

**Department of Statistics, University of Auckland**  
**Summer Scholarship 2014-2015**

**Adjusting for linkage bias in the New  
Zealand Longitudinal census**

**Name:** Rahul Singhal

**Supervisor:** Barry Milne

**Degree:** BA/BCom

**Disclaimer:**

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## **Summer scholarship experience**

Statistics has interested me ever since I took the Statistics 108 course at the University of Auckland, in which I learned about the power and flexibility of statistics. It is the main reason why I decided to change from a single degree to a conjoint degree, so that I could include a statistics major within my studies. My experience here at COMPASS working on the New Zealand Longitudinal census has been an amazing opportunity to learn more about statistics and how it is applied in the real world.

This has only increased my enthusiasm to continue my career and further post-graduate studies within statistics. Getting to work with complicated data and large datasets containing as many as 7.4 million observations was a great way to both apply what I have learned at my time in the University of Auckland and develop critical skills that I would need in further postgraduate courses and in the working world. Working independently on this project has helped me to think critically about what I am analyzing and how to interpret it, in a statistically sound way.

# Summary

The project “Developing Bias Weights for the New Zealand Longitudinal Census” is attempting to adjust for linkage bias in the New Zealand longitudinal census. When we link people from one census to another, those people that have been linked may differ from those that could not be linked, such as their age, sex, and ethnic compositions of census pairs may differ between those linked and those not linked in a way that has variable effects on research questions.

Having the bias can result in a tendency to overestimate or underestimate important relationships between variables, such as the effect of a person’s occupation on mortality risk. This tendency could potentially result in incorrect conclusions. Thus this project could be very helpful for other projects that use the New Zealand Longitudinal Census to investigate the effect of different variables.

The project has been successful for almost all the linkages across censuses, ranging from an increase of 3%-25% in overall unbiased linkages.

# Abstract

Write your technical abstract here.....

An abstract should provide a brief overview of the substance of the report. It should state the topic, outline your approach to the task, give the most important findings of your research and state the main outcomes or conclusions. It should be no more than 250 words.

The aim of this project is to adjust for linkage bias in the New Zealand longitudinal census, a series of 15 cohorts linking the 1981, 1986, 1991, 1996, 2001 & 2006 censuses. These include five cohorts of two Censuses, four cohorts of three Censuses, three cohorts of four Censuses, two cohorts of five Censuses, and one cohort of six Censuses.

To determine bias we assessed 2-way (X-Y) correlations between children & adult variables for each cohort for (1) Full (linkable) Census at time t; (2) Sample linked from t to t-1, (3) Sample linked from t to t-1 weighted by each individuals propensity to be linked, by a logistic regression model including main effects only; and (4) Sample linked from t to t-1 weighted by each individuals propensity to be linked by a logistic regression model including main effects and two way interaction effects. We then calculated the magnitude of the differences between the correlations: 1 vs 2 (unweighted); 1 vs 3 (weighted-main); 1 vs 4 (weighted-interactions); and considered correlations to be unbiased if the magnitude was smaller than .01.

Across cohorts, 40%-76% of correlations were unbiased in unweighted analyses. Weighting increased the number of unbiased correlations by 3 to 25 percentage points, and the weighted-interaction correlations tended to be less biased than the weighted-main correlations. For adults we can see that we have improvements ranging from about 4 to 25 percentage points. For children we can see that we have improvements ranging from about 4 to 19 percentage points, with the exception of one cohort.

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# 1.0 Introduction

The census is the official count of how many dwellings and people there are in New Zealand, and it covers the entire population. However it is limited in that it only takes a cross-sectional snapshot in time. The main benefit of a longitudinal study is that developments or changes in the characteristics of the target population are able to be detected by researchers, at both the group and the individual level. As a result of longitudinal studies extending beyond a single moment in time, we can establish sequences of events.

For example, we might choose to look at what factors explain changing ethnic identification. The longitudinal study design would account for variables such as age or gender as the ethnic identification changed over time. Therefore, a longitudinal study is more likely to suggest cause-and-effect relationships than a cross-sectional study by virtue of its scope. It will also become possible to answer questions such as what is the extent of ethnic mobility or is geographical mobility increasing in NZ?

Currently the NZLC contains the censuses from 1981-2006, where records have been “linked” back to the previous census. What this means is that individuals in the eligible population are “linked” back to a previous census, where the eligible population is defined to be where the individual was (1) in New Zealand at the previous census and (2) old enough to have been alive at the last census.

