lower years of education for most occupations and lower incomes for most occupations were the likely reason for the low ethnic-specific NZSEI-18 scores assigned to Māori and Pacific workers.

To aid interpretation of the validation chapter to follow (Chapter 5), which uses the six socio-economic groups, Table 29 shows the absolute and percentage differences in income by ethnicity, and socio-economic group, for full- and part-time workers aged 21–69 years from the 2018 Census. Table 30 shows the absolute and percentage differences in education (in years) by ethnicity and socio-economic group.

Within each socio-economic group, European workers reported higher incomes on average than every other ethnic group, mirroring the pattern shown in Figure 7. The income gaps were larger between men than between women.

Differences between European and Māori workers were larger for higher socio-economic groups. For example, the difference between European and Māori male workers was 22 percent for the most advantaged SES group, SES group 1, but 12 percent for the least advantaged SES group, SES group 6. Differences between incomes for Europeans and other ethnic groups showed a less clear SES gradient. There was some indication that income differences for Pacific men compared to European men were greater for higher SES groups (e.g. there was a 20 percent difference for SES 6 and a 28 percent difference for SES group 1). There did not appear to be a SES gradient for the income disparity between European and Asian workers. Unlike for Māori workers, the income gap between European and MELAA workers seemed to increase for lower SES groups. For example, the income difference for MELAA men was 14 percent for SES group 1, and 31 percent for SES group 6. The equivalent figures for MELAA women were 9 percent and 25 percent, respectively.

Differences in education between ethnic groups were typically less marked than the differences in income shown in Table 28. However, as with income, European workers reported higher education than both Māori and Pacific workers for all socio-economic groups. These differences were typically larger for higher socio-economic groups (e.g. in Pacific men, these differences were 8 percent for SES group 1, and 2 percent for SES group 6).

In contrast, European workers reported lower education than Asian and MELAA workers for all SES groups. These differences were typically larger for middle and low SES groups (e.g. 1–7 percent for SES groups 1–2, and 9–14 percent for SES groups 3–6).

Table 29. Differences in mean income, European ethnic group compared with Māori, Pacific, Asian, and MELAA, within SES groups

| SES group | Mean income ($) | | | | | Mean difference in income compared with European | | | | | | | |
| | | | | | | $ | | | | Percent | | | |
	European	Māori	Pacific	Asian	MELAA	Māori	Pacific	Asian	MELAA	Māori	Pacific	Asian	MELAA
Men													
1	117,100	91,400	84,000	89,000	100,500	25,800	33,100	28,100	16,600	22	28	24	14
2	91,500	72,800	66,400	76,100	79,600	18,600	25,100	15,400	11,800	20	27	17	13
3	94,900	75,400	66,800	66,100	72,700	19,500	28,100	28,800	22,200	21	30	30	23
4	63,000	54,300	50,000	47,100	48,800	8,700	13,100	16,000	14,200	14	21	25	23
5	53,400	48,800	45,500	41,600	40,700	4,600	7,900	11,800	12,700	9	15	22	24
6	49,800	43,900	40,100	37,500	34,500	5,900	9,700	12,300	15,300	12	20	25	31
Women													
1	82,000	72,900	68,400	70,300	74,700	9,000	13,600	11,700	7,300	11	17	14	9
2	66,800	58,900	55,100	59,900	58,700	8,000	11,800	6,900	8,200	12	18	10	12
3	69,700	60,700	56,600	56,800	57,900	9,000	13,100	12,900	11,800	13	19	19	17
4	50,400	45,600	43,800	41,000	41,000	4,900	6,600	9,400	9,500	10	13	19	19
5	41,500	41,000	38,100	34,800	34,300	500	3,400	6,600	7,200	1	8	16	17
6	42,400	39,800	35,900	33,400	32,000	2,600	6,600	9,000	10,500	6	16	21	25

Table 30. Differences in mean years of education, European ethnic group compared with Māori, Pacific, Asian and MELAA, within SES groups

| SES group | Mean education (years) | | | | | Mean difference in education compared with European | | | | | | | |
| | | | | | | Years | | | | Percent | | | |
	European	Māori	Pacific	Asian	MELAA	Māori	Pacific	Asian	MELAA	Māori	Pacific	Asian	MELAA
Men													
1	16.0	15.1	14.8	16.3	17.0	1.0	1.3	-0.3	-1.0	6	8	-2	-6
2	15.0	14.2	13.9	15.9	16.0	0.8	1.1	-0.9	-1.0	5	7	-6	-7
3	13.5	12.8	12.7	14.8	14.8	0.7	0.8	-1.3	-1.4	5	6	-10	-10
4	12.4	12.0	12.0	13.9	13.5	0.4	0.4	-1.5	-1.1	3	3	-12	-9
5	11.8	11.5	11.5	13.1	13.1	0.3	0.3	-1.3	-1.3	3	2	-11	-11
6	11.7	11.4	11.4	13.3	13.3	0.3	0.3	-1.5	-1.6	3	2	-13	-14
Women													
1	15.8	15.2	14.9	16.0	16.4	0.6	0.9	-0.2	-0.6	4	6	-1	-4
2	15.5	14.7	14.5	16.0	16.1	0.8	1.0	-0.5	-0.6	5	6	-3	-4
3	13.6	13.0	13.0	15.0	15.1	0.5	0.5	-1.4	-1.6	4	4	-10	-12
4	12.6	12.2	12.4	14.1	14.2	0.4	0.2	-1.5	-1.6	3	2	-12	-13
5	12.3	11.9	11.9	13.5	13.7	0.4	0.3	-1.2	-1.4	3	3	-10	-12
6	11.9	11.5	11.5	12.9	13.4	0.4	0.4	-1.0	-1.5	3	3	-9	-13

4.4 Analyses by rurality

To assess the possibility that the associations between education, income, and occupation may differ for workers by whether they lived in urban or rural areas, the model coefficients from Table 25 were used to calculate separate scales for workers in urban and rural areas. The minor group (three-digit) area-specific NZSEI-18 scores are shown in Figure 10.

Figure 10. Comparison of urban and rural NZSEI-18 scores (ANZSCO minor group)
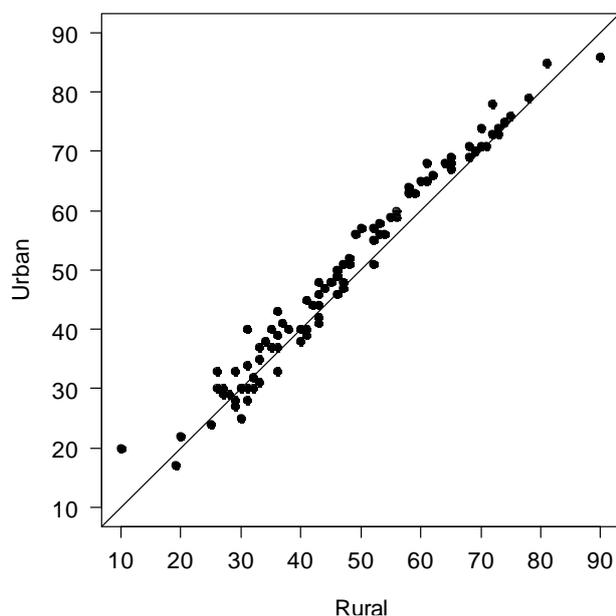
Figure 10 shows that for most occupations (72 out of 97), urban workers were assigned higher NZSEI-18 scores than rural workers, and for one occupations the difference was 10 points. There was a 2.3 point difference in mean urban and rural workers' scores across occupations (urban mean = 49.5, rural mean = 47.2). Despite this difference, urban and rural workers scores correlated at r = 0.99, suggesting that the socio-economic structuring of occupations was similar for both urban and rural areas.

To investigate reasons for the higher scores assigned to urban workers, Figure 11 compares the mean income, years of education, and age for workers in urban and rural areas by minor group (three-digit) occupation. This shows that for all occupations the average age of rural workers is older than the average age of urban workers. Urban and rural workers reported similar incomes across occupations. The biggest difference that can be seen is the higher levels of education among urban workers for nearly all (87 of 97) occupations; the only occupations for which rural workers had higher average years of education were: Medical Practitioners (253); Fabrication Engineering Trades Workers (322); and Farm, Forestry and Garden Workers (841). These differences were all relatively minor. The difference in education levels across nearly all occupations, combined with the strong contribution education makes to NZSEI-18 scores, is the primary reason that urban workers are assigned higher NZSEI-18 scores.

Figure 11. Mean values for income, years of education, and age, urban compared with rural for each occupation (ANZSCO minor group)
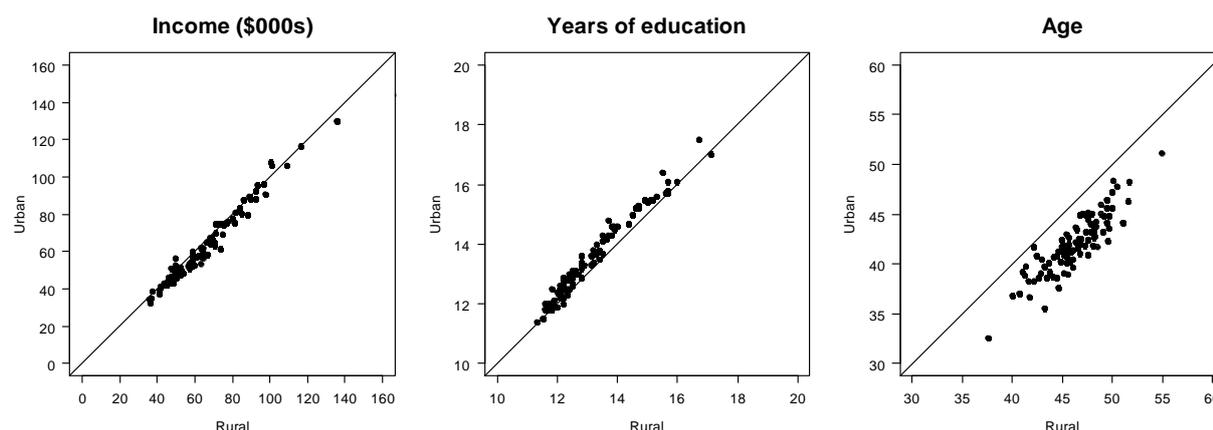
Source: Stats NZ, 2018 Census

The absolute and percentage differences between urban and rural workers in education and income by socio-economic group are shown in Table 31. Rural workers reported higher incomes for all socio-economic groups (by between 1 and 8 percent). Urban workers had 1–4 percent higher average years of education across socio-economic groups.

Table 31. Differences in mean income and years of education, urban compared with rural, within SES groups

SES Group	Mean income ($)		Difference in income between regions (U-R)		Mean education (years)		Difference in education between regions (U-R)	
	Urban	Rural	Percent (U-R)/R	$ (U-R)	Urban	Rural	Percent (U-R)/R	Years (U-R)
1	96,800	100,800	-4	-4,000	16.1	15.7	2	0.4
2	77,700	80,000	-3	-2,300	15.1	14.6	4	0.5
3	72,200	72,600	-1	-400	13.7	13.2	4	0.5
4	53,800	57,500	-6	-3,700	12.7	9.2	3	0.4
5	46,000	48,100	-4	-2,100	12.2	12.0	2	0.2
6	42,400	46,000	-8	-3,600	11.9	11.3	1	0.1

4.5 Analyses by region

To assess the possibility that the associations between education, income, and occupation may differ for workers in Auckland, when compared to the rest of New Zealand, the model coefficients from Table 25 were used to calculate separate scales for workers in both. The minor group (three-digit) area-specific NZSEI-18 scores are shown in Figure 12.

Figure 12. Comparison of Auckland and the rest of New Zealand NZSEI-18 scores (ANZSCO minor group)
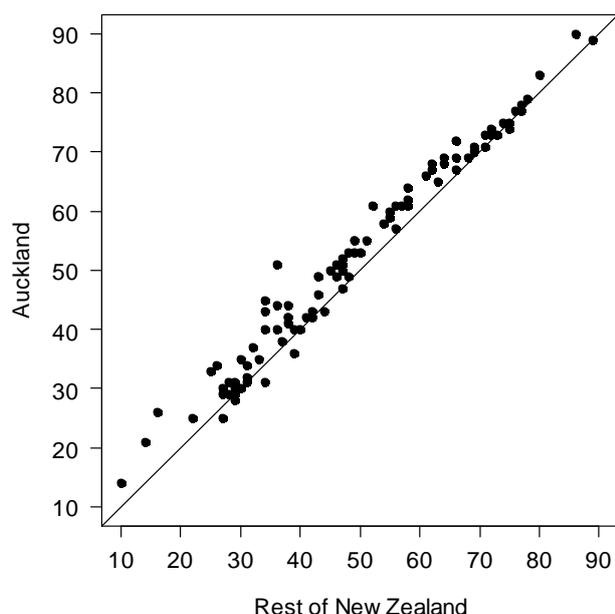
Figure 12 shows that for most occupations (80 out of 97), workers in Auckland were assigned higher NZSEI-18 scores than those elsewhere in New Zealand, and for three occupations the difference was 10 points or greater. Workers outside of Auckland were assigned higher scores for only six occupations, and these differences were all 3 points or fewer. There was a 3.2 point difference in mean scores across occupations (Auckland mean = 51.7, rest of New Zealand mean = 48.5). Despite this difference, both region's scores correlated at r = 0.99, suggesting that the socio-economic structuring of occupations was similar for Auckland and the rest of New Zealand.

To investigate reasons for the higher scores assigned to Auckland workers, Figure 13 compares the mean income, years of education, and age for workers in Auckland and the rest of New Zealand by minor group (three-digit) occupation. For most occupations, Auckland workers were younger, on average. Despite this, workers in Auckland reported slightly higher incomes, especially for high-paying occupations. Similar to the urban workers, workers in Auckland had a higher level of education for nearly all (90 of 97) occupations. There were only two occupations for which workers in the rest of New Zealand had slightly more years of education on average than Auckland workers, which were Printing Trades Workers (392) and Wood Trades Workers (394). These differences in both income and education likely contribute to the higher NZSEI-18 scores assigned to Auckland workers.

Figure 13. Mean values for income, years of education, and age, Auckland compared with the rest of New Zealand for each occupation (ANZSCO minor group)
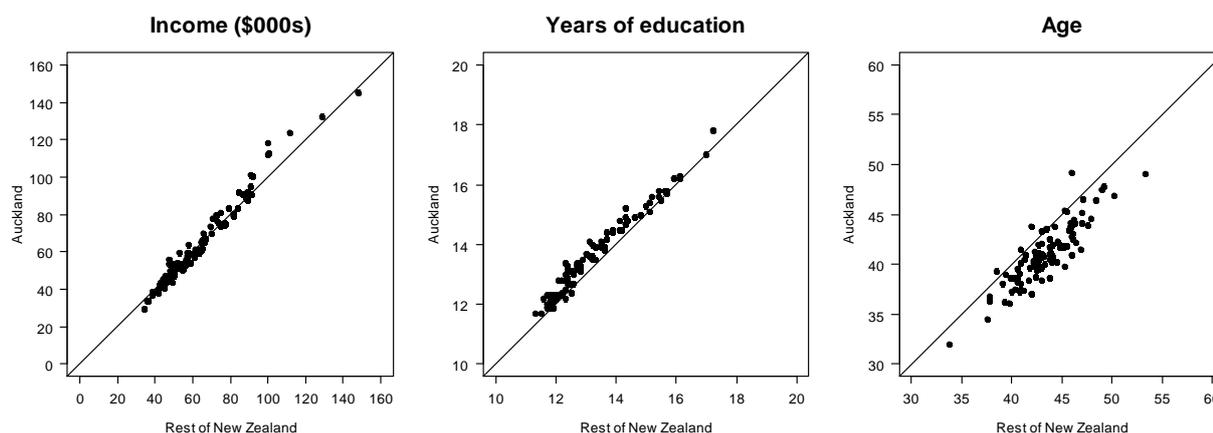
Source: Stats NZ, 2018 Census

The absolute and percentage differences between Auckland and the rest of New Zealand's workers in education and income by socio-economic group is shown in Table 32. As for Figure 13, workers outside of Auckland in lower socio-economic groups reported higher incomes (by between 3 and 6 percent for groups 5–6), whereas in higher socio-economic groups, workers in Auckland reported higher incomes (by between 2 and 5 percent for groups 1–3). For all socio-economic groups, workers in Auckland had higher education levels. Differences in average education levels were consistent but small across socio-economic groups (all between 1 and 4 percent).

Table 32. Differences in mean income and years of education, Auckland compared with the rest of New Zealand, within SES groups

SES Group	Mean income ($)		Difference in income between regions (A-R)		Mean education (years)		Difference in education between regions (A-R)	
	Auckland	Rest of NZ	Percent (A-R)/R	$ (A-R)	Auckland	Rest of NZ	Percent (A-R)/R	Years (A-R)
1	98,400	96,400	2	2,000	16.1	15.9	1	0.2
2	78,600	77,300	2	1,300	15.3	14.9	3	0.4
3	74,600	70,600	6	4,000	14.0	13.5	4	0.5
4	54,300	54,500	0	-200	13.0	12.5	3	0.4
5	45,400	46,600	-3	1,200	12.4	12.1	3	0.3
6	41,300	43,900	-6	-2,600	12.2	11.8	3	0.4

4.6 Analyses by country of birth

To assess the possibility that the associations between education, income, and occupation may differ for overseas-born and New Zealand-born workers, the model coefficients from Table 25 were used to calculate separate scales for workers born inside and outside of New Zealand. The minor group (three-digit) birthplace-specific NZSEI-18 scores are shown in Figure 14.

Figure 14. Comparison of overseas-born and New Zealand-born NZSEI-18 scores (ANZSCO minor group)
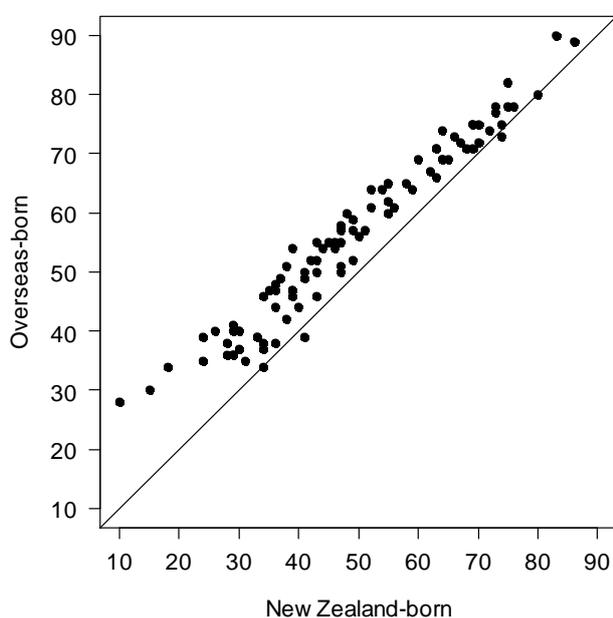
Figure 14 shows that for nearly all occupations (93 out of 97), overseas-born workers were assigned higher NZSEI-18 scores than workers born in New Zealand, and for 31 occupations this difference was 10 points or greater. There was a 7.3 point difference in mean scores across occupations (New Zealand-born mean = 48.3, overseas-born mean = 55.6). However, as with urban vs. rural workers, and Auckland workers vs. workers from the rest of New Zealand, overseas-born and New Zealand-born scores correlated strongly (r = 0.98), suggesting that the socio-economic structuring of occupations was largely the same, regardless of country of birth.

To investigate reasons for the higher scores assigned to overseas-born workers, Figure 15 compares the mean income, years of education, and age for workers born inside and outside of New Zealand by minor group (three-digit) occupation. For most occupations, the average age of workers was older for those born in New Zealand. For almost all occupations, New Zealand-born workers reported higher incomes (88 out of 97). Workers born outside of New Zealand had a higher level of education, on average, for almost all occupations. Only Midwifery and Nursing Professionals (254) had the same average level of education for those born overseas and those born in New Zealand. The difference in education levels is likely the reason that overseas-born workers were assigned higher NZSEI-18 scores, despite reporting lower incomes (remembering that education contributes more to NZSEI-18 scores than income). It is worth mentioning that this analysis assumes that qualifications gained overseas are equivalent to qualifications of the same level obtained in New Zealand. This assumption may not always hold.