The 15 cohorts of the NZLC are shown in Figure 1. These include five cohorts of two Censuses, four cohorts of three Censuses, three cohorts of four Censuses, two cohorts of five Censuses, and one cohort of six Censuses. We can see that there is incomplete linkage between Censuses, ranging from 31%-75% of theoretical population linked, depending on the cohort. When we link people from one census to another, those people that have been linked may differ from those that could not be linked, such as their age, sex, and ethnic compositions of census pairs may differ across time in a way that has variable effects on research questions. Previous work undertaken by [Vera Puti Puti Clarkson](#) in a 2013-2014 summer scholarship found that the five strongest variables that determines linkage across the cohorts are: Same address 5 years ago, Marital Status, European Ethnicity, Live with partner and sex.

Having the bias can result in a tendency to overestimate or underestimate important relationships between variables, such as the effect of a person’s occupation on mortality risk. This tendency could potentially result in incorrect conclusions. Thus this project could be very helpful for other projects that use the New Zealand Longitudinal Census to investigate the effect of different variables.

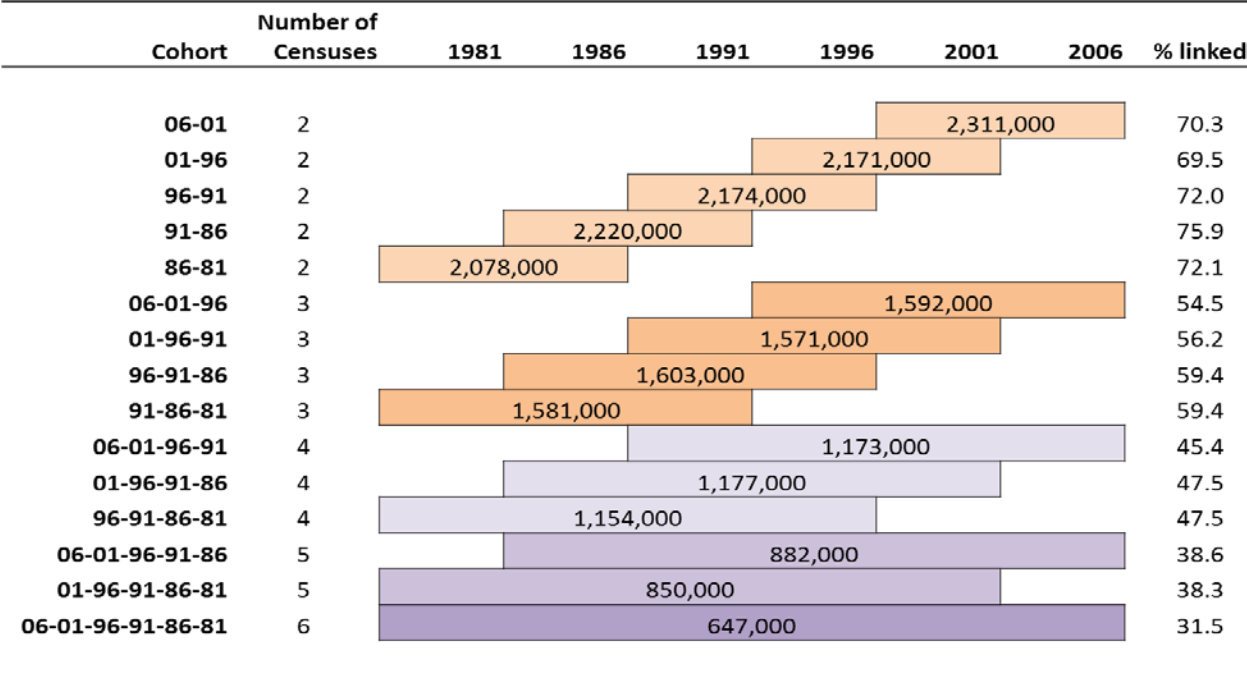


Figure 1.. New Zealand Longitudinal Census cohorts

Weighting refers to the process trying to infer results for the relevant population by adjusting a sample. To do this, a 'weight' is allocated to each individual. The weight attempts to adjust for how many people in the relevant population are represented by each person in the sample. Weights allow for linked records to estimate longitudinal populations. The project “Developing Bias Weights for the New Zealand Longitudinal Census” is attempting to adjust for linkage bias in the New Zealand longitudinal census. This will be done by conducting analyses to estimate bias weights, and examining the extent to which adjusting for these weights results in unbiased analyses.

## 2.0 Methods

The program used to analyze the data was SAS Enterprise Guide.

### For two census cohorts

Each two census pair file (i.e., 2006-2001, 2001-1996, 1996-1991, 1991-1986, 1986-1981) was created by merging the appropriate Census level files. Variables were then modified to change them all into numeric values, and categorised. We then separated the data into an “adult” (age $\geq$ 15) and “child” (age $<$ 15) dataset. Afterwards, we used the `ranuni` SAS function separately on both of these datasets, to randomize the data and then split the randomized data into two parts. The training set contained 70% of the data, and the test case contained 30% of the data. To assess linkage before adjusting for weights, we made a correlation matrix using test cases only for the full linkable Census in  $t$  (e.g., 2006) and the linked census from  $t$  to  $t-1$  (e.g., 2006 to 2001) separately for adults and children, using the adult and children variables. We then assessed the magnitude of differences between the full linkable Census and the linked census correlations (weighted), for both the adults and children. We then used these magnitudes to determine how biased the cohorts are. If the difference in correlations was smaller than .01 we considered the correlation to be unbiased.

Note, we always compared correlations using data from the latter of the two linked Censuses ( $t$ ), as all those in  $t$  are eligible to be linked back to  $t-1$ . Thus, we want correlations among those linked from  $t$  to  $t-1$  to match as closely as possible correlations among those in  $t$ . The opposite is not the case: some in  $t-1$  are not eligible to be linked to  $t$  (e.g., those who die or emigrate in the interim). As such, correlations among those linked from  $t$  to  $t-1$  are not expected to match the correlations among those in  $t-1$ .

To adjust for weights we calculated each individual’s probability to be linked, based on their characteristics. This was done using two logistic regression models, run on the training data. The first logistic regression model included main effects only (weighted-main). Predicted probabilities of being linked were output from this model. We then weighted observations by inverse of these probabilities in analyses. A correlation matrix using test cases only for the full linkable Census in  $t$  and the main-effects-weighted linked census from  $t$  to  $t-1$  were made for adults and children, using the adult and children variables. We then assessed the magnitude of differences between the full linkable Census and the linked census correlations, for both the adults and children. We then used these magnitudes to determine how biased the cohorts are. If the difference in correlations was smaller than .01 we considered the correlation to be unbiased.

The second logistic regression model included both main effects and two-way interaction effects (weighted-interactions). Note that processing power did not allow the inclusion of all two-way interactions, so only those deemed ‘important’ were included. To determine ‘important’ interaction effects, we ran a `proc surveyselect` command on the adults on a sample size of 14500 to create a new dataset (thus, with approximately 10,000 training cases and approximately 4500 test cases). Any two-variable interaction found to be significant was added into the logistic regression model in addition to the other adult variables. Thus, we considered any interaction significant in a random sample of 10,000



to be 'important' enough to include in the logistic model. A correlation matrix for the full linkable Census in  $t$  and the interaction-effects-weighted linked census from  $t$  to  $t-1$  were made for adults, using the adult variables. We then assessed the magnitude of differences between the full linkable Census and the linked census correlations. We then used these magnitudes to determine how biased the cohorts are. If the difference in correlations was smaller than .01 we considered the correlation to be unbiased. The children's dataset involved all the steps taken in the adult dataset using instead the children's dataset and children variables.

#### **For three and higher census cohorts:**

The weights obtained in the second method above combined using two different methods, where the method that had the highest reduction in bias was used.

1. The Arithmetic mean method: Calculated by adding the weights together and dividing by the number of censuses in the set .For example in the 060196 cohort we added the 0601 and 0196 weights, then divided by two to obtain the new weights
2. Geometric mean: Calculated by multiplying the weights together and taking the number of censuses root. For example in the 060196 cohort we multiplied the 0601 and 0196 weights, then raised them to the 2<sup>nd</sup> root (square root).

For each method we then assessed the magnitude of differences between the full linkable Census and the Arithmetic mean or Geometric mean linked census correlations. We then used these magnitudes to determine how biased the cohorts are. If the difference in correlations was smaller than .01 we considered the correlation to be unbiased. This was undertaken separately for adults and children as before.