Figure 15. Mean values for income, years of education, and age, overseas-born compared with New Zealand-born for each occupation (ANZSCO minor group)
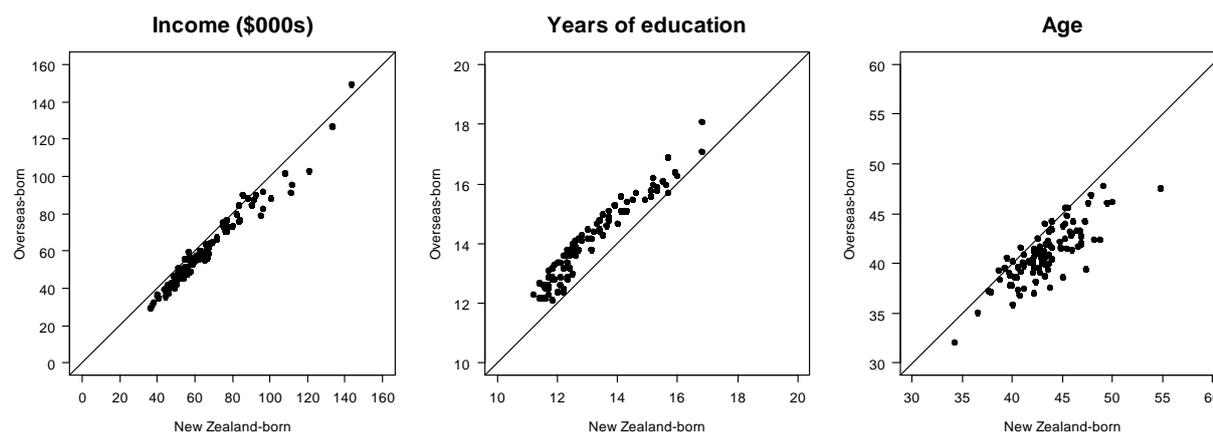
Source: Stats NZ, 2018 Census

The absolute and percentage differences between overseas-born and New Zealand-born workers in education and income by socio-economic group is shown in Table 33. As shown in Figure 15, overseas-born workers report consistently lower incomes than New Zealand-born workers. This difference is higher in lower socio-economic groups (between 10 and 16 percent for groups 4–6, between 5 and 7 percent for groups 1–3). For all socio-economic groups, overseas-born workers have higher levels of education, especially in lower socio-economic groups (between 7 and 9 percent for groups 3–6).

Table 33. Differences in mean income and years of education, overseas-born compared with New Zealand-born, within SES groups

SES Group	Mean income ($)		Difference in income between birthplace (O-N)		Mean education (years)		Difference in education between birthplace (O-N)	
	Overseas-born	NZ-born	Percent (O-N)/N	$ (O-N)	Overseas-born	NZ-born	Percent (O-N)/N	Years (O-N)
1	94,300	98,600	-5	-4,300	16.4	15.7	4	0.7
2	75,400	79,500	-5	-4,100	15.6	14.7	6	0.9
3	68,700	73,800	-7	-5,100	14.5	13.3	9	1.2
4	51,000	56,200	-10	-5,200	13.4	12.4	9	1.1
5	42,900	47,900	-12	-5,000	12.7	11.9	7	0.9
6	39,100	45,300	-16	-6,200	12.6	11.6	9	1.0

4.7 Analyses by disability status

To assess the possibility that the associations between education, income, and occupation may differ for disabled and non-disabled workers, the model coefficients from Table 25 were used to calculate separate scales for disabled and non-disabled workers. The minor group (three-digit) area-specific NZSEI-18 scores are shown in Figure 16.

Figure 16. Comparison of disabled and non-disabled NZSEI-18 scores (ANZSCO minor group)
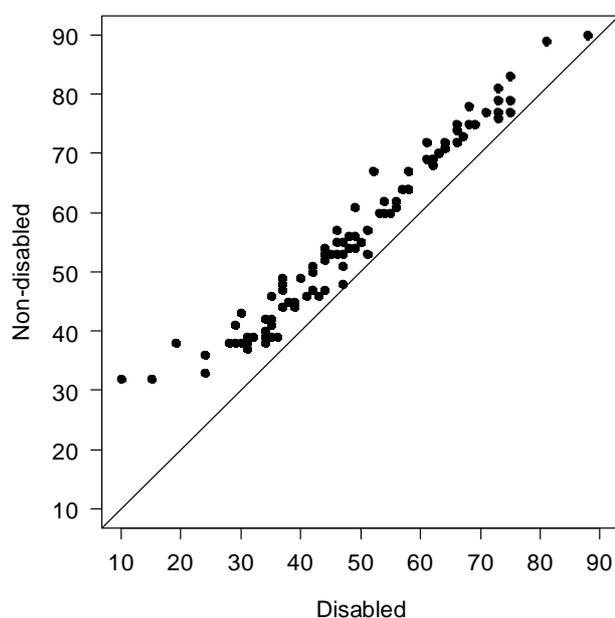
Figure 16 shows that for all occupations, non-disabled workers were assigned a higher score than disabled workers and for 17 occupations this difference was 10 points or greater. There was a 7.4 point difference in mean scores across occupations (disabled = 48.3, non-disabled = 55.7). As with other subgroups examined, disabled and non-disabled scores were strongly correlated (r = 0.98), suggesting that the socio-economic structuring of occupations was largely the same, regardless of disability status and despite large difference in scores.

To investigate reasons for the higher scores assigned to non-disabled workers, Figure 17 compares the mean income, years of education, and age for disabled and non-disabled workers by minor group (three-digit) occupation. Non-disabled workers had a higher level of education, on average, for all occupations, and were younger on average for all but one occupation (ICT and Telecommunications Technicians (313)). Non-disabled workers received higher incomes for most occupations (84/97). The difference in education and income levels is likely the reason that disabled workers were assigned lower NZSEI-18 scores than non-disabled workers.

Figure 17. Mean values for income, years of education, and age, disabled workers compared with non-disabled workers for each occupation (ANZSCO minor group)
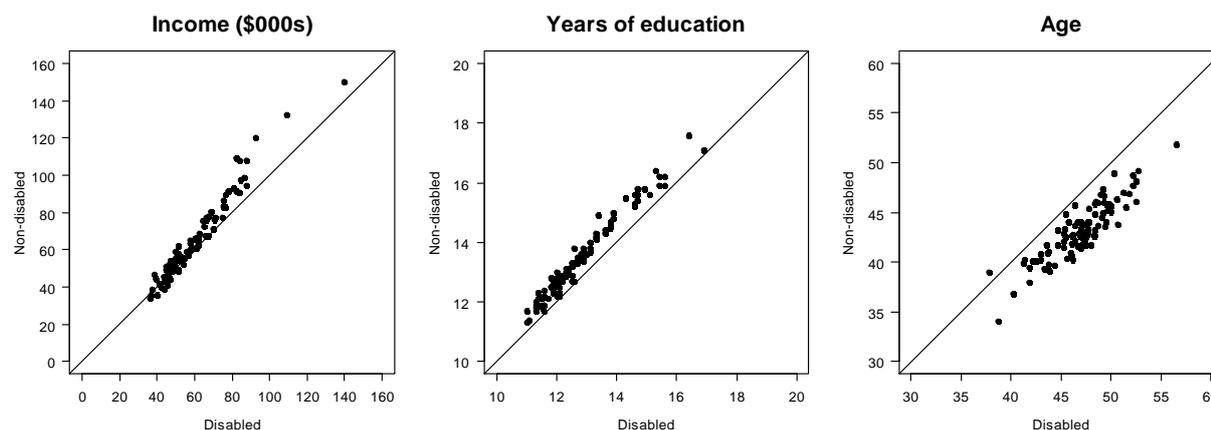
Source: Stats NZ, 2018 Census

The absolute and percentage differences between disabled and non-disabled workers in education and income by socio-economic group is shown in Table 34. Disabled workers reported lower incomes than non-disabled workers for all socio-economic groups, with a larger difference for higher socio-economic groups (between 9 and 12 percent for groups 1–3 and between 2 and 7 percent for groups 4–6). Disabled workers reported lower education levels for all socio-economic groups.

Table 34. Differences in mean income and years of education, disabled workers compared with non-disabled workers, within SES groups

SES Group	Mean income ($)		Difference in income by disability status (D-N)		Mean education (years)		Difference in education by disability status (D-N)	
	Disabled	Non-disabled	Percent (D-N)/N	$ (D-N)	Disabled	Non-disabled	Percent (D-N)/N	Years (D-N)
1	88,400	99,300	-11	-10,900	15.4	16.1	-4	-0.7
2	70,300	79,800	-12	-9,500	14.3	15.2	-6	-0.9
3	66,800	73,800	-9	-7,000	13.0	13.8	-6	-0.8
4	52,200	56,000	-7	-3,800	12.2	12.7	-4	-0.5
5	45,600	47,400	-4	-1,800	11.7	12.1	-3	-0.4
6	43,500	44,600	-2	-1,100	11.3	11.9	-5	-0.6

4.8 Summary and discussion

Comparison with NZSEI-13

It was possible to compare the scores assigned to individuals by NZSEI-18 with the scores assigned to individuals by NZSEI-13. This revealed that NZSEI-18 assigned socio-economic scores to occupations similarly to NZSEI-13 (the scores correlate at $r > 0.99$). However, NZSEI-18 scores were on average just under 4 points higher, due to a change in the centring methodology employed. The near perfect correlation was not surprising, given that the two scales were calculated using very similar path coefficients. The implication of this is that the NZSEI-18 can reasonably be applied to occupation data collected prior to 2018 (at least as far back as 2013), so long as the ANZSCO classification has been used.

Comparisons between population subgroups

Using the path coefficients determined for the sample as a whole, NZSEI-18 scores were constructed separately for men and women. Comparisons showed that men were assigned higher scores for the vast majority of occupations (mean difference across occupations was 2.8 points). Comparing men and women on mean income, years of education, and age for each minor group occupation revealed that it was the lower mean income reported by women that likely resulted in lower sex-specific NZSEI-18 scores. However, male and female scores correlated strongly ($r = 0.96$), suggesting that the socio-economic structure of occupations is similar for the two sexes. This also suggests that the NZSEI-18 scale is applicable to both men and women.

NZSEI-18 scores were also constructed separately and compared for five ethnic groups – European, Māori, Pacific, Asian, and MELAA. Asian and MELAA workers had ethnic-specific NZSEI-18 scores that were higher than European, Māori, and Pacific workers. Comparing ethnic groups on mean income, years of education, and age for each minor group occupation revealed that the higher mean years of education for Asian and MELAA workers relative to other ethnic groups was the likely reason for their higher ethnic-specific NZSEI-18 scores. European workers were assigned the next highest NZSEI-18 scores. Further examination suggested this was due to this group receiving higher incomes and being on average older. Māori and Pacific workers were on average younger, less well paid and less educated and were assigned the lowest ethnic-specific NZSEI-18 scores. These differences notwithstanding, the ethnic-specific NZSEI-18 scores of each ethnic group correlated strongly with every other group (all pairwise $r \geq 0.92$). This suggests that the socio-economic structure of occupations is similar across ethnic groups, and that NZSEI-18 can be applied to these ethnic groups.

NZSEI-18 scores were also constructed separately for workers who lived in urban and rural areas; Auckland workers and workers from the rest of New Zealand; New Zealand-born and overseas-born workers; and disabled and non-disabled workers. Some between-group differences were found. Urban workers were assigned higher scale scores for most occupations (mean difference across occupations was 2.3 points), and this was likely because of the higher levels of education for urban vs. rural workers for nearly all occupations. Similarly, Auckland workers were assigned higher scale scores than workers from the rest of New Zealand (mean difference 3.2 points). This was likely a function both of the higher incomes and the higher education levels of Auckland workers for most occupations. Overseas-born workers were assigned substantially higher scores than New Zealand-born workers for most occupations (mean difference 7.3 points). This appeared to be a function of the higher education levels for most occupations for overseas-born workers, despite the lower incomes reported for most occupations for overseas-born workers. Disabled workers were assigned lower scores than non-disabled workers for all occupations (mean difference 7.4 points). This was likely due to the higher levels of education for non-disabled workers for all occupations, and higher incomes for non-disabled workers for most occupations.

Notwithstanding these differences, the scales constructed for each of the groups were very similar to each other. Urban and rural scores correlated at $r = 0.99$; scores for Auckland workers and for workers from the rest of New Zealand correlated at $r = 0.99$; scores for overseas-born and New Zealand-born workers correlated at $r = 0.98$; and scores for disabled and non-disabled workers correlated at $r = 0.98$.

Taken together, this suggests that the socio-economic structure of occupations is similar for workers – and the NZSEI-18 scale is applicable – regardless of rurality, region, country of birth or disability status.
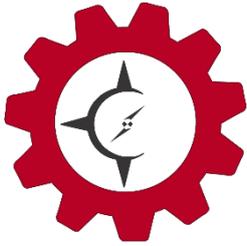
5. Construct validation of NZSEI-18

In this section, NZSEI-18 is applied to data from the 2018 Census to assess whether the socio-economic index replicated expected patterns for smoking, residential deprivation, housing tenure, hospitalisations, self-rated health and life-satisfaction.

Multivariable regression analyses will be presented to further assess the validity of NZSEI-18 and to determine the contribution of age, sex, ethnicity, and the NZSEI-18 to the six outcomes. Logistic and ordinal logistic regression analyses were undertaken for binary outcomes (smoking, housing tenure, hospitalisations, self-rated health and life satisfaction), while least-squares regression analyses were undertaken for the continuous NZDep2018 measure. For each correlate, two models were fitted, one using the continuous measure of NZSEI-18, and the other using the categorical six socio-economic group measure of NZSEI-18.

All models included age group, sex (male versus female), and ethnic group (European, Māori, Pacific, Asian, and MELAA; for each ethnicity, the comparison group is those not identifying with that ethnic group). The odds ratios for NZSEI-18 scores are reported on a scale converted into units of 10 (that is, per 10 NZSEI-18 score units).

5.1 Smoking prevalence

The overall prevalence of smoking for workers aged 21–69 years for the 2018 Census was 13.9 percent.

Bivariate analysis

Figure 18 shows the prevalence of smoking across the six NZSEI-18 socio-economic groups. There was a graded association between smoking prevalence and socio-economic group, with the prevalence of smoking increasing with declining socio-economic groups. The prevalence of smoking in the lowest socio-economic group was more than four times as high (25.4 percent) as that reported by the highest occupational group (5.3 percent).

Figure 18. Smoking prevalence by NZSEI-18 SES group
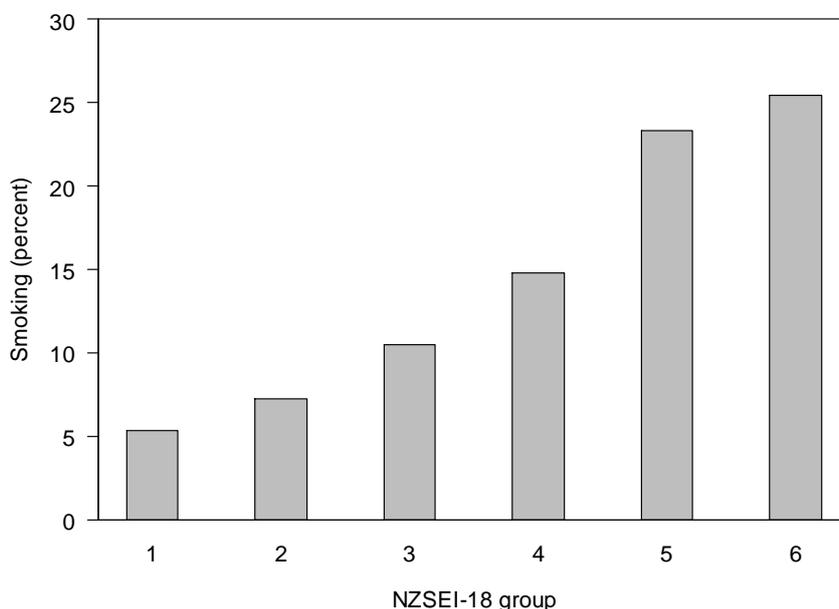
Figure 19 shows that the socio-economic gradient in smoking was apparent for both men and women of each ethnic group. This is most obvious among European, Māori and Pacific gender groups.

For Asian men and women and MELAA men, there was a clear gradient for socio-economic groups 1–5, but smoking prevalence was slightly lower among those in group 6 compared with group 5.

A male excess in smoking was apparent for those of Pacific, Asian and MELAA ethnicity, while a female excess was apparent among Māori. Smoking prevalence was particularly low among Asian women.

Figure 19. Smoking prevalence by NZSEI-18 SES group, sex, and ethnic group
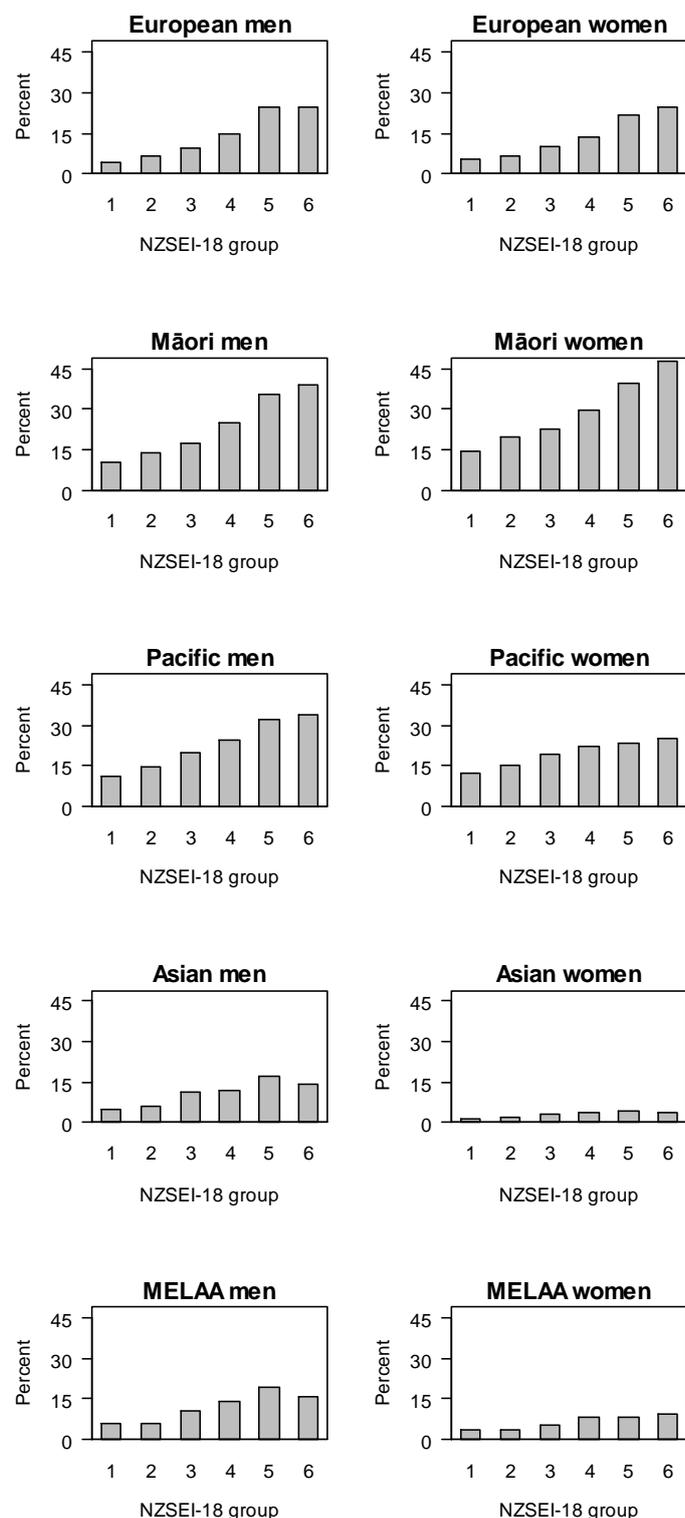
Multi-variable analysis

Table 35 shows the results for the logistic regression model on smoking, using the continuous measure of NZSEI-18. Controlling for age group, sex, and ethnicity, the odds ratio for smoking was 0.752 for each 10-unit increase in NZSEI-18. Older age groups were less likely to smoke than younger age groups, but this relationship was non-linear. Being male was associated with lower odds of smoking. Identifying with Māori and Pacific ethnicities was associated with substantial higher odds of smoking, while identifying with European, Asian or MELAA ethnicities was associated with substantially lower odds of smoking.