The three cohort and above censuses require some additional coding, to allow for the fact that the individual must alive at the earliest census, and have been in New Zealand at the previous censuses. For example for cohort 06019691, the individual must be at least 15 years old, and have been in New Zealand for both the 0196 and 9691 censuses. This also means that there will be no child datasets beyond the three cohort censuses, as the individual will have to be 15 or older, which means they will not meet the census definition of a child.

## 3.0 Results

Adults 2 census cohorts table

Adults				
Cohort	Non-biased linkages before weighting	Non-biased linkages after main effects weighting	Non-biased linkages after main and interaction effects weighting	Largest increase in non-biased linkages
0601	40.9%	57.2%	57.8%	16.9%
0196	46.5%	71.1%	71.3%	24.8%
9691	63.7%	71.7%	71.0%	8%
9186	42.8%	52.0%	53.1%	10.3%
8681	45.5%	49.8%	47.7%	4.3%

We can see that we have improvement across all five adult cohorts, ranging from about 4% to 25%. The non-biased linkages before the weighting range from 41% to 64%, and after weighting we can see they improve to about 50% to 72%. We can also see that there are occasions when the main effects weighting give better results than the main and interaction effects weighting, such as in the case of cohort 9186 and 8681.

Adults 3+ census cohorts table

Adults				
	before weighting	linkages after weighting	biased linkages	
060196	62.7%	83.8%	21.1%	Geometric mean
019691	72.1%	79.2%	7.1%	Arithmetic mean
969186	75.2%	83.0%	7.8%	Geometric mean
918681	72.0%	78.3%	6.3%	Geometric mean
06019691	72.3%	81.1%	8.8%	Arithmetic mean
01969186	74.4%	81.3%	6.9%	Geometric mean
96918681	76.0%	82.0%	6.0%	Geometric mean
0601969186	73.2%	78.2%	5.0%	Arithmetic mean
0196918681	75.8%	79.8%	4.0%	Geometric mean
060196918681	71.3%	74.2%	2.9%	Geometric mean

We can see that we have improvement across the remaining ten adult cohorts, ranging from about 3% to 9%. The non-biased linkages before the weighting range from 72% to 76%, and after weighting we can see they improve to about 78% to 83%. We can also see that although geometric mean weighting usually give a better result, there are occasions when the arithmetic mean weighting give better results, such as in the case of the cohort 019691, cohort 06019691 and cohort 0601969186.

## Children 2 census cohorts table

Children				
Cohort	Non-biased linkages before weighting	Non-biased linkages after main effects weighting	Non-biased linkages after main and interaction effects weighting	Largest increase in non-biased linkages
0601	54.5%	68.0%	73.6%	19.1%
0196	62.3%	78.9%	73.3%	16.6%
9691	58.3%	57.7%	65.0%	6.7%
9186	55.6%	60.8%	56.9%	5.2%
8681	61.9%	66.7%	70.5%	8.6%

We can see that we have improvement across all five children cohorts, ranging from about 5% to 19%. The non-biased linkages before the weighting range from 55% to 62%, and after weighting we can see they improve to about 61% to 79%. We can also see that there are occasions when the main effects weighting give better results than the main and interaction effects weighting, such as in the case of cohort 9691 .

## Children 3+ census cohorts table

Children				
Cohort	Non-biased linkages before weighting	Non-biased linkages after weighting	Increase in non-biased linkages	Method Used
060196	69.1%	79.3%	10.2%	Arithmetic mean
019691	72.1%	75.6%	3.5%	Geometric mean
969186	68.3%	75.8%	7.5%	Geometric mean
918681	72.6%	72.2%	~0%	

We can see that we have improvement across the remaining four children cohorts, with the exception of cohort 918681, ranging from about 4% to 10%. The non-biased linkages before the weighting range from 68% to 73%, and after weighting we can see they improve to about 72% to 79%. We can also see that although geometric mean weighting usually give a better result, there are occasions when the arithmetic mean weighting give better results, such as in the case of the cohort 060196.

Note:

There are no results for children beyond these cohorts due to the longitudinal nature of the NZLC. To be in a four census cohort, the individual had to be at least 15 years old in the earliest census, and due to a child being defined as a 0-15 year old in the census, by definition there cannot be children beyond the 3 cohort censuses.

## 4.0 Discussion & Conclusions

Across cohorts, 40%-76% of correlations were unbiased in unweighted analyses. Weighting increased the number of unbiased correlations by 3 to 25 percentage points, and the weighted-interaction correlations tended to be less biased than the weighted-main correlations. For adults we can see that we have improvements ranging from about 4 to 25 percentage points. For children we can see that we have improvements ranging from about 4 to 19 percentage points, with the exception of one cohort.

While we cannot eliminate bias from the census, we can significantly reduce it. The project has successfully found ways to significantly reduce bias across all cohorts, and thus has achieved its intended goal. However there are still a few things left that could potentially improve the current results. Firstly, new variables have been created that we could include in the correlation matrix to create better weights to use, reducing the bias further. The second thing that could be done is to use the weights obtained in the interaction and main effects logistic regression model to get better results in the later census cohorts.

For cohorts with 3+ Censuses, we tried a number of analysis methods, but found using the two census cohort weights we had obtained in the previous logistic regressions to estimate weights for three census and above cohorts worked very well, bypassing the need to use the logistic model for further cohorts

## 5.0 References

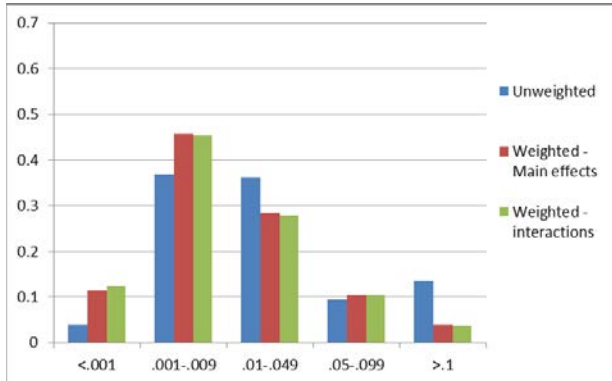
Statistics New Zealand (2013). Linking Censuses: New Zealand Longitudinal Census 1981-2006. Available from [www.stats.govt.nz](http://www.stats.govt.nz)

# Appendices

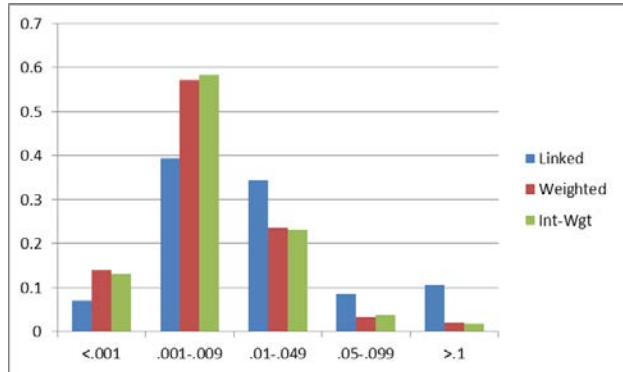
1. Graphs of proportion of correlations with different magnitudes of bias using different weighting methods (all cohorts)