Table 35. Odds ratios for smoking, NZSEI-18 continuous measure

Factor	Odds ratio (95 percent CI)	P value
NZSEI-18 (per 10 units)	0.752 (0.750 – 0.753)	<.0001
Sex (male vs. female)	0.868 (0.861 – 0.875)	<.0001
European (vs. non-European)	0.740 (0.730 – 0.750)	<.0001
Māori (vs. non-Māori)	2.007 (1.984 – 2.030)	<.0001
Pacific (vs. non-Pacific)	1.262 (1.241 – 1.283)	<.0001
Asian (vs. non-Asian)	0.382 (0.375 – 0.389)	<.0001
MELAA (vs. non-MELAA)	0.490 (0.471 – 0.510)	<.0001
Age (21–29 vs. 60–69)	1.730 (1.703 – 1.757)	<.0001
Age (30–39 vs. 60–69)	1.972 (1.942 – 2.003)	<.0001
Age (40–49 vs. 60–69)	1.715 (1.688 – 1.742)	<.0001
Age (50–59 vs. 60–69)	1.498 (1.475 – 1.522)	<.0001

The results of the logistic regression model using the categorical group measure of NZSEI-18 are shown in Figure 20, with odds ratios shown for each socio-economic group, controlling for age group, sex, and ethnicity (reference group is SES group 6).

There was a linear association between socio-economic group and smoking. Those from socio-economic groups 1–5 all had lower odds of smoking than those from socio-economic group 6. Those from socio-economic group 1 had much lower odds of smoking (0.21) while the odds of smoking were also lower for each of the remaining socio-economic groups, with the strength of the difference diminishing in a linear fashion.

5.2 Deprivation

As described in Section 1.3, an area-based measure of deprivation – NZDep2018 – has been derived using data from the 2018 Census. NZDep2018 assigns each SA1 in New Zealand a score from 1 (least deprived) to 10 (most deprived) with roughly the same number of SA1s in each of the 10 categories. For the analyses presented here, each individual was assigned the NZDep2018 score of the dwelling in which they lived.

Bivariate analysis

Figure 21 shows the mean NZDep2018 scores for each NZSEI-18 socio-economic group. Note that the mean NZDep2018 score across all workers aged 21–69 years was 5.3. There was little evidence that the top half of the NZSEI-18 distribution (groups 1–3) differed on NZDep2018 scores. However, generally average NZDep2018 scores increased across increasing NZSEI-18 groups.

Figure 20. Odds ratios for smoking, NZSEI-18 categorical measure
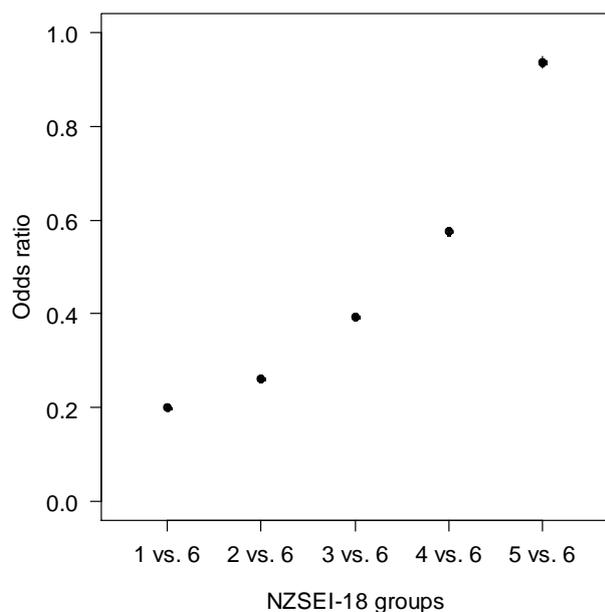
Note: Because of the large sample size for this analysis, the confidence intervals for the odds ratios are so narrow that they do not appear on the plot above.

Figure 21. Mean scores on NZDep2018 scale, by NZSEI-18 SES group
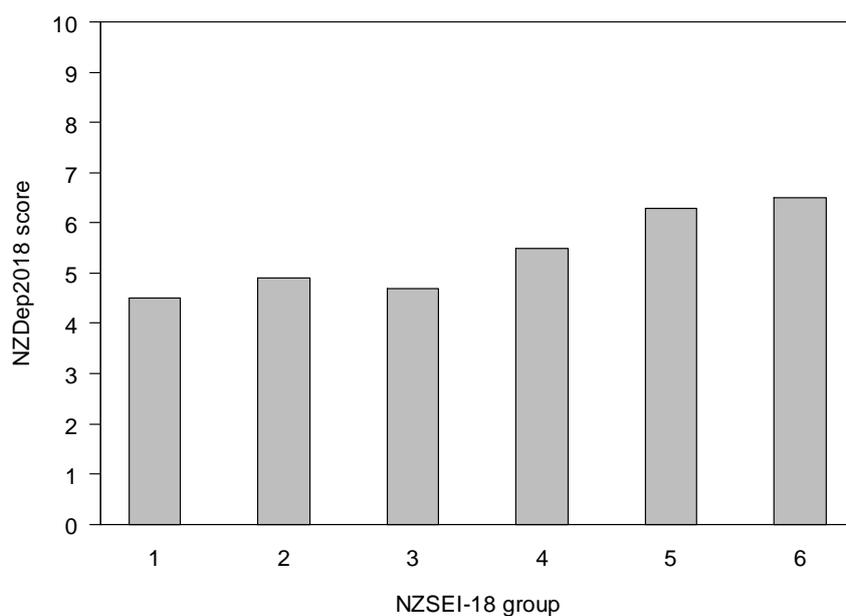
There were slight socio-economic gradients in deprivation by sex and ethnicity, as shown in Figure 22. However, there was little to distinguish those in socio-economic groups 1–3, with gradients more apparent across groups 4–6 for both sexes and each ethnic group. Few sex differences were evident, but there were clear ethnic differences in deprivation. European workers lived in the least deprived areas, followed in order by MELAA workers, Asian workers, Māori workers and lastly Pacific workers.

Figure 22. Mean scores on NZDep2018 scale, by NZSEI-18 SES group, sex and ethnic group
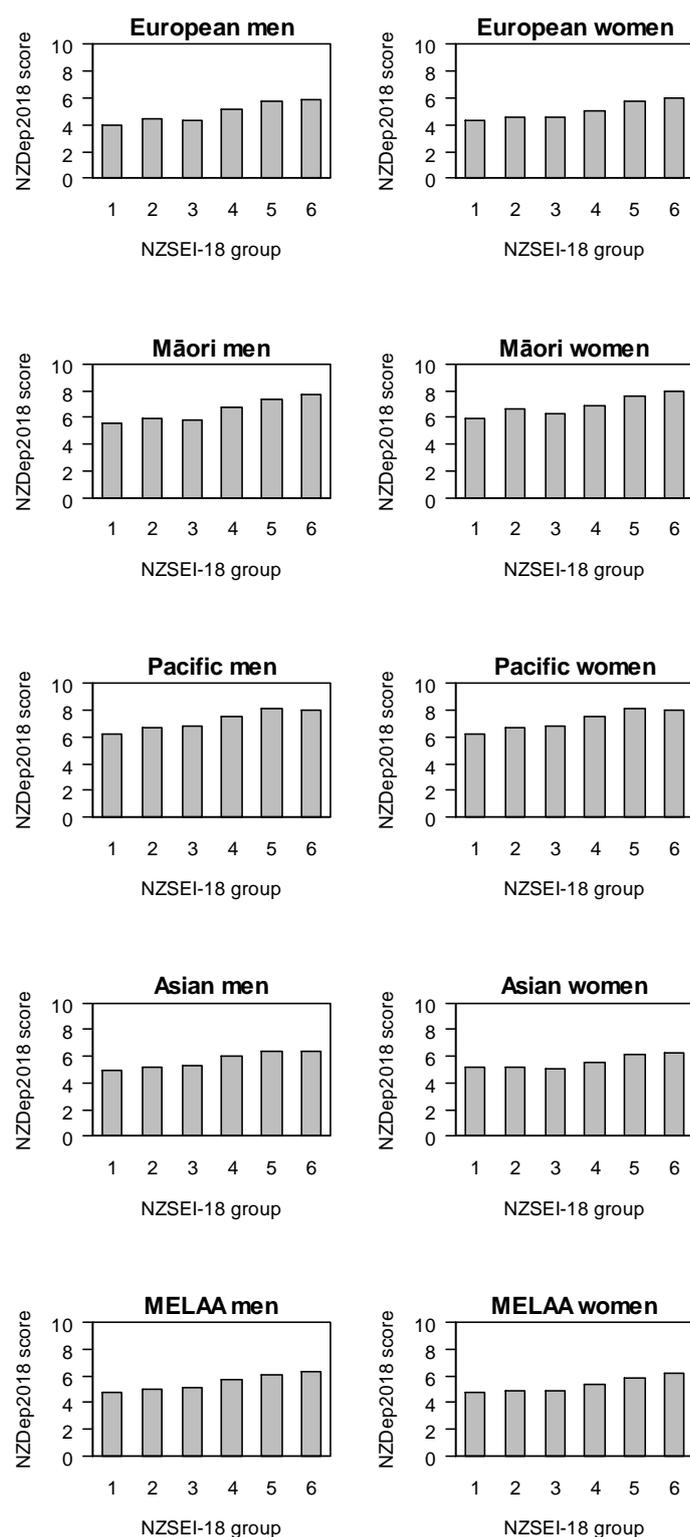
Multi-variable analysis

Table 36 shows the effect of the continuous NZSEI-18 measure on scores of the NZDep2018 scale, controlling for age group, sex, and ethnicity. The table shows that NZDep2018 scores decreased by 0.287 for every 10-point increase in the continuous NZSEI-18 measure. Note that while increasing scores on the continuous NZSEI-18 scale represent higher SES, increasing scores on the NZDep2018 scale represents higher deprivation, so a negative association is expected. NZDep2018 scores also decreased with increasing age, were lower for women and those identifying with European, Asian and MELAA ethnic groups. NZDep2018 scores were higher for those with Māori and Pacific ethnicities.

Table 36. Beta coefficients for scores on the NZDep2018 scale, NZSEI-18 continuous measure

Factor	Beta coefficients (95 percent CI)	P value
NZSEI-18 (per 10 units)	-0.287 (-0.289 – -0.285)	<.0001
Sex (male vs. female)	0.100 (0.093 – 0.107)	<.0001
European (vs. non-European)	-1.225 (-1.239 – -1.211)	<.0001
Māori (vs. non-Māori)	1.117 (1.105 – 1.129)	<.0001
Pacific (vs. non-Pacific)	1.407 (1.390 – 1.424)	<.0001
Asian (vs. non-Asian)	-0.487 (-0.503 – -0.471)	<.0001
MELAA (vs. non-MELAA)	-0.631 (-0.662 – -0.600)	<.0001
Age (21–29 vs. 60–69)	0.456 (0.444 – 0.468)	<.0001
Age (30–39 vs. 60–69)	0.309 (0.296 – 0.321)	<.0001
Age (40–49 vs. 60–69)	-0.020 (-0.032 – -0.008)	0.0012
Age (50–59 vs. 60–69)	-0.056 (-0.068 – -0.044)	<.0001

Note: *NZDep2018 scale = index of deprivation 2018*

Analysing NZSEI-18 as a six-group categorical variable (see Figure 23) revealed that those in socio-economic groups 1–3 had NZDep2018 scores that were approximately 1.3–1.5 less than those in socio-economic group 6. The effect on NZDep2018 scores for each of the remaining socio-economic groups was less, with the strength of the difference diminishing in a fairly linear fashion for SES groups 3–5.

Figure 23. Beta coefficients for scores on the NZDep2018 scale, NZSEI-18 categorical measure
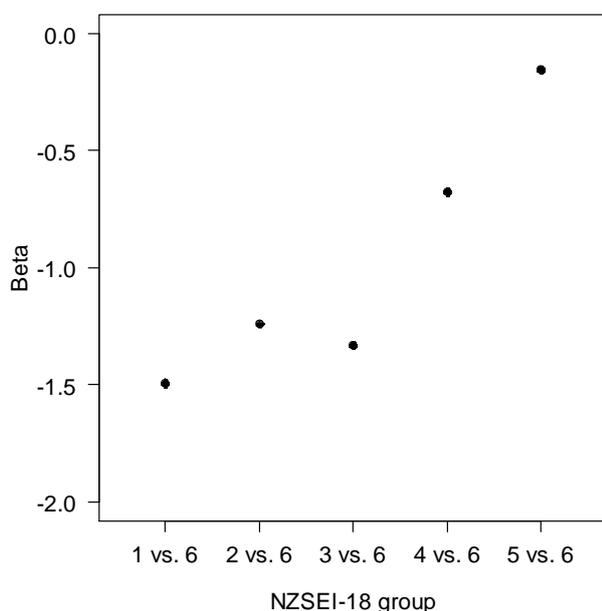
Note: *Because of the large sample size for this analysis, the confidence intervals for the odds ratios are so narrow that they do not appear on the plot above.*

5.3 Housing tenure

Among workers aged 21–69, 41.7 percent were classified as renting the home they were living in at the time of the 2018 Census. The remaining 58.3 percent were classified as not renting. This group was composed of respondents who reported owning or partly owning their home (46.9 percent of total) and respondents who reported that their home was held in a family trust (11.4 percent).

Bivariate analysis

Figure 24 shows the prevalence of renting across the six NZSEI-18 socio-economic groups. Generally, renting prevalence was higher for more socio-economically deprived groups. However, there was less evidence of a socio-economic gradient among the more advantaged socio-economic groups, and group 3 had a slightly lower prevalence than group 2 (33.9 percent compared to 37.9 percent).

Figure 24. Renting prevalence by NZSEI-18 SES group
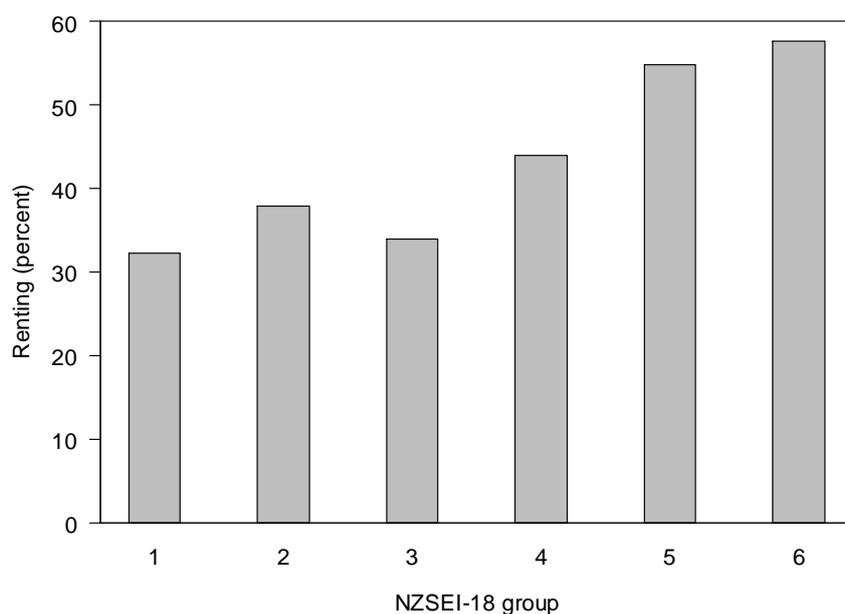
Figure 25 shows a socio-economic gradient in renting for both men and women across ethnic groups. For many ethnic by gender groups, there was a clear differentiation between the three most advantaged socio-economic groups and the three least socio-economically advantaged groups, with little to distinguish the groups within these sets.

Figure 25. Renting prevalence by NZSEI-18 SES group, sex, and ethnicity
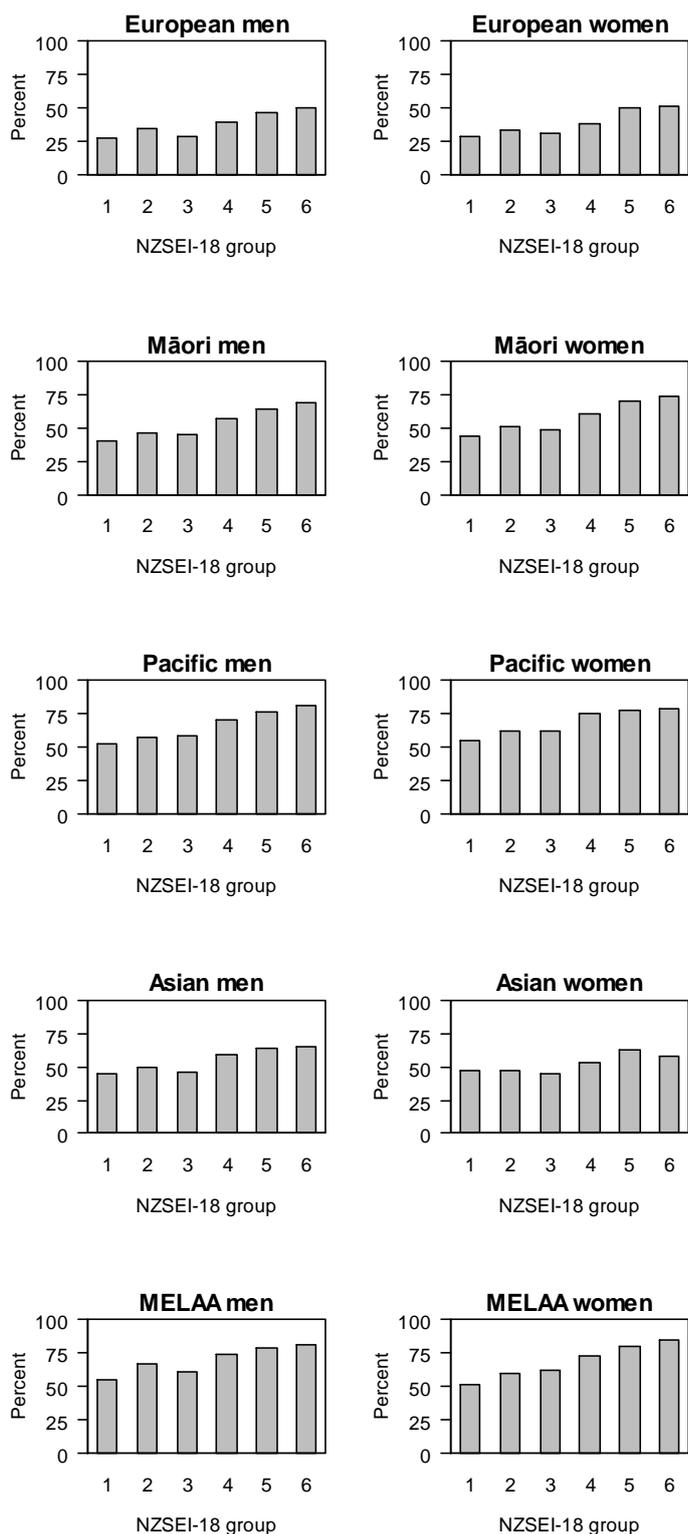
Multi-variable analysis

Table 37 shows that the odds ratio of renting was 0.828 for every 10-unit difference in NZSEI score, after adjusting for age group, sex and ethnic group. The odds of renting were greater for younger age groups. Being male and identifying with a Māori, Pacific or MELAA ethnic group were associated with higher odds of renting, while identifying with a European or Asian ethnic group was associated with lower odds of renting.