## Adults

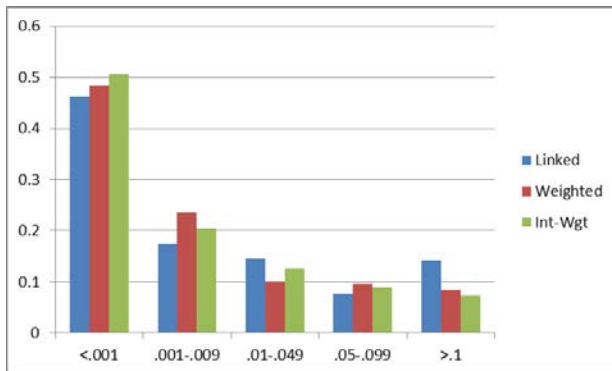
0601



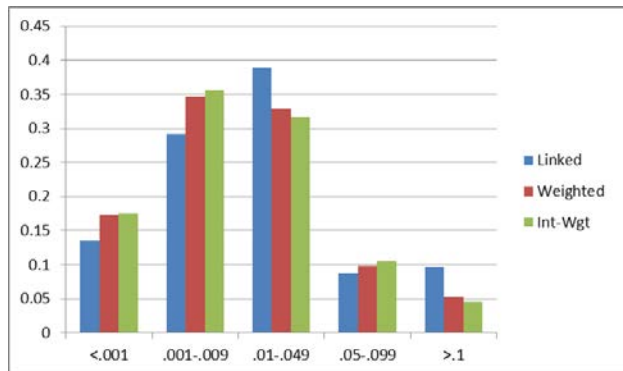
0196



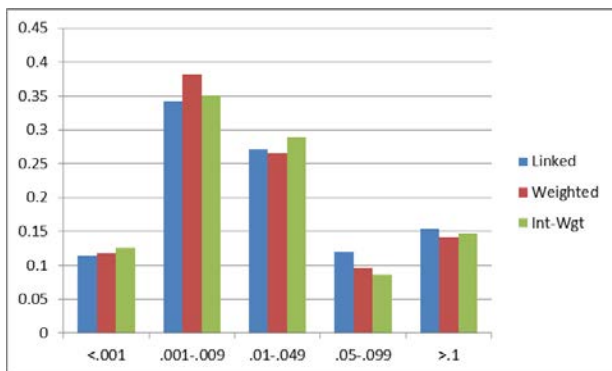
9691



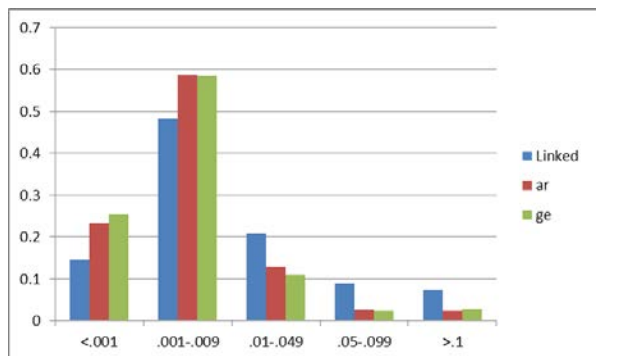
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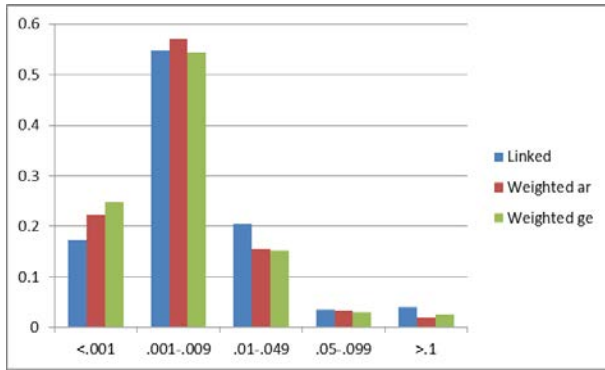
8681