Table 37. Odds ratios for renting, NZSEI-18 continuous measure

Factor	Odds ratio (95 percent CI)	P value
NZSEI-18 (per 10 units)	0.828 (0.826 – 0.829)	<.0001
Sex (male vs. female)	1.031 (1.024 – 1.038)	<.0001
European (vs. non-European)	0.556 (0.548 – 0.564)	<.0001
Māori (vs. non-Māori)	1.586 (1.567 – 1.605)	<.0001
Pacific (vs. non-Pacific)	2.171 (2.130 – 2.212)	<.0001
Asian (vs. non-Asian)	0.840 (0.827 – 0.854)	<.0001
MELAA (vs. non-MELAA)	1.970 (1.908 – 2.034)	<.0001
Age (21–29 vs. 60–69)	20.408 (20.127 – 20.693)	<.0001
Age (30–39 vs. 60–69)	4.584 (4.528 – 4.641)	<.0001
Age (40–49 vs. 60–69)	2.072 (2.047 – 2.098)	<.0001
Age (50–59 vs. 60–69)	1.330 (1.314 – 1.347)	<.0001

Figure 26. Odds ratios for renting, NZSEI-18 categorical measure
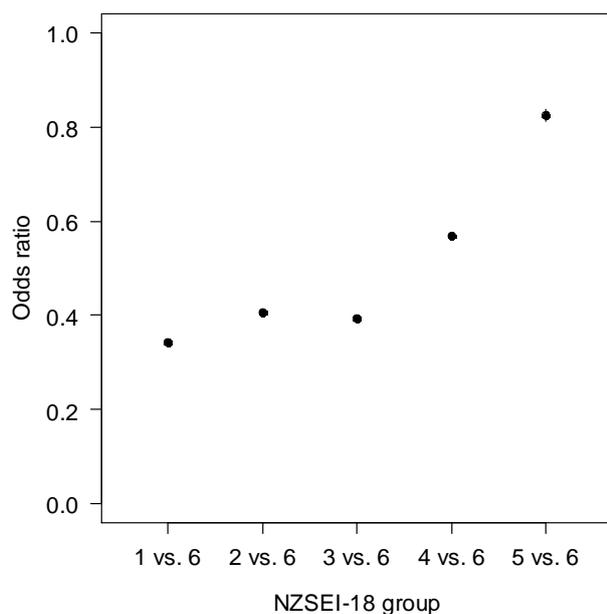
Figure 26 displays the results of the logistic regression model for renting using the categorical measure of NZSEI, adjusting for age group, sex and ethnic group (reference category is socio-economic group 6). More socio-economically advantaged groups were less likely to rent. As was evident for residential deprivation, the odds of renting for the first three socio-economic groups compared to group 6 were similar.

5.4 Hospitalisations

Of workers aged 21–69 who were present in the IDI spine (97.8 percent of workers aged 21–69), 10.3 percent were hospitalised at least once during 2018. Controlling for age group, sex, and ethnicity, the odds ratio for being hospitalised was 0.959 for each 10-unit difference in NZSEI score, as displayed in Table 38. Being male and identifying with a Māori or Pacific ethnic group was associated with higher

odds of being hospitalised. Identifying with a European, Asian or MELAA ethnic group was associated with lower odds of being hospitalised. The odds of being hospitalised were generally greater for older age groups.

Table 38. Odds ratios for being hospitalised during 2018, NZSEI-18 continuous measure

Factor	Odds ratio (95 percent CI)	P value
NZSEI-18 (per 10 units)	0.959 (0.957 – 0.962)	<.0001
Sex (male vs. female)	1.542 (1.528 – 1.556)	<.0001
European (vs. non-European)	0.905 (0.890 – 0.920)	<.0001
Māori (vs. non-Māori)	1.250 (1.232 – 1.268)	<.0001
Pacific (vs. non-Pacific)	1.140 (1.116 – 1.164)	<.0001
Asian (vs. non-Asian)	0.631 (0.618 – 0.645)	<.0001
MELAA (vs. non-MELAA)	0.886 (0.851 – 0.923)	<.0001
Age (21–29 vs. 60–69)	0.672 (0.662 – 0.683)	<.0001
Age (30–39 vs. 60–69)	0.767 (0.756 – 0.778)	<.0001
Age (40–49 vs. 60–69)	0.585 (0.576 – 0.594)	<.0001
Age (50–59 vs. 60–69)	0.707 (0.697 – 0.718)	<.0001

Figure 27. Odds ratios for being hospitalised during 2018, NZSEI-18 categorical measure
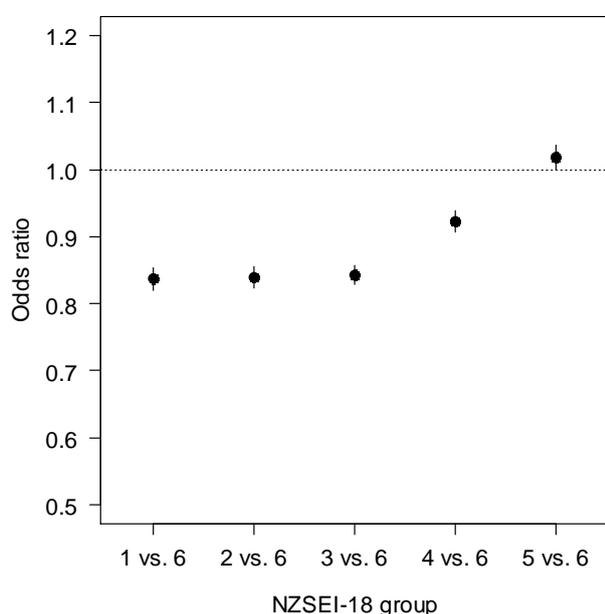
The results of the logistic regression model using the categorical group measure of NZSEI-18 are shown in Figure 27, with odds ratios shown for each socio-economic group, controlling for age group, sex, and ethnicity (reference group is socio-economic group 6).

Generally, those from higher socio-economic groups had slightly lower odds of being hospitalised during 2018.

5.5 Self-rated health

As detailed in Section 1.3, two outcomes from the General Social Survey were used to validate the NZSEI-18: self-rated health and life-satisfaction. There were five possible self-rated health ratings: excellent, very good, good, fair and poor. As such, ordinal logistic regression has been used. The estimates therefore represent the difference in the odds ratios of reporting better health between adjacent categories (e.g. the odds of reporting fair health rather than poor health). Data were available for 15,108 workers aged 21–69 years in the 2018 General Social Survey.

Table 39 presents the results for the analysis of self-rated health. Adjusting for age group, sex and ethnic group, the odds ratio for reporting better self-rated health was 1.120 for each 10-unit increase in NZSEI-18 scores. The odds of reporting better self-rated health were greater for younger age groups and for European and MELAA workers. Māori workers reported poorer self-rated health than non-Māori workers. There did not appear to be a difference in self-rated health by sex or for Pacific and Asian workers (however, this analysis may have been underpowered to detect differences for small groups).

Table 39. Odds ratios for reporting better self-rated health, NZSEI-18 continuous measure

Factor	Odds ratio (95 percent CI)	P value
NZSEI-18 (per 10 units)	1.120 (1.097 – 1.144)	<.0001
Sex (male vs. female)	0.983 (0.911 – 1.061)	0.663
European (vs. non-European)	1.248 (1.079 – 1.445)	0.003
Māori (vs. non-Māori)	0.652 (0.564 – 0.753)	<.0001
Pacific (vs. non-Pacific)	0.937 (0.743 – 1.181)	0.578
Asian (vs. non-Asian)	1.163 (0.969 – 1.395)	0.104
MELAA (vs. non-MELAA)	1.530 (0.999 – 2.342)	0.050
Age (21–29 vs. 60–69)	1.413 (1.205 – 1.656)	<.0001
Age (30–39 vs. 60–69)	1.207 (1.056 – 1.380)	0.006
Age (40–49 vs. 60–69)	1.127 (0.991 – 1.283)	0.069
Age (50–59 vs. 60–69)	1.012 (0.881 – 1.163)	0.865

The results of the ordinal logistic regression model using the categorical group measure of NZSEI-18 are shown in Figure 28, with odds ratios shown for each socio-economic group, controlling for age group, sex, and ethnicity (reference group is SES group 6). This shows that the odds of reporting better self-rated health were reduced for lower socio-economic groups.

Figure 28. Odds ratios for better self-rated health, NZSEI-18 categorical measure
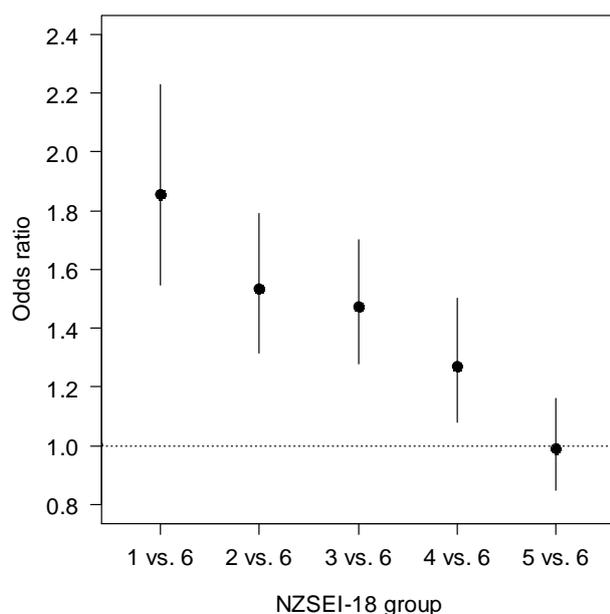
5.6 Life-satisfaction

The odds of reporting greater life-satisfaction were modelled using data for 15,099 workers aged 21–69 using data from the 2018 General Social Survey. Life-satisfaction was reported on an 11-point scale, ranging from completely dissatisfied (0) to completely satisfied (10). Life-satisfaction ratings were highly skewed, with the majority of respondents reporting high levels of life-satisfaction, As such, the following cut-points were used for creating life satisfaction groups: low = 0–6, medium = 7–8, and high = 9–10. The estimates represent the difference in the odds ratios of reporting greater life-satisfaction between adjacent categories (e.g. the odds of reporting medium life satisfaction rather than low life satisfaction).

Adjusted for age group, sex and ethnic group, the odds of reporting greater life-satisfaction were 1.073 times higher for each additional 10-unit difference in NZSEI-18 scores, as shown in Table 40. There was some evidence that men reported slightly higher life-satisfaction than women. Those aged 60–69 reported greater life-satisfaction than all other age groups. There did not appear to be any ethnic differences in life-satisfaction (however, this analysis may be underpowered to detect differences for small groups).

Table 40. Odds ratios for reporting higher life satisfaction, NZSEI-18 continuous measure

Factor	Odds ratio (95 percent CI)	P value
NZSEI-18 (per 10 units)	1.073 (1.051 – 1.095)	<.0001
Sex (male vs. female)	1.080 (1.003 – 1.163)	0.042
European (vs. non-European)	1.036 (0.885 – 1.212)	0.656
Māori (vs. non-Māori)	1.040 (0.899 – 1.203)	0.595
Pacific (vs. non-Pacific)	1.144 (0.915 – 1.431)	0.235
Asian (vs. non-Asian)	1.122 (0.917 – 1.372)	0.260
MELAA (vs. non-MELAA)	0.992 (0.672 – 1.465)	0.969
Age (21–29 vs. 60–69)	0.607 (0.525 – 0.701)	<.0001
Age (30–39 vs. 60–69)	0.625 (0.540 – 0.724)	<.0001
Age (40–49 vs. 60–69)	0.628 (0.542 – 0.729)	<.0001
Age (50–59 vs. 60–69)	0.646 (0.559 – 0.746)	<.0001

The results of the ordinal logistic regression model using the categorical group measure of NZSEI-18 is shown in Figure 29. This model estimates the odds ratios for reporting greater life-satisfaction among adjacent categories, adjusted for age group, sex and ethnic group (reference group is SES group 1). This shows that SES groups 1–3 had greater odds of reporting higher life satisfaction than SES group 6, with little difference between SES groups 4, 5, and 6.

Figure 29. Odds ratios for reporting higher life satisfaction, NZSEI-18 categorical measure
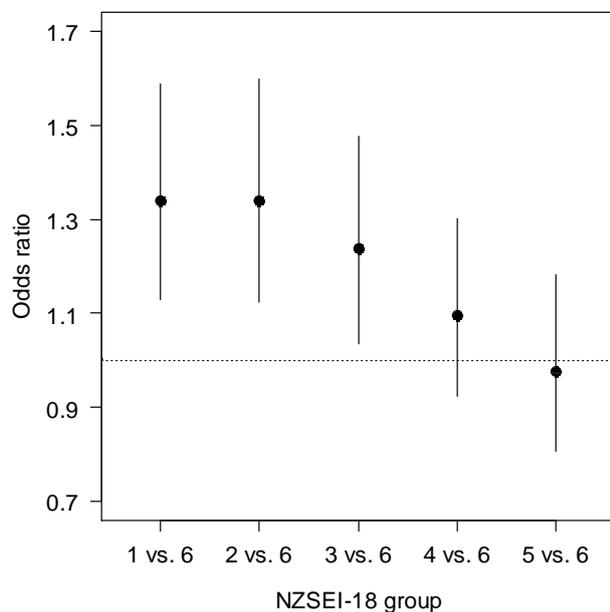
5.7 Summary and discussion

The purpose of this section was to assess NZSEI-18 in relation to a several health and other socio-economic indicators.

The expected socio-economic relationship was found between NZSEI-18 and the three Census outcomes: smoking, residential deprivation and housing tenure. Moreover, these patterns were apparent for both men and women of each major ethnic group. Results were clearest for smoking. The higher the NZSEI-18 score (or socio-economic group), the lower the likelihood of smoking. While NZSEI-18 was related to NZDep2018 and housing tenure, there was little to distinguish the three groups with the highest socio-economic status (SES groups 1–3) from each other for these outcomes.

NZSEI-18 was also related to the three new outcomes examined: hospitalisations during 2018, self-rated health and life-satisfaction. Greater NZSEI-18 scores were associated with lower odds of hospitalisation, better self-rated health, and higher life-satisfaction. The association between NZSEI-18 and the odds of being hospitalised was quite small. A larger effect was observed for NZSEI-18 on self-rated health, and to a lesser extent, for life-satisfaction. Groups 5 and 6 were not significantly different in the analyses of self-rated health and life-satisfaction also. Similar to the analyses of NZDep2018 and housing tenure, there was little to distinguish the most socio-economically advantaged groups in the analyses of hospitalisations and life-satisfaction.

As NZSEI-18 appears to be replicating expected socio-economic relationships, the NZSEI-18 appears to be a valid measure of socio-economic position.
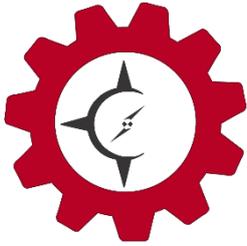
6. Imputing NZSEI-18 scores in the absence of occupational data

This section describes and evaluates a method for imputing NZSEI-18 scores for those with no occupational data. The 'simple averages' method, which was used for NZSEI-06 and NZSEI-13, was also used for NZSEI-18. This method is based on the notion of 'occupational potential' (Jones & McMillan, 2001), whereby, in the absence of information on occupation, and where information on income is not likely to be a reliable indicator of occupational socio-economic status, scores can be assigned using available data on age and education.

6.1 Imputing NZSEI-18 scores: results

For the imputation for NZSEI-13, educational qualifications were classified at the greatest (15-group) level of detail, as was done with the NZSEI-06 (Milne, at al., 2013). For 2018, a slightly simplified version of highest qualification classification was used which did not distinguish between school level qualifications obtained at school and those obtained post-school. The rationale for switching to a simpler classification was that this level of classification is more likely to be the same or similar to classifications used in other data sets. This should make the imputation easier for users to apply. Furthermore, Ministry of Education data in the IDI does not differentiate between Levels 1, 2, and 3 certificates obtained at school and post-school (2018 Census External Data Quality Panel, 2019), so there may have been some misclassification of those with education data supplemented from administrative sources who had a Level 1, 2 or 3 certificate as their highest qualification. The classification scheme used in NZSEI-18 had 12 levels and is similar to the 15-group classification used for imputation for the NZSEI-06 and NZSEI-13. The 15-group classification was still used for calculating years of education for use with the NZSEI algorithm.

For the purposes of imputing NZSEI-18 scores, 10-year age bands were used from the 2018 Census. All ages 15 years and older were used so that all those out of the workforce with valid education data (available only for those 15 years and older) could have scores imputed.

Table 41 shows a classification of highest qualification by 10-year age band for those reporting an occupation as part of the 2018 Census. Due to a low number of individuals aged 15–24 reporting having received a doctorate degree, the mean NZSEI-18 score for this group has been suppressed, in accordance with Stats NZ IDI requirements (Stats NZ, 2020b). In 2013, this group was assigned an imputed score of 48 (Fahy, et al., 2017), likely reflecting this group having spent little time in the labour market and therefore having had limited opportunity to convert their education into income.

Imputation method – simple averages

The method of imputation involves calculating the average NZSEI-18 scores by highest educational qualification and age band. These are shown in Table 42. The mean NZSEI-18 scores obtained ranged from 34, for those aged 15–24 years with no qualifications, to 76, for those aged 45–64 years with doctoral degrees. This range of scores is substantially narrower than the potential range of 10–90 for the 97 minor group occupations. Scores increased with age, irrespective of education, and also generally increased with education, irrespective of age. Both these effects were reported with previous imputations of NZSEI (e.g. Davis, et al., 2003; Fahy, et al., 2017; Milne, at al., 2013).

Table 41. Distribution of people with an occupation, by age-band and qualification, 2018 Census

Highest qualification	Age (years)						
	15–24	25–34	35–44	45–54	55–64	65–74	75+
Doctorate degree	S	2,805	6,042	6,369	5,139	2,241	396
Master's degree	2,148	24,258	26,445	24,639	17,484	5,697	675
Post-graduate and honours degree	8,961	44,415	44,310	37,122	23,238	6,189	630
Bachelor's degree and level 7 qualification	39,096	122,916	97,074	78,969	52,194	15,096	2,244
Level 6 diploma	7,485	20,466	21,849	27,735	27,354	10,293	1,743
Level 5 diploma	15,369	30,087	26,934	29,568	22,266	6,654	885
Level 4 Certificate	22,665	54,333	45,684	52,143	42,828	12,417	1,920
Overseas secondary school	7,368	22,587	28,488	30,018	18,717	5,610	1,047
Level 3 Certificate	98,526	57,150	46,323	38,271	25,938	7,269	1,092
Level 2 Certificate	58,530	38,133	37,863	54,072	41,505	9,672	1,533
Level 1 Certificate	32,016	32,520	34,014	56,109	54,444	19,008	3,045
No school qualifications	20,889	33,255	38,946	63,699	68,160	33,945	7,590

Source: Stats NZ, 2018 Census
Note: S = data suppressed for confidentiality reasons

Table 42. Imputed mean NZSEI-18 scores, for each age/qualification category

Highest qualification	Age (years)						
	15–24	25–34	35–44	45–54	55–64	65–74	75+
	Imputed mean NZSEI-18 score						
Doctorate degree	S	72	75	76	76	74	67
Master's degree	61	63	66	67	67	67	62
Post-graduate and honours degree	61	65	67	67	67	66	61
Bachelor's degree and level 7 qualification	56	60	62	63	63	63	61
Level 6 diploma	46	52	57	59	59	58	54
Level 5 diploma	41	47	51	52	52	52	51
Level 4 Certificate	41	45	47	48	48	48	46
Overseas secondary school	37	44	45	45	44	46	46
Level 3 Certificate	40	46	49	48	48	48	47
Level 2 Certificate	37	44	47	49	48	48	47
Level 1 Certificate	35	41	44	45	45	46	45
No school qualifications	34	38	39	38	39	40	42

Source: Stats NZ, 2018 Census
Note: S = data suppressed for confidentiality reasons

Differences between adjacent qualification levels were in some cases large and in others virtually non-existent. For example, those with a doctoral degree had NZSEI-18 scores that were, on average, around 9 points higher than those with a master's degree. Conversely, those with a master's degree were not always assigned a higher score than those with a post-graduate or honours degree, and differences between these groups were slight. There were reasonably large gaps in assigned scores between Levels 4, 5, 6, "Bachelor's degree and level 7 qualification", and "Post-graduate and honours degree" of the framework, although the difference between Levels 4 and 5 were smaller for younger age groups. Age groups with Levels 2, 3 and 4 and overseas secondary school qualifications were assigned quite similar scores. There was a notable gap in scores across age groups from Level 2 to Level 1 and again from Level 1 to no qualifications.

These similarities and differences have implications for coding educational qualifications for the classification of socio-economic status. In particular, it may <u>not</u> be important to distinguish:

(i) between those with a master's degree and those with a post-graduate or honours degree
(ii) between those with a Level 2, 3, or 4 or overseas secondary qualifications.

The imputed scores for those with a master's degree and those with a post-graduate or honours degree combined are: 61 for those aged 15–24 and 75 and above, 64 for those aged 25–34, 66 for those aged 35–44 and 65–74, and 67 for those aged 45–54 and 55–64. The imputed scores for those with Levels 2, 3, 4 and overseas secondary qualifications combined are: 39 for those aged 15–24, 45 for those aged 25–34, 47 for those aged 35–44 and 75+ and 48 for those aged 45–54, 55–64 and 65–74.

All other distinctions appear important.

6.2 Comparison of actual and imputed scores

The Pearson correlation coefficient between actual NZSEI-18 scores and imputed scores for all workers (with highest qualification data) aged 21–69 was 0.549. The correlation between the actual NZSEI-18 scores and imputed scores was slightly weaker than the correlation observed for NZSEI-13, which was 0.577. This shows that imputed scores correlated substantially but by no means perfectly with actual NZSEI-18 scores. Imperfect correlation is expected as there are variety of occupations – and a range of occupation status scores – held by those with the same education-level and within the same age band.

To gain a greater insight into the performance of the method, the mean error between imputed scores and actual scores by age and qualification level is shown in Table 43. This shows that the mean difference between imputed scores and actual scores ranged from 9 points for those aged 25–34 holding a doctoral degree to 16 points for several age-qualification groups. Overall, the mean difference averaged across age and qualification level was 12.35. These descriptive statistics are similar to those found for the NZSEI-13 which had mean differences by age bands and qualification levels which ranged from 10 to 21, and an overall mean difference averaged across age and qualification level which was the same as for NZSEI-18, at 12.35 (Fahy, et al., 2013).

Table 43. Mean error (absolute difference) between imputed and actual NZSEI-18 scores for each age/qualification category

Highest qualification	Age (years)						
	15–24	25–34	35–44	45–54	55–64	65–74	75+
	Mean error						
Doctorate degree	S	9	10	10	11	12	13
Master's degree	15	13	10	10	10	11	15
Post-graduate and honours degree	15	12	10	10	11	12	16
Bachelor's degree and level 7 qualification	16	14	13	12	13	14	15
Level 6 diploma	13	13	13	13	14	15	16
Level 5 diploma	11	12	13	13	13	14	14
Level 4 Certificate	10	11	11	12	12	12	12
Overseas secondary school	11	14	14	14	13	13	13
Level 3 Certificate	11	13	13	13	13	13	14
Level 2 Certificate	10	12	12	12	12	13	12
Level 1 Certificate	10	12	13	12	12	12	12
No school qualifications	10	11	12	12	11	11	11

Note: S = data suppressed for confidentiality reasons

6.3 Validation against health and socio-economic correlates

As a final assessment of the imputation method, the performance of the method at predicting health and socio-economic correlates was assessed for those aged 21–69 years and not in the workforce, using data from the 2018 Census. The assessment involved regressing each of three health and socio-economic correlates – smoking prevalence, housing tenure, and deprivation – against the imputed scores, controlling for age, sex, and ethnicity.

A regression approach was favoured over comparing rates of each correlate across the six socio-economic groups, in part because the restricted range of imputed scores resulted in no imputed cases in socio-economic group 6 and very few in socio-economic group 1. These validation analyses are equivalent to those presented in Figure 20, Figure 23, and Figure 26 in Sections 5.1 to 5.3, describing the validation of actual NZSEI-18 scores among those in the workforce. Thus, the performance of the imputed NZSEI-18 scores was able to be directly compared with the performance of the actual NZSEI-18 for those aged 21–69 at predicting each of the health and socio-economic correlates. In addition, results for imputed scores for those aged 15 and above were included to assess how well the imputation is performing for the full possible age range. This is important as young people and older adults are more likely to be out of the labour force and have their NZSEI-18 scores imputed. The result of these comparisons is described below.

Smoking prevalence and housing tenure

Figure 30 shows the odds ratios for smoking and renting per 10-unit increase in NZSEI-18 scores, comparing actual scores for those aged 21–69 in the workforce versus imputed scores for those with data on age and highest qualifications for two age groups: 21–69 and 15 and above, using the method described above. The effects of age, sex, and ethnicity were controlled.

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The figure indicates that the odds of smoking were more distant from unity for the imputed scores (odds ratios = 0.499 and 0.486 for age groups 21–69 and 15+ respectively) than for actual scores (odds ratio = 0.752). Thus, imputed socio-economic scores were found to be a strong predictor of smoking. Similar to the NZSEI-13 and NZSEI-06, the imputed scores were more strongly associated with smoking than the actual scores were among those in the workforce. This perhaps highlights the importance of age and education as a predictor of smoking.

Unlike NZSEI-13, the odds of renting were only marginally lower for the imputed scores (odds ratios = 0.772 and 0.794 for age groups 21–69 and 15+ respectively) than for the actual scores (odds ratio = 0.828).

Figure 30. Odds ratios for smoking and renting, comparison between actual and imputed NZSEI-18 scores (per 10 units)
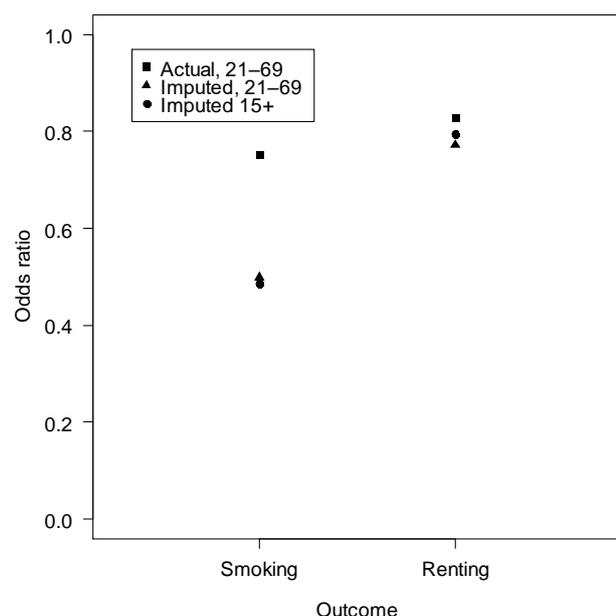
Note: Because of the large sample size for this analysis, the confidence intervals for the odds ratios are so narrow that they do not appear on the plot above.

Deprivation

Figure 31 shows the effect on the NZDep2018 scale per 10-unit increase in actual and imputed NZSEI-18 scores, controlling for age, sex, and ethnicity.

The figure indicates that NZDep2018 scores were approximately 0.5 lower for every 10-unit increase in imputed NZSEI-18 scores for the population aged 21–69 and 15 and above (β = -0.500 and -0.495 respectively). This was a stronger effect than the effect of actual NZSEI-18 scores among those in the workforce (β = -0.287).

Note: *Because of the large sample size for this analysis, the confidence intervals for the odds ratios are so narrow that they do not appear on the plot above.*

6.4 Summary and discussion

This section described a method for imputing NZSEI-18 scores when data on occupation are unavailable. This involved analysing data from the 2018 Census for those in an occupation and with an NZSEI-18 score assigned and using this to calculate the average NZSEI-18 scores by highest educational qualification and age band.

Three evaluations of this method were undertaken:

   (i)   assessing the extent to which imputed scores correlated with actual NZSEI-18 scores
   (ii)   assessing the mean error between imputed and actual NZSEI-18 scores
   (iii) validating the imputed scores against health and socio-economic correlates.

These evaluations revealed that the imputations correlated with actual NZSEI-18 scores and validated well against a health and a socio-economic correlate – at least as well as (if not better than) actual NZSEI-18 scores. However, this method produced a restricted range of scores compared with the actual NZSEI-18, suggesting that it is unsuitable for the assignment of socio-economic groups.
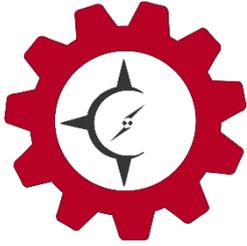
7. Impact of alternative data sources

There were a number of operational issues which resulted in the 2018 Census only achieving a response rate of 87.5 percent (2018 Census External Data Quality Panel, 2019). This is substantially lower than the response rates for prior Censuses – e.g. the 2013 Census achieved a response rate of 93.2 percent (2018 Census External Data Quality Panel, 2019). Response rates were far lower for certain groups, including those identifying with Māori, Pacific or Asian ethnic groups, young people and those living in certain regions, such as Gisborne and Northland (2018 Census External Data Quality Panel, 2019).

To mitigate the impact of the low response rate, Stats NZ supplemented the 2018 Census data file with information from alternative data sources, including administrative data and the 2013 Census, and with imputation (Stats NZ, 2019). While the use of alternative data sources substantially improved the coverage of the 2018 Census file, it also means that data collected for one purpose are being used for another, which can introduce biases or disrupt trends through time (2018 Census External Data Quality Panel, 2019). For example, the use of smoking data from the 2013 Census may lead to slight overestimation of cigarette smoking levels, as smoking prevalence has been reducing over time (2018 Census External Data Quality Panel, 2019).

Table 44 summarises the extent of the use of alternative data sources for working adults aged 21–69 for key variables used in this report. Generally, about 80 percent of the information from each variable was available in the 2018 Census.

Nearly 20 percent of records for occupation were imputed. While the imputation preserved the distribution of major group occupations, it is estimated that only about 40 percent of imputed values are correct to the major group level (2018 Census External Data Quality Panel, 2019). Very few imputed values for occupation will be correct to the minor group level on which NZSEI-18 scores are based. Relationships between occupation and income and occupation and education seem to have been largely maintained (2018 Census External Data Quality Panel, 2019).

The use of tax records for 16.6 percent of records is unlikely to have adversely affected data quality due to the reliability of this data source but may have disrupted the trend for income to some extent (2018 Census External Data Quality Panel, 2019).

Highest qualification data was sourced from administrative data and the 2013 Census. There are slight differences between the classification scheme for the 2018 Census and Ministry of Education data for highest qualification (2018 Census External Data Quality Panel, 2019).

There were also high levels of use of alternative data sources for key validation variables and for classifying population subgroups (e.g. 16.3 percent of records for usual residence, which was used to assign NZDep2018, were supplemented with alternative data sources).

Table 44. Percentage of records by data source for key variables, workers aged 21–69 years, 2018 Census

Variable	2018 Census form	Admin data	2013 Census	Imputed	2018 dwelling form	No info
Occupation	80.4			19.6		
Income	81.9	16.6		1.5		
Secondary school education	82.4	4.1	8.0			5.5
Post-school education	81.1	7.3	6.1			5.4
Usual residence address	83.7	11.5		0.3	4.5	
Ethnicity	83.9	6.1	8.7			1.4
Smoke regularly	83.5		8.6	7.9		
Country of birth	83.6	6.4	8.8			1.2
Activity limitations	80.4					16.4
Housing tenure	83.1					16.9

Source: Stats NZ, 2018 Census

While around 80 percent of records for key variables were sourced from 2018 Census forms for workers aged 21–69 overall, these figures differ considerably by ethnic group, as shown in Table 45. For example, only 60.0 percent of occupation values were sourced from 2018 Census forms for Pacific workers, compared to 67.5 percent for Māori workers, 73.0 percent for MELAA workers, 75.8 percent for Asian workers and 85.4 percent for European workers. The percentage of missing data for education variables was considerably higher for Pacific, Asian and MELAA workers than for the overall population.

Table 45. Percentage of records by data source for variables required for constructing NZSEI by ethnic group, workers aged 21–69 years, 2018 Census

Variable	2018 Census form	Admin data	2013 Census	Imputed	2018 dwelling form	No info
European						
Occupation	85.4			14.6		
Income	86.8	12.0		1.2		
Secondary school education	87.3	2.8	6.8			3.1
Post-school education	85.6	5.1	5.7			3.7
Māori						
Occupation	67.5			32.5		
Income	68.7	29.5		1.8		
Secondary school education	69.4	11.3	14.7			4.7
Post-school education	68.3	17.0	8.5			6.1

Variable	2018 Census form	Admin data	2013 Census	Imputed	2018 dwelling form	No info
Pacific						
Occupation	60.0			40.0		
Income	61.2	36.3		2.5		
Secondary school education	61.7	10.6	16.7			11.0
Post-school education	61.6	16.3	10.9			11.2
Asian						
Occupation	75.8			24.2		
Income	78.0	19.8		2.2		
Secondary school education	77.8	2.4	7.1			12.7
Post-school education	78.2	7.6	5.1			9.1
MELAA						
Occupation	73.0			27.0		
Income	74.9	22.8		2.3		
Secondary school education	75.4	4.1	7.6			12.9
Post-school education	75.3	7.6	5.3			11.7

Source: Stats NZ, 2018 Census

7.1 Constructing Census and alternative data sources cohorts

In order to assess the potential impact of the use of alternative data sources on the overall NZSEI-18 scale, two cohorts were constructed. The first consisted of records where both occupation and income were available in the 2018 Census, which was termed the Census cohort. The second consisted of records where either occupation or income was sourced from alternative data sources, which was termed the alternative data sources cohort. The overall cohort refers to the full population of working adults aged 21–69 on which the overall NZSEI-18 scale was constructed. The Census and alternative data sources cohorts consisted of 79.2 percent and 20.8 percent of the overall cohort, respectively.

It is important to note that simply excluding records with data from alternative data sources would introduce bias as those who did not complete a 2018 Census form are systematically different from those who did. For example, only 15.8 percent of European workers were classified into the alternative data sources cohort, compared to 34.2 percent of Māori workers and 41.9 percent of Pacific workers. Somewhat fewer Asian workers and MELAA workers were classified into the alternative data sources cohort at 25.3 percent and 28.2 percent, respectively. Workers in the alternative data sources cohort were more likely to live in a deprived area and to be young, as shown in Figure 32 and Figure 33. It is worth bearing in mind that the variables used to describe these cohorts in this section, including ethnicity, NZDep2018 (which requires usual residence data), occupation, education, income and age have been largely supplemented for the alternative data sources cohort and hence may be less reliable for this cohort.

Figure 32. Percentage of records with occupation and/or income supplemented by NZDep2018 scores, workers aged 21–69 years
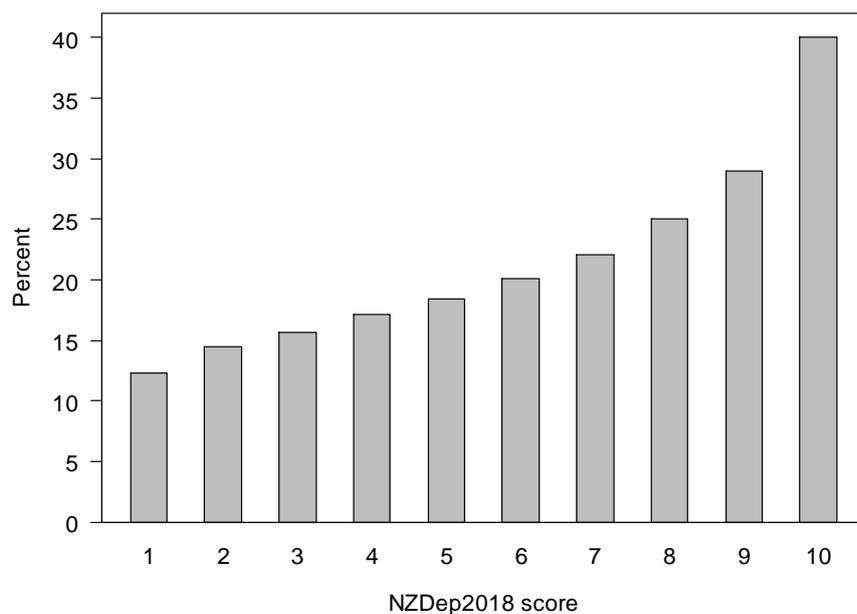
Figure 33. Percentage of records with occupation and/or income supplemented by age group, workers aged 21–69, 2018 Census
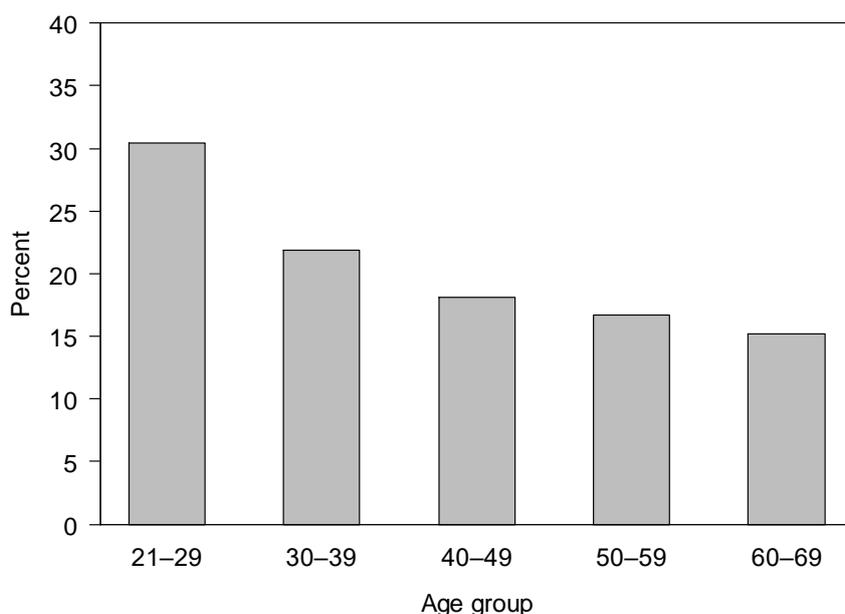
The percentage of records using alternative data for occupation or income differed by occupation. At the minor group level, the percentage varied from 10–30 percent. Importantly, the percentage of records using alternative data for occupation or income was generally greater for major group occupations with lower NZSEI-18 scores, as shown in Table 46. It should be noted that most of the occupation data for the alternative data sources cohort was imputed, and hence these individual's actual occupations are unknown.

The Census and alternative data sources cohorts were also compositionally different at the occupational level. Figure 34 compares the mean age, income and education levels for each minor group occupation across the three cohorts. The mean age, income and education level of those in the Census and overall cohort were very similar. This is not surprising, as the majority of the overall cohort is made up of records from the Census cohort. The alternative data sources cohort was younger, less educated and received less income for the same occupation, on average.