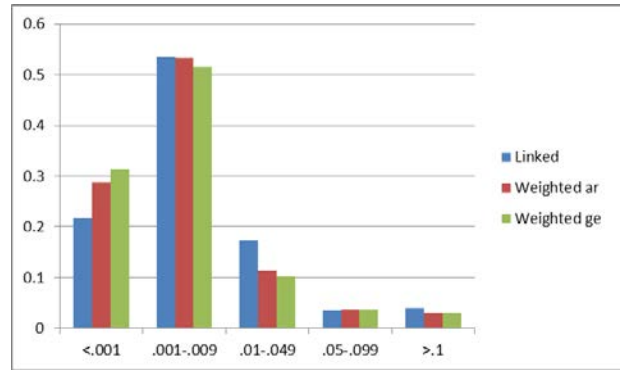
060196



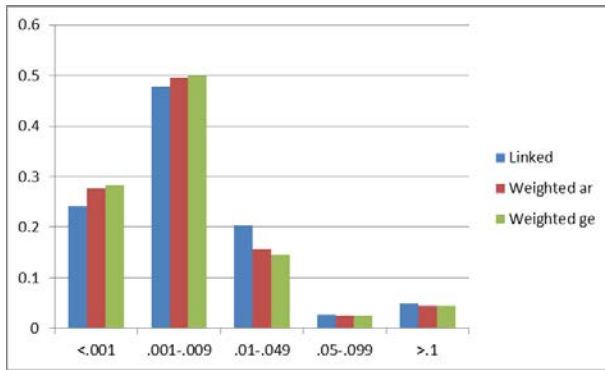
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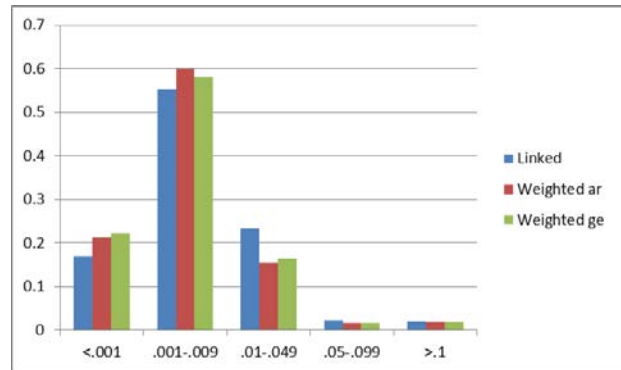
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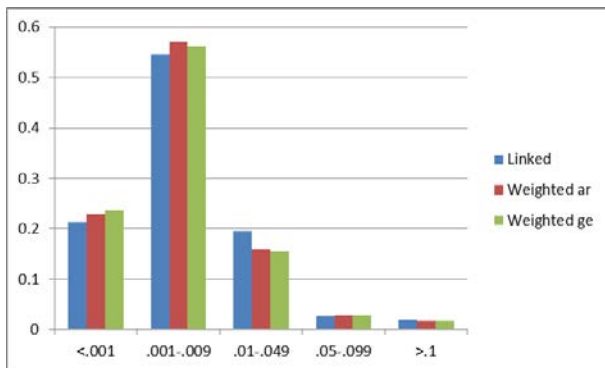
918681



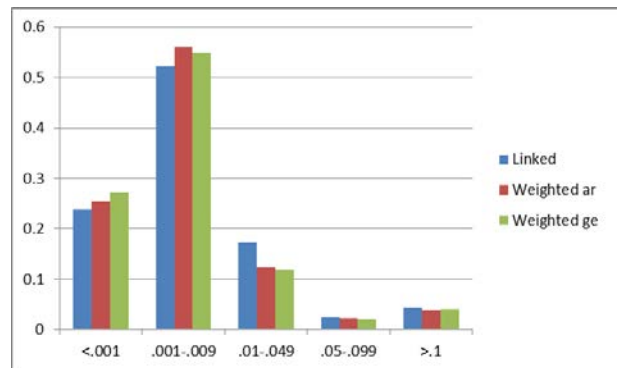
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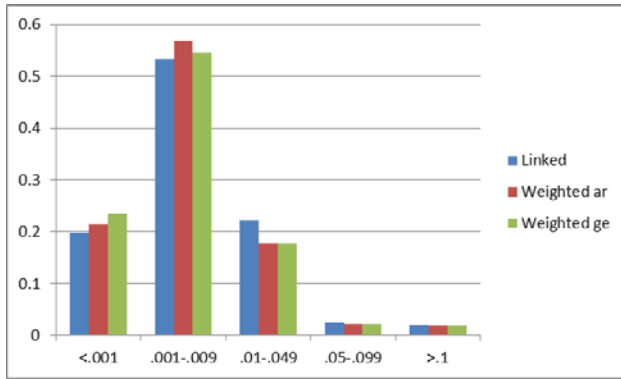
01969186



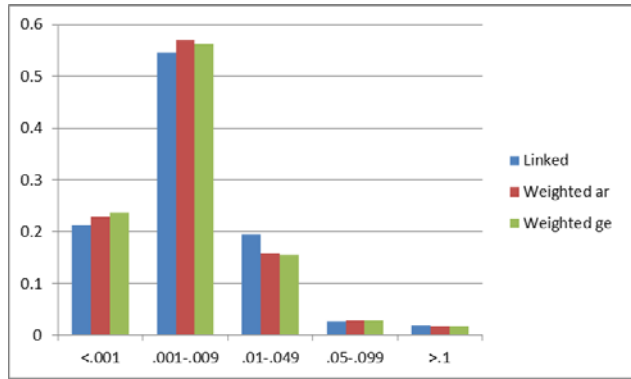
96918681



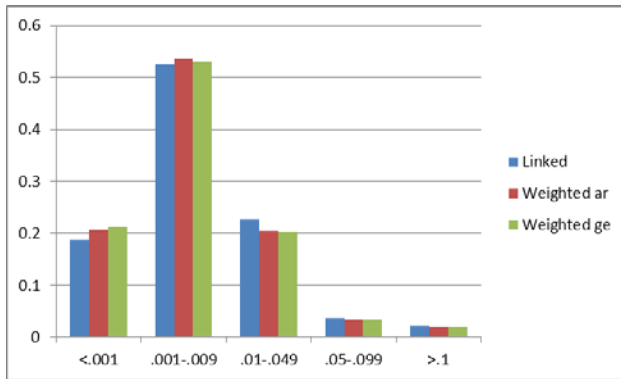
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0196918681