Table 46. Percentage of records with occupation and/or income supplemented by assigned major group occupation, workers aged 21–69

Occupation (major group)	Alternative data sources cohort percentage	NZSEI-18 score
Managers	16.4	58
Professionals	14.8	74
Technicians and Trades Workers	23.6	41
Community and Personal Service Workers	24.9	43
Clerical and Administrative Workers	18.1	50
Sales Workers	23.8	43
Machinery Operators and Drivers	29.6	31
Labourers	32.3	23

Figure 34. Mean values for income, years of education, and age for the overall, Census and alternative data sources cohorts (ANZSCO minor group)
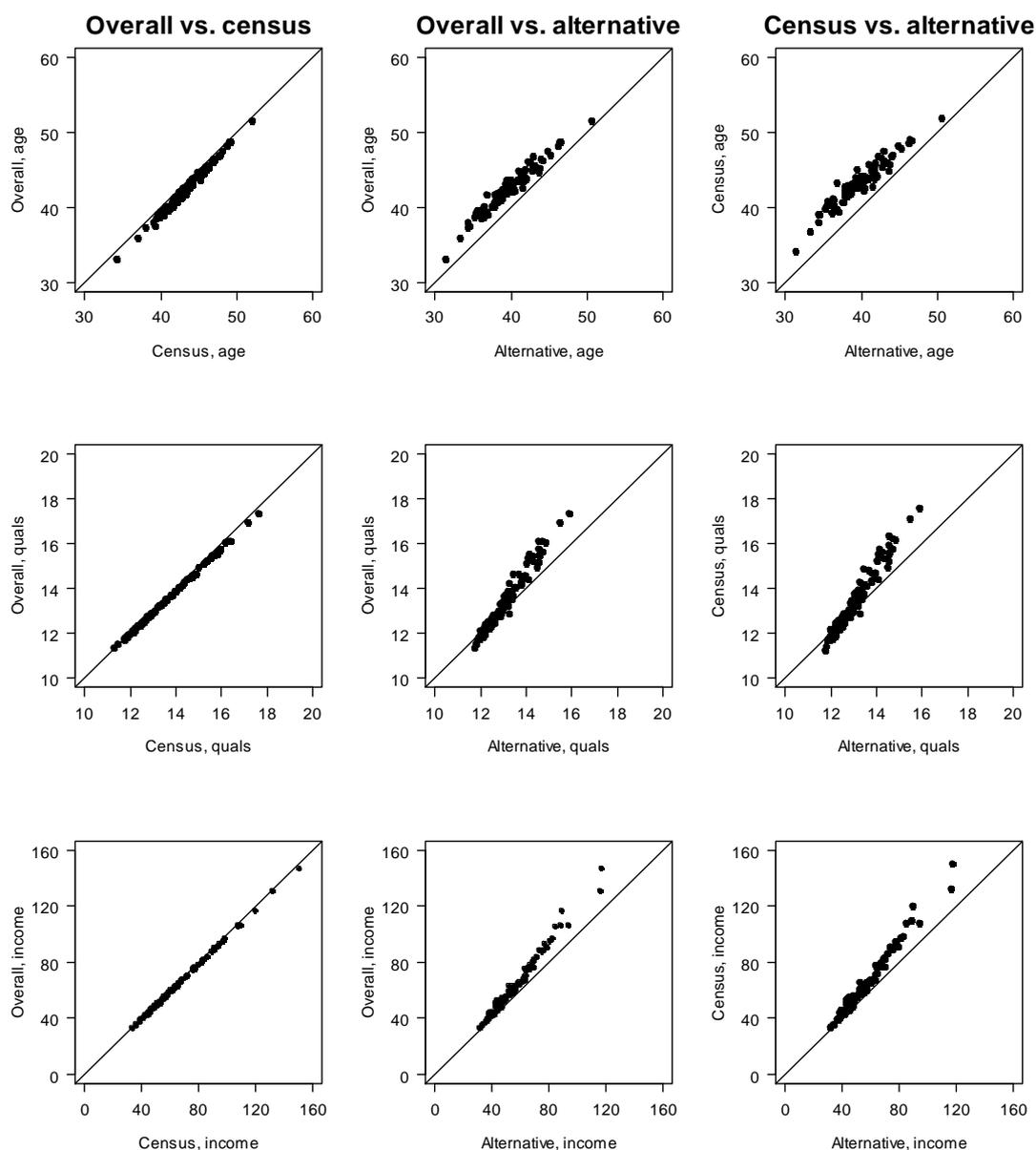
While there are systematic differences between these cohorts, there are also important differences between the quality and features of data between these cohorts (noting that most records in the alternative data sources cohort will only have data from alternative data sources due to missing 2018 Census individual forms). Notably, administrative data is collected by agencies to meet their operational purposes and these will often differ from the purposes of information collected in Censuses. Consequently, data sourced from administrative sources often relate to different time periods, may have slightly different definitions and categorisation, and may have been collated across multiple collections (e.g. highest qualification data was collated from multiple data sets held by the Ministry of Education; 2018 Census External Data Quality Panel, 2019). Both the systematic differences between the cohorts and the differences in data characteristics for key variables will affect analyses conducted using these cohorts, such as those presented in Section 7.2.

7.2 Constructing separate Census and alternative data sources NZSEI scales

In order to assess the effect of the use of alternative data on the NZSEI-18 scale, separate NZSEI scales were constructed for the Census and alternative data sources cohorts. Unlike the subgroup analyses presented earlier in the report, these scales were constructed by allowing the path coefficients to differ for those from the overall scale. This makes it possible to assess whether the key socio-economic relationships underpinning the NZSEI were preserved by the imputation of occupation.

The betas for the paths from education to occupation and occupation to income across these groups are presented in Table 47. This shows that the path coefficients were fairly similar for the Census and overall cohorts. The estimated coefficient for the alternative data sources cohort was quite a lot smaller for the education to occupation pathway, as well as being somewhat smaller for the occupation to income pathway, compared to the Census and overall cohorts. This suggests that the socio-economic relationships central to creating the NZSEI have not been fully preserved in the alternative data sources cohort. It is important to note, however, that it is impossible to disentangle the direct effects of the use of alternative data (e.g. incorrect assignment of occupations by imputation) from compositional differences for those missing 2018 Census forms.

Table 47. Comparison of beta values for the overall, Census and alternative data sources cohorts

Scales	β_{32} (education-SES)	β_{43} (SES-income)
NZSEI-18 overall	0.545	0.306
Census cohort	0.570	0.309
Alternative data sources cohort	0.368	0.252

The calculated NZSEI scores for each cohort were scaled to have a mean of 50 to allow for comparisons unaffected by differences in the means. Figure 35 presents a comparison of these scores. This shows that the Census and overall cohorts are assigning similar scores to each occupation, whereas there is slightly more variability when comparing the alternative data sources cohort and overall cohort. Despite this, the correlations between the overall and alternative data sources cohort was r = 0.98. The correlation between the Census and overall cohorts was r ≈ 1. This indicates that the socio-economic ordering of occupations is similar across the three cohorts.

Figure 35. Comparison of overall, Census, and alternative data sources NZSEI-18 scores (ANZSCO minor group)
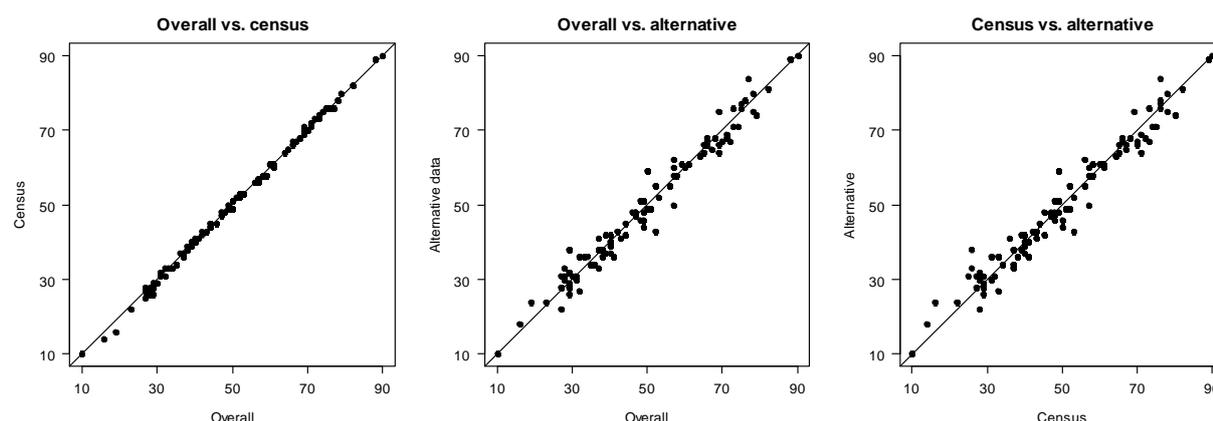
7.3 Validation against health and socio-economic correlates

The Census and alternative data sources subscales were also validated against smoking and neighbour-hood deprivation to ensure that the socio-economic patterning observed for the overall scale was maintained regardless of data source.

Smoking prevalence

Table 48 presents the results for the logistic regression model on smoking by the Census and alternative data sources NZSEI subscales, controlling for age group, sex and five ethnic groups. This shows that the relationship between smoking and NZSEI-18 scores was maintained for both cohorts. The relationship between NZSEI-18 and smoking was slightly stronger for the Census cohort than the alternative data sources cohort. There were a few estimates that were noticeably different between the Census cohort and alternative data sources cohort models, such as the estimate for the Pacific ethnic group and the 21–29 year old age group.

Table 48. Odds ratios for smoking, comparison between Census and alternative data sources cohorts (per 10 units)

Factor	Census cohort, odds ratio (95 percent CI)	Alternative data sources cohort, odds ratio (95 percent CI)
NZSEI-18 (per 10 units)	0.751 (0.749 – 0.754)**	0.802 (0.798 – 0.806)**
Sex (male vs. female)	0.883 (0.875 – 0.892)**	0.855 (0.842 – 0.868)**
European (vs. non-European)	0.724 (0.712 – 0.736)**	0.912 (0.891 – 0.932)**
Māori (vs. non-Māori)	1.961 (1.933 – 1.988)**	1.893 (1.853 – 1.933)**
Pacific (vs. non-Pacific)	1.333 (1.304 – 1.361)**	1.100 (1.071 – 1.130)**
Asian (vs. non-Asian)	0.381 (0.373 – 0.390)**	0.386 (0.374 – 0.398)**
MELAA (vs. non-MELAA)	0.463 (0.440 – 0.487)**	0.528 (0.495 – 0.563)**
Age (21–29 vs. 60–69)	1.755 (1.723 – 1.787)**	1.463 (1.419 – 1.508)**
Age (30–39 vs. 60–69)	1.920 (1.886 – 1.955)**	1.940 (1.880 – 2.002)**
Age (40–49 vs. 60–69)	1.669 (1.640 – 1.700)**	1.787 (1.731 – 1.844)**
Age (50–59 vs. 60–69)	1.478 (1.452 – 1.505)**	1.539 (1.490 – 1.590)*

Note: * $p < 0.05$, ** $p < 0.001$

Deprivation

The associations between NZSEI-18 and residential deprivation for the Census and alternative data sources cohorts, adjusted for age group, sex and five ethnic groups, are detailed in Table 49. This shows that, similarly for smoking, the relationship between NZSEI-18 and residential deprivation was slightly stronger for the Census cohort than the alternative data sources cohort. As for smoking, there were notable differences in the size, and in these analyses, direction, of some estimates.

Table 49. Beta coefficients for scores on the NZDep2018 scale, comparison between Census and alternative data sources cohorts (per 10 units)

Factor	Census cohort, odds ratio (95 percent CI)	Alternative data sources cohort, odds ratio (95 percent CI)
NZSEI-18 (per 10 units)	-0.272 (-0.274 – -0.270)**	-0.260 (-0.264 – -0.255)**
Sex (male vs. female)	0.139 (0.131 – 0.147)**	-0.013 (-0.028 – 0.002)
European (vs. non-European)	-1.097 (-1.114 – -1.081)**	-1.187 (-1.212 – -1.162)**
Māori (vs. non-Māori)	1.020 (1.006 – 1.034)**	1.243 (1.220 – 1.267)**
Pacific (vs. non-Pacific)	1.354 (1.333 – 1.376)**	1.441 (1.411 – 1.470)**
Asian (vs. non-Asian)	-0.398 (-0.417 – -0.379)**	-0.468 (-0.498 – -0.438)**
MELAA (vs. non-MELAA)	-0.556 (-0.593 – -0.520)**	-0.641 (-0.699 – -0.584)**
Age (21–29 vs. 60–69)	0.463 (0.449 – 0.477)**	0.225 (0.197 – 0.254)**
Age (30–39 vs. 60–69)	0.312 (0.299 – 0.326)**	0.178 (0.149 – 0.208)**
Age (40–49 vs. 60–69)	-0.051 (-0.064 – -0.037)**	0.062 (0.032 – 0.092)**
Age (50–59 vs. 60–69)	-0.084 (-0.097 – -0.071)**	0.057 (0.026 – 0.087)**

*Note: * $p < 0.05$, ** $p < 0.001$*

7.4 Summary and discussion

Unlike previous Censuses, the 2018 Census supplemented a large number of records with data from alternative sources, including imputation, 2013 Census data and administrative data. This affected the key variables necessary for constructing the NZSEI – occupation, highest qualification and income. Most notably, occupation was imputed for nearly 20 percent of records on which the NZSEI was constructed.

To assess the impact of the use of alternative data sources, two cohorts were constructed, one consisting of Census records and the other consisting of records where either or both occupation and income were supplemented. The alternative data sources cohort was younger, lived in more deprived areas, and had a different occupation distribution. Within minor group occupations, the alternative data sources cohort was younger, received less income and was less educated, on average.

NZSEI-18 scales constructed separately for both the Census and alternative data sources cohort were highly correlated with the overall NZSEI scale. The path coefficients for the alternative data sources cohort were somewhat weaker, especially for the education to socio-economic position path.

Importantly, subscales for both the Census and alternative data sources cohorts were significantly associated with both smoking and residential deprivation after adjusting for age group, sex, and five ethnic groups.
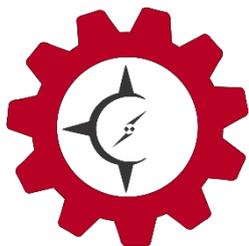
Conclusion

This report detailed the construction of NZSEI-18, an occupation-based measure of socio-economic status, derived using data from the 2018 Census. NZSEI-18 assigned scores from 10 (lowest) to 90 (highest) for each minor group (three-digit) occupation in New Zealand according to the Australian and New Zealand Standard Classification of Occupations (ANZSCO).

The algorithm used to derive NZSEI-18 scores was based on a path-analytic representation of the 'returns to human capital' model of stratification, in which occupation is viewed as the means by which human capital (education) is converted into material rewards (income).

NZSEI-18 produced similar scores to the previous NZSEI-13. NZSEI-18 validated well against some health and socio-economic correlates for both sexes and also for five major ethnic groups: European, Māori, Pacific, Asian, and MELAA.

The NZSEI-18 scale was developed for the workforce, with part-time workers incomes inflated to a full-time equivalent. The full scale (including part-time workers) was very similar to the scale including the full-time workforce only, with no large rank-order changes among occupations.

Also, like previous versions, a method was suggested for imputing NZSEI-18 scores for those not in the workforce. The method involved assigning scores based on the mean NZSEI-18 scores for each age and educational qualification group. It was suggested that categorisation should not be used for imputed scores (e.g. for those not in the workforce) because the restricted range of the imputed scores results in some categories having few or no cases.

Several differences between NZSEI-18 and its predecessors should be noted. First, NZSEI-18 was scaled slightly differently to achieve a mean of exactly 50. This means NZSEI-18 scores are generally slightly higher than NZSEI-13 scores.

NZSEI-18 was also validated for disabled workers in addition to the subgroups examined for NZSEI-13 (ethnic groups, gender groups, Auckland/rest of New Zealand, urban/rural and country of birth). In general, NZSEI-18 validated well for the subgroups analysed, although with some differences in average scores across groups.

NZSEI-18 was validated against three new outcomes: any hospitalisations, self-rated health and life-satisfaction. NZSEI-18 showed the expected relationship with these outcomes, although the relationships were less sizeable than for smoking, housing tenure and NZDep2018.

Most notably, NZSEI-18 was constructed on a Census data set where alternative data sources and imputation were used to fill in data for a considerable number of records to mitigate issues with non-response. Nearly 20% of data for occupation for workers aged 21–69 were imputed and there was extensive use of administrative and historical sources for income and education data, which are also required to construct the scale. Some variables used for subgroup and validation analyses also had large amounts of supplemented data (e.g. 16.5 percent for smoking).

Further analyses were undertaken to ensure the use of supplementary data to complete the Census data set was not having an undue impact. These analyses revealed that records containing data for occupation and/or income from alternative sources produced similar NZSEI-18 scores and expected socio-economic relationships with smoking and residential deprivation. Despite the extensive use of alternative data for the 2018 Census, the NZSEI-18 appears to be a valid measure of occupational socio-economic position.

Advantages of NZSEI-18 as a measure of socio-economic status

There are several advantages of NZSEI-18. First, occupation is readily and accurately recalled. It is not subject to stigma with reporting, or a tendency to misreport (as, for example, income may be in some instances (Davis & Smith, 1994, Galobardes, 2006a).

Second, occupation can be retrospectively recalled with some accuracy (Hauser & Warren, 1997). Thus, it may be possible (and preferable) to assess the socio-economic status of individuals in late-aged or retired samples by asking about their main occupation during their working years.

Third, occupation is often recorded in survey datasets, especially in the socio-economic and sociological fields, and also on administrative datasets (e.g. birth and death records; Galobardes, 2006a). Against this, recent health surveys and Statistics surveys in New Zealand have tended to neglect the collection of occupation data. The NZSEI would be of even greater value if occupation was recorded in an even greater range of data sets than it currently is.

Fourth, as the validation exercise showed, NZSEI-18 is a robust measure of socio-economic status in that it produces expected stratification patterns across a range of outcomes.

Fifth, NZSEI-18 has a sound theoretical basis – the 'returns to human capital model' – that has been used and validated previously in New Zealand and elsewhere (Davis, et al., 1997; 2003; Ganzeboom, et al., 1992; McMillan, et al., 2009).

Sixth, because NZSEI-18 uses a similar methodology to other scales developed internationally, this provides opportunities for international comparisons.

Seventh, New Zealand has a long history of occupation-based socio-economic measures that have been frequently updated, and an even longer history of collecting information on occupation. This enables socio-economic comparisons over time to be undertaken, and for cohort samples to have socio-economic status to be assessed at different life-stages using the 'current' occupation-based socio-economic measure.

Limitations of NZSEI-18

There are a number of limitations to NZSEI-18 which warrant mentioning. Firstly, the widespread use of alternative data in the 2018 Census means that the scale was constructed on a data set where a considerable number of records for occupation, income and/or education were supplemented from alternative data sources. While this appears to not have had a substantial impact on the overall scale, users should consider possible impacts for their research questions when using NZSEI-18.

Secondly, the Census does not collect information on income specifically relating to main occupation but rather collects information on total income from all sources. Incomes from part-time workers were then adjusted upwards using reported hours worked in employment per week. As there are differences between part and full-time workers in the extent to which they receive other sources of income (e.g. benefits, dividends), this may have biased adjusted income for these groups. This may have led to some overestimation of the reward dimension of the 'returns to human capital' model and consequently some inflation of NZSEI scores for occupations with a disproportionate share of part-time workers, and vice-versa. NZSEI subscales for part-time, and part-time and full-time workers combined were reassuringly similar, however. It also warrants mention that we are not able to assess the accuracy with which incomes were reported, and whether all respondents estimated their annual incomes in the same way.

Additionally, the hours worked variable was imputed where individuals did not complete 2018 Census forms, which may have affected data quality for this variable, particularly for Māori and Pacific ethnic groups (2018 Census External Data Quality Panel, 2019). Additionally, while part-time workers had their incomes inflated to construct NZSEI-18, those working more than 40 hours per week did not have their income deflated, which may have overestimated the reward component for occupations where workers tend to work large numbers of hours per week.

Lastly, NZSEI-18 requires occupational information. A significant proportion of the population is not currently employed, and unless further steps are taken to collect such information – for example, previous occupation – NZSEI-18 cannot be directly estimated. An 'imputed' score, based on the age and education of respondents, has been suggested as a way to assign scores to those without any information on occupation, but previous occupation or 'main' occupation during working life may be preferable for some individuals, such as retirees (although this would not be possible for those who have never been in an occupation). Note that in some cases it may be justified to use the occupation of a proxy person to assess socio-economic status (e.g. for children). Furthermore, occupation is often difficult to classify accurately, and there can be considerable heterogeneity between occupations classified at the minor group level used for NZSEI-18.

Future work

There are a number of questions which remain to be explored in relation to NZSEI-18. The most notable of these relate to the widespread use of alternative data in the 2018 Census. While initial checks have indicated that, overall, the NZSEI-18 is performing adequately as a measure of socio-economic status, further examinations are warranted. Firstly, the cause and impact of the drop in the size of the path coefficients for the alternative data sources cohort requires further investigation. Furthermore, given the large variation in Census non-response across ethnic groups, the extent to which the use of alternative data may have affected key socio-economic relationships across ethnic groups requires exploration.

Secondly, the current method of assessing the applicability of the NZSEI assumes that the socio-economic relationships underpinning the NZSEI are the same across population subgroups. Further research should examine whether these relationships hold across key population subgroups, including ethnic by gender groups. Relatedly, further work could examine the applicability of the scale for more complex ethnic identities, such as combination ethnic groups, as the proportion of the New Zealand population identifying with more than one ethnic group continues to increase.

Thirdly, as discussed in the limitations section, while incomes for part-time workers were inflated, incomes for those working more than 40 hours per week were not deflated. The impact of this should be assessed, and future iterations of the NZSEI should consider deflating incomes for those working more than 40 hours per week. Relatedly, future iterations of the NZSEI should consider the impact of additional income sources when inflating part-time incomes.

Lastly, the NZSEI-18 algorithm uses years of education to construct the scale using a 15-level qualifications scheme. In line with the simplification of qualifications data used for imputing NZSEI-18 scores for those not in the workforce, it may be worthwhile to investigate using the simplified framework for constructing the scale for future iterations of the NZSEI. It may also be worth considering standardising the conversion of qualifications to years of education using the International Standard Classification of Education (ISCED; UNESCO Institute for Statistics, 2012) in future versions of the NZSEI.
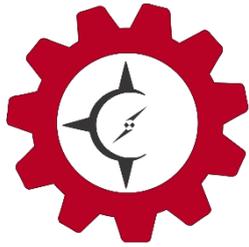
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Appendix I: Occupation by sex

Table A1. Occupation by sex, workers aged 21–69, 2018 Census

Occupation (minor group)		Sex		Total
		Male	**Female**	
Managers				
111	Chief Executives, General Managers and Legislators	58,494	27,099	85,593
121	Farmers and Farm Managers	41,775	16,065	57,840
131	Advertising, Public Relations and Sales Managers	22,476	16,458	38,934
132	Business Administration Managers	32,991	35,559	68,550
133	Construction, Distribution and Production Managers	54,828	5,013	59,841
134	Education, Health and Welfare Services Managers	2,949	8,565	11,514
135	ICT Managers	7,995	2,817	10,812
139	Miscellaneous Specialist Managers	5,289	4,566	9,855
141	Accommodation and Hospitality Managers	8,601	12,345	20,946
142	Retail Managers	16,047	17,973	34,020
149	Miscellaneous Hospitality, Retail and Service Managers	9,345	9,138	18,483
	Total	260,790	155,598	416,388
Professionals				
211	Arts Professionals	3,912	3,231	7,143
212	Media Professionals	5,034	5,082	10,116
221	Accountants, Auditors and Company Secretaries	13,806	18,810	32,616
222	Financial Brokers and Dealers, and Investment Advisers	6,879	5,175	12,054
223	Human Resource and Training Professionals	3,423	8,763	12,186
224	Information and Organisation Professionals	17,610	20,637	38,247
225	Sales, Marketing and Public Relations Professionals	10,932	12,966	23,898
231	Air and Marine Transport Professionals	6,423	540	6,963
232	Architects, Designers, Planners and Surveyors	14,073	12,357	26,430
233	Engineering Professionals	34,713	3,459	38,172
234	Natural and Physical Science Professionals	8,898	7,596	16,494
241	School Teachers	15,501	75,924	91,425
242	Tertiary Education Teachers	7,965	7,905	15,870
249	Miscellaneous Education Professionals	2,427	6,630	9,057

Occupation (minor group)		Sex		Total
		Male	Female	
251	Health Diagnostic and Promotion Professionals	3,723	9,600	13,323
252	Health Therapy Professionals	3,741	10,206	13,947
253	Medical Practitioners	8,421	7,776	16,197
254	Midwifery and Nursing Professionals	4,650	46,113	50,763
261	Business and Systems Analysts, and Programmers	36,906	8,778	45,684
262	Database and Systems Administrators, and ICT Security Specialists	3,126	1,926	5,052
263	ICT Network and Support Professionals	5,376	1,494	6,870
271	Legal Professionals	7,218	8,640	15,858
272	Social and Welfare Professionals	10,491	22,842	33,333
	Total	235,248	306,450	541,698
Technicians and Trades Workers				
311	Agricultural, Medical and Science Technicians	5,838	8,136	13,974
312	Building and Engineering Technicians	18,624	2,850	21,474
313	ICT and Telecommunications Technicians	4,527	1,488	6,015
321	Automotive Electricians and Mechanics	20,718	246	20,964
322	Fabrication Engineering Trades Workers	11,538	192	11,730
323	Mechanical Engineering Trades Workers	14,625	435	15,060
324	Panelbeaters, and Vehicle Body Builders, Trimmers and Painters	5,169	111	5,280
331	Bricklayers, Carpenters and Joiners	19,272	192	19,464
332	Floor Finishers and Painting Trades Workers	13,296	990	14,286
333	Glaziers, Plasterers and Tilers	10,887	261	11,148
334	Plumbers	11,049	81	11,130
341	Electricians	17,925	246	18,171
342	Electronics and Telecommunications Trades Workers	9,570	426	9,996
351	Food Trades Workers	24,525	14,727	39,252
361	Animal Attendants and Trainers, and Shearers	2,346	4,047	6,393
362	Horticultural Trades Workers	12,285	5,301	17,586
391	Hairdressers	1,446	8,229	9,675
392	Printing Trades Workers	3,282	906	4,188
393	Textile, Clothing and Footwear Trades Workers	1,470	1,029	2,499
394	Wood Trades Workers	3,234	297	3,531
399	Miscellaneous Technicians and Trades Workers	8,481	2,793	11,274
	Total	220,107	52,983	273,090

Occupation (minor group)		Sex		Total
		Male	Female	
Community and Personal Service Workers				
411	Health and Welfare Support Workers	6,921	21,219	28,140
421	Child Carers	486	7,173	7,659
422	Education Aides	1,629	16,059	17,688
423	Personal Carers and Assistants	5,442	39,393	44,835
431	Hospitality Workers	10,905	25,593	36,498
441	Defence Force Members, Fire Fighters and Police	14,484	3,576	18,060
442	Prison and Security Officers	9,696	2,964	12,660
451	Personal Service and Travel Workers	5,223	14,364	19,587
452	Sports and Fitness Workers	7,026	6,441	13,467
	Total	61,812	136,782	198,594
Clerical and Administrative Workers				
511	Contract, Program and Project Administrators	5,646	12,888	18,534
512	Office and Practice Managers	5,775	59,943	65,718
521	Personal Assistants and Secretaries	624	16,215	16,839
531	General Clerks	6,423	26,301	32,724
532	Keyboard Operators	525	2,529	3,054
541	Call or Contact Centre Information Clerks	1,557	3,147	4,704
542	Receptionists	1,647	17,466	19,113
551	Accounting Clerks and Bookkeepers	3,129	21,576	24,705
552	Financial and Insurance Clerks	4,398	9,990	14,388
561	Clerical and Office Support Workers	5,604	4,842	10,446
591	Logistics Clerks	13,470	8,925	22,395
599	Miscellaneous Clerical and Administrative Workers	5,811	10,653	16,464
	Total	54,609	194,475	249,084
Sales Workers				
611	Insurance Agents and Sales Representatives	20,208	29,682	49,890
612	Real Estate Sales Agents	9,201	8,463	17,664
621	Sales Assistants and Salespersons	37,602	55,593	93,195
631	Checkout Operators and Office Cashiers	1,197	6,861	8,058
639	Miscellaneous Sales Support Workers	2,250	5,787	8,037
	Total	70,458	106,386	176,844

Occupation (minor group)		Sex		Total
		Male	Female	
	Machinery Operators and Drivers			
711	Machine Operators	13,806	5,967	19,773
712	Stationary Plant Operators	10,512	906	11,418
721	Mobile Plant Operators	22,134	1,338	23,472
731	Automobile, Bus and Rail Drivers	13,398	2,688	16,086
732	Delivery Drivers	3,492	798	4,290
733	Truck Drivers	34,233	1,368	35,601
741	Storepersons	18,768	4,290	23,058
	Total	116,343	17,355	133,698
	Labourers			
811	Cleaners and Laundry Workers	13,647	31,656	45,303
821	Construction and Mining Labourers	20,424	900	21,324
831	Food Process Workers	15,966	7,245	23,211
832	Packers and Product Assemblers	6,795	8,085	14,880
839	Miscellaneous Factory Process Workers	6,228	1,581	7,809
841	Farm, Forestry and Garden Workers	29,295	13,947	43,242
851	Food Preparation Assistants	5,163	8,781	13,944
891	Freight Handlers and Shelf Fillers	4,983	1,317	6,300
899	Miscellaneous Labourers	38,940	11,295	50,235
	Total	141,441	84,807	226,248
	All occupations			
	Total	1,160,808	1,054,836	2,215,644

Note: Data randomly rounded to base 3
Source: Stats NZ, 2018 Census

Appendix II: Occupations of self-employed and non self-employed workers

Table A2. Occupations of self-employed and non self-employed workers aged 21–69, 2018 Census

Occupation (minor group)		Employment status		Percent self-employed
		Non self-employed	Self-employed	
Managers				
111	Chief Executives, General Managers and Legislators	37,173	48,417	56.6
121	Farmers and Farm Managers	23,802	34,038	58.8
131	Advertising, Public Relations and Sales Managers	33,192	5,739	14.7
132	Business Administration Managers	58,188	10,362	15.1
133	Construction, Distribution and Production Managers	39,639	20,205	33.8
134	Education, Health and Welfare Services Managers	10,383	1,131	9.8
135	ICT Managers	8,586	2,229	20.6
139	Miscellaneous Specialist Managers	8,889	969	9.8
141	Accommodation and Hospitality Managers	12,057	8,889	42.4
142	Retail Managers	24,489	9,528	28.0
149	Miscellaneous Hospitality, Retail and Service Managers	15,657	2,826	15.3
	Total	272,058	144,333	34.7
Professionals				
211	Arts Professionals	1,737	5,406	75.7
212	Media Professionals	5,424	4,692	46.4
221	Accountants, Auditors and Company Secretaries	24,885	7,734	23.7
222	Financial Brokers and Dealers, and Investment Advisers	8,673	3,381	28.0
223	Human Resource and Training Professionals	10,236	1,953	16.0
224	Information and Organisation Professionals	29,643	8,607	22.5
225	Sales, Marketing and Public Relations Professionals	19,896	4,002	16.7
231	Air and Marine Transport Professionals	5,658	1,305	18.7
232	Architects, Designers, Planners and Surveyors	16,332	10,098	38.2
233	Engineering Professionals	31,668	6,504	17.0
234	Natural and Physical Science Professionals	13,260	3,234	19.6
241	School Teachers	84,081	7,341	8.0
242	Tertiary Education Teachers	13,242	2,628	16.6
249	Miscellaneous Education Professionals	5,205	3,852	42.5

	Occupation (minor group)	Employment status		Percent self-employed
		Non self-employed	Self-employed	
251	Health Diagnostic and Promotion Professionals	10,821	2,499	18.8
252	Health Therapy Professionals	7,773	6,171	44.3
253	Medical Practitioners	10,347	5,850	36.1
254	Midwifery and Nursing Professionals	47,004	3,759	7.4
261	Business and Systems Analysts, and Programmers	35,967	9,717	21.3
262	Database and Systems Administrators, and ICT Security Specialists	4,551	498	9.9
263	ICT Network and Support Professionals	5,913	957	13.9
271	Legal Professionals	10,542	5,316	33.5
272	Social and Welfare Professionals	26,616	6,717	20.2
	Total	429,477	112,221	20.7

Technicians and Trades Workers

	Occupation (minor group)	Non self-employed	Self-employed	Percent self-employed
311	Agricultural, Medical and Science Technicians	12,714	1,260	9.0
312	Building and Engineering Technicians	18,120	3,351	15.6
313	ICT and Telecommunications Technicians	5,256	762	12.7
321	Automotive Electricians and Mechanics	16,569	4,395	21.0
322	Fabrication Engineering Trades Workers	10,029	1,701	14.5
323	Mechanical Engineering Trades Workers	12,930	2,127	14.1
324	Panelbeaters, and Vehicle Body Builders, Trimmers and Painters	4,071	1,212	22.9
331	Bricklayers, Carpenters and Joiners	13,251	6,219	31.9
332	Floor Finishers and Painting Trades Workers	7,854	6,432	45.0
333	Glaziers, Plasterers and Tilers	6,849	4,299	38.6
334	Plumbers	7,779	3,351	30.1
341	Electricians	13,203	4,968	27.3
342	Electronics and Telecommunications Trades Workers	8,466	1,530	15.3
351	Food Trades Workers	33,501	5,751	14.7
361	Animal Attendants and Trainers, and Shearers	4,710	1,683	26.3
362	Horticultural Trades Workers	10,860	6,723	38.2
391	Hairdressers	5,610	4,065	42.0
392	Printing Trades Workers	3,579	612	14.6
393	Textile, Clothing and Footwear Trades Workers	1,488	1,008	40.4
394	Wood Trades Workers	2,436	1,095	31.0
399	Miscellaneous Technicians and Trades Workers	7,599	3,675	32.6
	Total	206,874	66,219	24.2

Occupation (minor group)	Employment status		Percent self-employed
	Non self-employed	Self-employed	
Community and Personal Service Workers			
411 Health and Welfare Support Workers	24,927	3,213	11.4
421 Child Carers	6,168	1,491	19.5
422 Education Aides	16,233	1,455	8.2
423 Personal Carers and Assistants	42,249	2,589	5.8
431 Hospitality Workers	33,633	2,862	7.8
441 Defence Force Members, Fire Fighters and Police	16,917	1,143	6.3
442 Prison and Security Officers	11,724	933	7.4
451 Personal Service and Travel Workers	14,076	5,514	28.1
452 Sports and Fitness Workers	8,367	5,103	37.9
Total	174,288	24,303	12.2
Clerical and Administrative Workers			
511 Contract, Program and Project Administrators	16,020	2,511	13.6
512 Office and Practice Managers	53,133	12,588	19.2
521 Personal Assistants and Secretaries	14,733	2,106	12.5
531 General Clerks	28,497	4,227	12.9
532 Keyboard Operators	2,592	462	15.1
541 Call or Contact Centre Information Clerks	4,482	219	4.7
542 Receptionists	17,664	1,449	7.6
551 Accounting Clerks and Bookkeepers	19,905	4,800	19.4
552 Financial and Insurance Clerks	13,545	840	5.8
561 Clerical and Office Support Workers	7,782	2,664	25.5
591 Logistics Clerks	20,772	1,623	7.2
599 Miscellaneous Clerical and Administrative Workers	14,949	1,515	9.2
Total	214,071	35,007	14.1
Sales Workers			
611 Insurance Agents and Sales Representatives	45,963	3,930	7.9
612 Real Estate Sales Agents	9,642	8,019	45.4
621 Sales Assistants and Salespersons	83,331	9,858	10.6
631 Checkout Operators and Office Cashiers	7,689	366	4.5
639 Miscellaneous Sales Support Workers	7,191	846	10.5
Total	153,822	23,019	13.0

Occupation (minor group)		Employment status		Percent self-employed
		Non self-employed	Self-employed	
Machinery Operators and Drivers				
711	Machine Operators	17,502	2,271	11.5
712	Stationary Plant Operators	10,428	990	8.7
721	Mobile Plant Operators	19,092	4,380	18.7
731	Automobile, Bus and Rail Drivers	11,094	4,992	31.0
732	Delivery Drivers	3,699	594	13.8
733	Truck Drivers	31,386	4,218	11.8
741	Storepersons	21,948	1,107	4.8
	Total	115,152	18,549	13.9
Labourers				
811	Cleaners and Laundry Workers	37,764	7,536	16.6
821	Construction and Mining Labourers	16,560	4,767	22.4
831	Food Process Workers	21,753	1,458	6.3
832	Packers and Product Assemblers	14,079	804	5.4
839	Miscellaneous Factory Process Workers	7,029	780	10.0
841	Farm, Forestry and Garden Workers	34,302	8,940	20.7
851	Food Preparation Assistants	12,756	1,188	8.5
891	Freight Handlers and Shelf Fillers	5,967	336	5.3
899	Miscellaneous Labourers	44,310	5,928	11.8
	Total	194,514	31,737	14.0
All occupations				
	Total	1,760,256	455,388	20.6

Note: Data randomly rounded to base 3
Source: Stats NZ, 2018 Census

Appendix III: Final NZSEI-18 scores

Table A3. Final NZSEI-18 scores, ANZSCO major, sub-major, and minor group level

Occupation (ANZSCO major, sub-major, and minor groups)			NZSEI-18 score			Count
			Major group	Sub-major group	Minor group	
1	**Managers**		**58**			**416,388**
	11	*Chief Executives, General Managers and Legislators*		*65*		*85,593*
		111 Chief Executives, General Managers and Legislators			65	85,593
	12	*Farmers and Farm Managers*		*41*		*57,840*
		121 Farmers and Farm Managers			41	57,480
	13	*Specialist Managers*		*63*		*199,506*
		131 Advertising, Public Relations and Sales Managers			66	38,934
		132 Business Administration Managers			66	68,550
		133 Construction, Distribution and Production Managers			51	59,841
		134 Education, Health and Welfare Services Managers			78	11,514
		135 ICT Managers			77	10,812
		139 Miscellaneous Specialist Managers			69	9,855
	14	*Hospital, Retail and Service Managers*		*50*		*73,449*
		141 Accommodation and Hospitality Managers			48	20,946
		142 Retail Managers			46	34,020
		149 Miscellaneous Hospitality, Retail and Service Managers			61	18,483
2	**Professionals**		**74**			**541,698**
	21	*Arts and Media Professionals*		*65*		*17,259*
		211 Arts Professionals			57	7,143
		212 Media Professionals			70	10,116

Occupation (ANZSCO major, sub-major, and minor groups)			NZSEI-18 score			Count
			Major group	Sub-major group	Minor group	
22		*Business, Human Resource and Marketing Professionals*		72		119,001
	221	Accountants, Auditors and Company Secretaries			75	32,616
	222	Financial Brokers and Dealers, and Investment Advisers			69	12,054
	223	Human Resource and Training Professionals			67	12,186
	224	Information and Organisation Professionals			76	38,247
	225	Sales, Marketing and Public Relations Professionals			66	23,898
23		*Design, Engineering, Science and Transport Professionals*		71		88,059
	231	Air and Marine Transport Professionals			64	6,983
	232	Architects, Designers, Planners and Surveyors			71	26,430
	233	Engineering Professionals			69	38,172
	234	Natural and Physical Science Professionals			79	16,494
24		*Education Professionals*		76		116,352
	241	School Teachers			74	91,425
	242	Tertiary Education Teachers			88	15,870
	249	Miscellaneous Education Professionals			71	9,057
25		*Health Professionals*		78		116,352
	251	Health Diagnostic and Promotion Professionals			73	13,323
	252	Health Therapy Professionals			78	13,947
	253	Medical Practitioners			90	16,197
	254	Midwifery and Nursing Professionals			75	50,763
26		*ICT Professionals*		72		57,606
	261	Business and Systems Analysts, and Programmers			73	45,684
	262	Database and Systems Administrators, and ICT Security Specialists			65	5,050
	263	ICT Network and Support Professionals			68	6,870
27		*Legal, Social and Welfare Professionals*		75		38,883
	271	Legal Professionals			82	15,858
	272	Social and Welfare Professionals			72	33,333

Occupation (ANZSCO major, sub-major, and minor groups)			NZSEI-18 score			Count
			Major group	Sub-major group	Minor group	
3	**Technicians and Trades Workers**		**41**			**273,090**
31	*Engineering, ICT and Science Technicians*			*57*		*41,463*
	311	Agricultural, Medical and Science Technicians			58	13,974
	312	Building and Engineering Technicians			56	21,474
	313	ICT and Telecommunications Technicians			60	6,015
32	*Automotive and Engineering Trades Workers*			*40*		*53,034*
	321	Automotive Electricians and Mechanics			40	20,964
	322	Fabrication Engineering Trades Workers			33	11,730
	323	Mechanical Engineering Trades Workers			47	15,060
	324	Panelbeaters, and Vehicle Body Builders, Trimmers and Painters			32	5,280
33	*Construction Trades Workers*			*35*		*56,028*
	331	Bricklayers, Carpenters and Joiners			38	19,464
	332	Floor Finishers and Painting Trades Workers			29	14,286
	333	Glaziers, Plasterers and Tilers			29	11,148
	334	Plumbers			42	11,130
34	*Electrotechnology and Telecommunication Trades Workers*			*47*		*20,259*
	341	Electricians			47	18,171
	342	Electronics and Telecommunications Trades Workers			48	9,996
35	*Food Trades Workers*			*34*		*39,252*
	351	Food Trades Workers			34	39,252
36	*Skilled Animal and Horticultural Workers*			*39*		*23,979*
	361	Animal Attendants and Trainers, and Shearers			37	6,393
	362	Horticultural Trades Workers			40	17,586
39	*Other Technicians and Trades Workers*			*40*		*31,167*
	391	Hairdressers			31	9,675
	392	Printing Trades Workers			44	4,188
	393	Textile, Clothing and Footwear Trades Workers			35	2,499
	394	Wood Trades Workers			37	3,531
	399	Miscellaneous Technicians and Trades Workers			49	11,274

Occupation (ANZSCO major, sub-major, and minor groups)			NZSEI-18 score			Count
			Major group	Sub-major group	Minor group	
4	**Community and Personal Service Workers**		**43**			**198,594**
41	*Health and Welfare Support Workers*			*53*		*28,140*
	411	Health and Welfare Support Workers			53	28,140
42	Carers and Aides			38		70,182
	421	Child Carers			36	7,659
	422	Education Aides			40	17,688
	423	Personal Carers and Assistants			37	44,835
43	*Hospitality Workers*			*32*		*36,498*
	431	Hospitality Workers			32	36,498
44	Protective Service Workers			51		30,720
	441	Defence Force Members, Fire Fighters and Police			57	18,060
	442	Prison and Security Officers			42	12,660
45	*Sports and Personal Service Workers*			*50*		*33,054*
	451	Personal Service and Travel Workers			49	19,587
	452	Sports and Fitness Workers			52	13,467
5	**Clerical and Administrative Workers**		**50**			**249,084**
51	*Office Managers and Program Administrators*			*51*		*84,252*
	511	Contract, Program and Project Administrators			59	18,534
	512	Office and Practice Managers			49	65,718
52	Personal Assistants and Secretaries			50		16,839
	521	Personal Assistants and Secretaries			50	16,839
53	General Clerical Workers			49		35,778
	531	General Clerks			50	32,724
	532	Keyboard Operators			44	3,054
54	Inquiry Clerks and Receptionists			42		23,817
	541	Call or Contact Centre Information Clerks			49	4,704
	542	Receptionists			40	19,113
55	Numerical Clerks			54		39,093
	551	Accounting Clerks and Bookkeepers			52	24,705
	552	Financial and Insurance Clerks			57	14,388
56	Clerical and Office Support Workers			39		10,446
	561	Clerical and Office Support Workers			39	10,446

Occupation (ANZSCO major, sub-major, and minor groups)		NZSEI-18 score			Count
		Major group	Sub-major group	Minor group	
59	*Other Clerical and Administrative Workers*		*51*		*38,859*
591	Logistics Clerks			47	22,395
599	Miscellaneous Clerical and Administrative Workers			57	16,464
6	**Sales Workers**	**43**			**176,844**
61	*Sales Representatives and Agents*		*51*		*67,554*
611	Insurance Agents and Sales Representatives			47	49,890
612	Real Estate Sales Agents			61	17,664
62	*Sales Assistants and Salespersons*		*38*		*93,195*
621	Sales Assistants and Salespersons			38	93,195
63	*Sales Support Workers*		*36*		*16,095*
631	Checkout Operators and Office Cashiers			29	8,058
639	Miscellaneous Sales Support Workers			43	8,037
7	**Machinery Operators and Drivers**	**31**			**133,698**
71	*Machinery and Stationary Plant Operators*		*32*		*31,191*
711	Machine Operators			28	19,773
712	Stationary Plant Operators			40	11,418
72	*Mobile Plant Operators*		*27*		*23,472*
721	Mobile Plant Operators			27	23,472
73	*Road and Rail Drivers*		*32*		*55,977*
731	Automobile, Bus and Rail Drivers			39	16,086
732	Delivery Drivers			30	4,290
733	Truck Drivers			29	35,601
74	*Storepersons*		*28*		*23,058*
741	Storepersons			28	23,058
8	**Labourers**	**23**			**226,248**
81	*Cleaners and Laundry Workers*		*19*		*45,303*
811	Cleaners and Laundry Workers			19	45,303
82	*Construction and Mining Labourers*		*31*		*21,324*
821	Construction and Mining Labourers			31	21,324
83	*Factory Process Workers*		*22*		*45,900*
831	Food Process Workers			28	23,211
832	Packers and Product Assemblers			10	14,880
839	Miscellaneous Factory Process Workers			27	7,809

Occupation (ANZSCO major, sub-major, and minor groups)			NZSEI-18 score			Count
			Major group	**Sub-major group**	**Minor group**	
84		*Farm, Forestry and Garden Workers*		*27*		*43,242*
	841	Farm, Forestry and Garden Workers			27	43,242
85		*Food Preparation Assistants*		*16*		*13,944*
	851	Food Preparation Assistants			16	13,944
89		*Other Labourers*		*24*		*56,535*
	891	Freight Handlers and Shelf Fillers			29	6,300
	899	Miscellaneous Labourers			23	50,235
All occupations						
Total						2,215,644

Note: *Data randomly rounded to base 3*
Source: *Stats NZ, 2018 Census*

Appendix IV: NZSEI-18 groups and final scores

Table A4. NZSEI-18 groups and final scores

Occupation (ANZSCO minor groups)		NZSEI-18 groups			NZSEI-18 score
		6-group	**4-group**	**10-group**	
Managers					
111	Chief Executives, General Managers and Legislators	3	2	4	65
121	Farmers and Farm Managers	4	3	7	41
131	Advertising, Public Relations and Sales Managers	3	2	3	66
132	Business Administration Managers	3	2	3	66
133	Construction, Distribution and Production Managers	3	2	5	51
134	Education, Health and Welfare Services Managers	1	1	1	78
135	ICT Managers	1	1	1	77
139	Miscellaneous Specialist Managers	2	1	3	69
141	Accommodation and Hospitality Managers	4	3	6	48
142	Retail Managers	4	3	7	46
149	Miscellaneous Hospitality, Retail and Service Managers	3	2	4	61
Professionals					
211	Arts Professionals	3	2	4	57
212	Media Professionals	2	1	2	70
221	Accountants, Auditors and Company Secretaries	1	1	1	75
222	Financial Brokers and Dealers, and Investment Advisers	2	1	3	69
223	Human Resource and Training Professionals	2	1	3	67
224	Information and Organisation Professionals	1	1	1	76
225	Sales, Marketing and Public Relations Professionals	3	2	3	66
231	Air and Marine Transport Professionals	3	2	4	64
232	Architects, Designers, Planners and Surveyors	2	1	2	71
233	Engineering Professionals	2	1	3	69
234	Natural and Physical Science Professionals	1	1	1	79
241	School Teachers	2	1	2	74

Occupation (ANZSCO minor groups)		NZSEI-18 groups			NZSEI-18 score
		6-group	4-group	10-group	
242	Tertiary Education Teachers	1	1	1	88
249	Miscellaneous Education Professionals	2	1	2	71
251	Health Diagnostic and Promotion Professionals	2	1	2	73
252	Health Therapy Professionals	1	1	1	78
253	Medical Practitioners	1	1	1	90
254	Midwifery and Nursing Professionals	1	1	1	75
261	Business and Systems Analysts, and Programmers	2	1	2	73
262	Database and Systems Administrators, and ICT Security Specialists	3	2	4	65
263	ICT Network and Support Professionals	2	1	3	68
271	Legal Professionals	1	1	1	82
272	Social and Welfare Professionals	2	1	2	72
Technicians and Trades Workers					
311	Agricultural, Medical and Science Technicians	3	2	4	58
312	Building and Engineering Technicians	3	2	5	56
313	ICT and Telecommunications Technicians	3	2	4	60
321	Automotive Electricians and Mechanics	4	3	7	40
322	Fabrication Engineering Trades Workers	5	4	9	33
323	Mechanical Engineering Trades Workers	4	3	6	47
324	Panelbeaters, and Vehicle Body Builders, Trimmers and Painters	5	4	9	32
331	Bricklayers, Carpenters and Joiners	4	3	8	38
332	Floor Finishers and Painting Trades Workers	5	4	9	29
333	Glaziers, Plasterers and Tilers	5	4	9	29
334	Plumbers	4	3	7	42
341	Electricians	4	3	6	47
342	Electronics and Telecommunications Trades Workers	4	3	6	48
351	Food Trades Workers	5	4	8	34
361	Animal Attendants and Trainers, and Shearers	5	4	8	37
362	Horticultural Trades Workers	4	3	7	40
391	Hairdressers	5	4	9	31
392	Printing Trades Workers	4	3	7	44
393	Textile, Clothing and Footwear Trades Workers	5	4	8	35
394	Wood Trades Workers	5	4	8	37
399	Miscellaneous Technicians and Trades Workers	4	3	6	49

Occupation (ANZSCO minor groups)		NZSEI-18 groups			NZSEI-18 score
		6-group	4-group	10-group	
Community and Personal Service Workers					
411	Health and Welfare Support Workers	3	2	5	53
421	Child Carers	5	4	8	36
422	Education Aides	4	3	7	40
423	Personal Carers and Assistants	5	4	8	37
431	Hospitality Workers	5	4	9	32
441	Defence Force Members, Fire Fighters and Police	3	2	4	57
442	Prison and Security Officers	4	3	7	42
451	Personal Service and Travel Workers	4	3	6	49
452	Sports and Fitness Workers	3	2	5	52
Clerical and Administrative Workers					
511	Contract, Program and Project Administrators	3	2	4	59
521	Personal Assistants and Secretaries	3	2	5	50
531	General Clerks	3	2	5	50
532	Keyboard Operators	4	3	7	44
541	Call or Contact Centre Information Clerks	4	3	6	49
542	Receptionists	4	3	7	40
551	Accounting Clerks and Bookkeepers	3	2	5	52
552	Financial and Insurance Clerks	3	2	4	57
561	Clerical and Office Support Workers	4	3	8	39
591	Logistics Clerks	4	3	6	47
599	Miscellaneous Clerical and Administrative Workers	3	2	4	57
Sales Workers					
611	Insurance Agents and Sales Representatives	4	3	6	47
612	Real Estate Sales Agents	3	2	4	61
621	Sales Assistants and Salespersons	4	3	8	38
631	Checkout Operators and Office Cashiers	5	4	9	29
639	Miscellaneous Sales Support Workers	4	3	7	43
Machinery Operators and Drivers					
711	Machine Operators	5	4	9	28
712	Stationary Plant Operators	4	3	7	40
721	Mobile Plant Operators	6	4	10	27
731	Automobile, Bus and Rail Drivers	4	3	8	39

Occupation (ANZSCO minor groups)		NZSEI-18 groups			NZSEI-18 score
		6-group	4-group	10-group	
732	Delivery Drivers	5	4	9	30
733	Truck Drivers	5	4	9	29
741	Storepersons	5	4	9	28
Labourers					
811	Cleaners and Laundry Workers	6	4	10	19
831	Food Process Workers	5	4	9	28
832	Packers and Product Assemblers	6	4	10	10
839	Miscellaneous Factory Process Workers	6	4	10	27
841	Farm, Forestry and Garden Workers	6	4	10	27
851	Food Preparation Assistants	6	4	10	16
891	Freight Handlers and Shelf Fillers	5	4	9	29

Note: Data randomly rounded to base 3
Source: Stats NZ, 2018 Census

Appendix V: Using NZSEI-18

This appendix is intended to provide brief notes on using NZSEI-18, and is a copy of the appendix V provided for the NZSEI-13. The websites mentioned in this section may also be a useful resource for those requiring more information of occupation coding.

Coding occupation

In order to assign NZSEI-18 scores or groups, occupation must first be coded using the Australian and New Zealand Standard Classification of Occupations (ANZSCO). At the time of writing, ANZSCO (version 1.3) is the classification system suggested for occupational classification in New Zealand, and since 2006 ANZSCO has been used in Stats NZ censuses and surveys where occupation data are collected.

For the coding of NZSEI-18, coding to the minor group (three-digit) level of ANZSCO is required. This has 97 categories. However, if coding to the minor group level is not possible (e.g. it is unavailable or if data on occupation lack the detail required), NZSEI-18 scores can be assigned to the sub-major group (two-digit, 43 categories) or major group (one-digit, 8 categories) level of ANZSCO. Coding to any greater detail than the minor group level is unnecessary.

Researchers with occupational data already pre-coded to the minor group level of ANZSCO can move to coding NZSEI-18 scores (see below).

For researchers with un-coded data on occupation in text form, a list of ANZSCO codes as well as guides for coding occupational data to ANZSCO can be found using aria.stats.govt.nz.

Coders may find it useful to alphabetise their occupational data so that individuals with the same occupation can be coded at the same time (and with the same code). This is particularly useful if a large number of individuals need to be coded. If necessary, the reliability of coding can be checked by two or more coders coding a subset (or all) of the occupational data and comparing results, e.g. by assessing the correlation or computing a kappa statistic.

Researchers who wish to collect occupational data to code to ANZSCO should take the following steps. First, to enable accurate coding, it is helpful to obtain:

- the occupation title
- the main tasks or duties of that occupation
- the industry to which the occupation belongs.

Second, data collected face-to-face or via telephone are likely to be more accurate, as this allows for the researcher to probe for more information where insufficient detail has been supplied. In this regard, it is helpful for interviewers to be trained with the ANZSCO system or with occupational coding, to gain an understanding of the level of detail required to code occupations accurately.

Coding NZSEI-18

If ANZSCO-classified occupational data are available to the minor group (three-digit) level, researchers can assign NZSEI-18 scores and groups by referring to the 'Minor group' column in appendix III. If ANZSCO-classified occupational data are only available to the sub-major (two-digit) or major (one-digit) group level, then NZSEI-18 scores can still be assigned by referring to the appropriate columns in appendix III. Note that NZSEI-18 scores are presented for sub-major group occupations in *italics* and for major group occupations in **bold**. Note also that if ANZSCO-classified occupational data are only available to the major or sub-major level, NZSEI-18 SES groups cannot be assigned.

Whether to assign individuals NZSEI-18 scores or assign them to NZSEI-18 SES groups is entirely up to the researcher. Greater sensitivity should be obtained by assigning scores, and scores may also be preferred for analytic reasons – e.g. continuous data allow analyses such as linear regression to be undertaken.

However, there are circumstances under which one or other of the SES group classifications would be preferred. For example, for researchers wanting equal-sized groups representing different levels of socio-economic status, NZSEI-18 four-group or 10-group classification would be appropriate. NZSEI-18 10-group classification also allows for direct comparisons with NZDep scales (e.g. NZDep2018; Atkinson, et al., 2019). Similarly, for comparisons with, or assessing continuity with, the previous Elley-Irving scales (e.g. Elley & Irving, 1972; 1976; 1985; 2003; Irving & Elley, 1977), NZSEI-18 six-group classification may be preferred.

Coding those not in the workforce

One of the major disadvantages of an occupational-based measure of SES such as NZSEI-18 is that those without an occupation – or for whom occupational data are unavailable – cannot be coded. There are at least three alternatives to assigning NZSEI-18 scores in this situation.

First, NZSEI-18 scores can be assigned based on previous occupation, if such data are available. Moreover, those wishing to estimate the SES of those who have left the workforce (e.g. retirees) might wish to consider collecting information on the main occupation held by respondents in their lifetime.

Second, in some cases it may be justifiable to use the occupation of a proxy person to assess socio-economic status (e.g. for children or homemakers). Researchers using this method should carefully consider whether an individual's SES is best captured by the SES of their proxy.

Third, individuals can be assigned SES scores based on their 'occupational potential' (Jones & McMillan, 2001), whereby in the absence of information on occupation, scores are imputed using available data on age and education. Methods for imputing NZSEI-18 scores based on age and education were described in Section 6, and were shown to provide reasonably robust measures of SES that validated well against health and socio-economic correlates.

The suggested imputed NZSEI-18 scores were previously shown in Table 42, and were based on the mean NZSEI-18 scores by age and education for those with a current occupation. Scores are given for seven age bands (10-year blocks from 15–24 years to 75+ years) and 12 different highest qualification levels (from No school qualifications to Doctorate degree). While no problem should be encountered classifying the age of individuals, in some cases there may be difficulties classifying the highest education of individuals to the level displayed in the table.

Researchers are advised to classify individuals as accurately as possible, but should note that similar scores are often assigned to adjacent groups. Thus, some distinctions are more important than others. For example, similar scores are assigned to:

   (i) those with a master's degree and those with a post-graduate or honours degree
  (ii) those with a Level 2, 3 or 4 certificate or overseas secondary school qualifications.

Thus, failure to distinguish between these adjacent qualification levels is unlikely to cause large misclassification in imputed NZSEI-18 scores.

The major disadvantage of these imputed NZSEI-18 scores is their restricted range from 34 to 76 (the NZSEI-18 scale for those with occupational data ranges from 10 to 90). A consequence of the restricted range is that NZSEI-18 SES groups cut points do not sensibly assign those with imputed NZSEI-18 scores to SES groups (e.g. individuals are concentrated in the middle groups, and groups at the upper and lower end often have no or few cases). Thus, it is suggested that SES groups are not used for those with imputed NZSEI-18 scores.

Appendix VI: Adjusted income bands

Table A6.1. Adjusted income distribution by major group occupation, workers aged 21–69 years

Total income ($NZ)	Occupation, major group (Percent)							
	Managers	Professionals	Technicians and Trades Workers	Community and Personal Service Workers	Clerical and Administrative Workers	Sales Workers	Machinery Operators and Drivers	Labourers
1–5,000	1.8	1.2	2.1	3.8	1.6	3.0	2.2	5.0
5,001–10,000	0.7	0.9	1.2	1.9	0.9	1.5	1.2	2.7
10,001–15,000	1.0	1.0	1.5	2.5	1.1	2.0	1.7	3.3
15,001–20,000	1.7	1.4	2.6	5.2	2.0	4.2	2.8	5.9
20,001–25,000	2.0	1.6	3.4	6.2	2.7	5.5	3.5	6.9
25,001–30,000	2.7	2.0	4.7	8.5	3.9	8.0	4.9	8.4
30,001–35,000	3.3	2.2	6.0	8.9	5.3	9.1	6.5	9.4
35,001–40,000	5.3	3.9	9.6	12.7	9.6	12.7	10.9	12.6
40,001–50,000	11.1	9.9	18.3	16.1	21.3	17.7	20.4	16.6
50,001–60,000	11.3	12.8	16.6	10.7	18.6	11.3	16.6	10.8
60,001–70,000	10.1	12.9	12.2	7.4	11.8	6.9	11.5	6.0
70,001–100,000	20.5	27.7	15.2	10.5	13.6	9.7	13.5	7.6
100,001–150,000	16.4	14.1	5.0	4.1	5.1	5.0	3.1	3.0
150,001 or more	11.9	8.3	1.6	1.5	2.4	3.4	1.3	1.7
Total	100	100	100	100	100	100	100	100

Source: Stats NZ, 2018 Census

Table A6.2. Adjusted income distribution for population subgroups, workers aged 21–69 years

Total income ($NZ)	Ethnic group					Rurality		Region		Country of birth		Disability status	
	European	Māori	Pacific	Asian	MELAA	Urban	Rural	Auckland	Rest of NZ	NZ-born	Overseas-born	Disabled	Non-disabled
1–5,000	1.6	2.3	4.4	4.3	4.5	2.2	2.6	2.7	2.1	1.7	3.5	3.8	2.1
5,001–10,000	1.0	1.3	2.0	2.1	2.4	1.2	1.3	1.4	1.2	1.0	1.8	1.6	1.1
10,001–15,000	1.3	2.2	2.2	2.2	2.8	1.5	1.7	1.6	1.6	1.4	1.9	1.9	1.3
15,001–20,000	2.3	4.0	3.8	3.9	4.4	2.8	3.0	2.7	2.8	2.6	3.2	3.6	2.3
20,001–25,000	2.8	4.6	4.3	4.8	4.9	3.4	3.6	3.2	3.5	3.1	4.0	4.1	3.0
25,001–30,000	4.0	6.1	5.8	5.6	5.5	4.5	4.7	4.0	4.9	4.4	4.8	5.5	4.2
30,001–35,000	4.7	6.7	7.1	7.0	6.4	5.4	5.2	4.8	5.7	5.1	5.9	6.4	5.0
35,001–40,000	7.4	10.1	11.3	10.4	9.1	8.4	7.8	7.7	8.7	8.1	8.8	9.7	8.0
40,001–50,000	14.0	16.7	19.0	17.2	14.8	15.1	14.3	14.2	15.3	14.8	15.2	15.6	14.5
50,001–60,000	13.4	13.8	14.4	12.7	12.0	13.4	13.1	13.1	13.5	13.7	12.6	13.4	13.5
60,001–70,000	11.0	9.6	9.0	8.8	8.4	10.4	10.5	10.2	10.5	10.9	9.5	9.7	10.8
70,001–100,000	19.4	14.1	10.8	12.4	14.0	17.3	17.3	17.6	17.2	18.2	15.6	14.3	18.5
100,001–150,000	10.5	5.6	3.9	5.8	7.3	9.0	8.9	10.2	8.4	9.3	8.5	6.8	9.9
150,001 or more	6.5	2.8	1.9	2.8	3.6	5.3	5.9	6.7	4.7	5.7	4.8	3.7	6.0
Total	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Stats NZ, 2018 Census