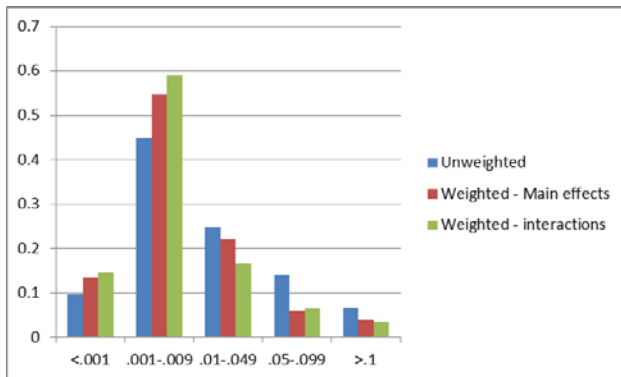


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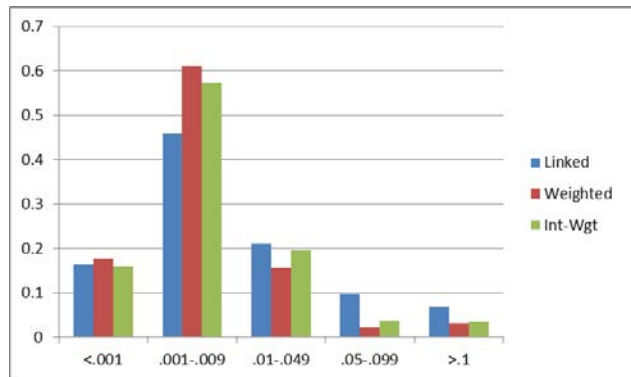


## Children

0601

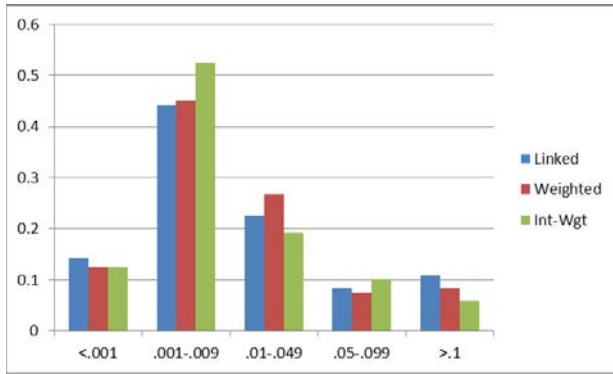


0196

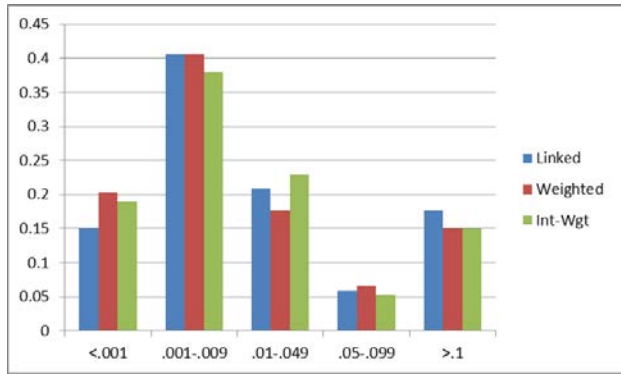




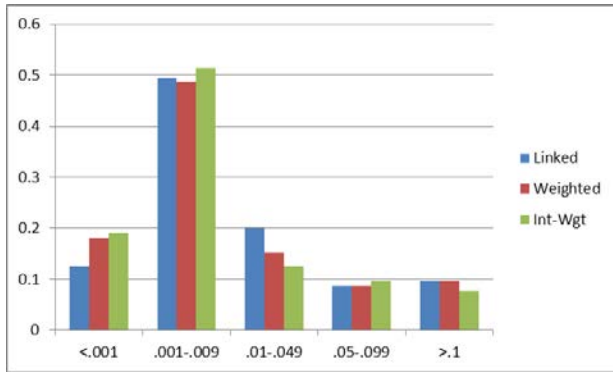
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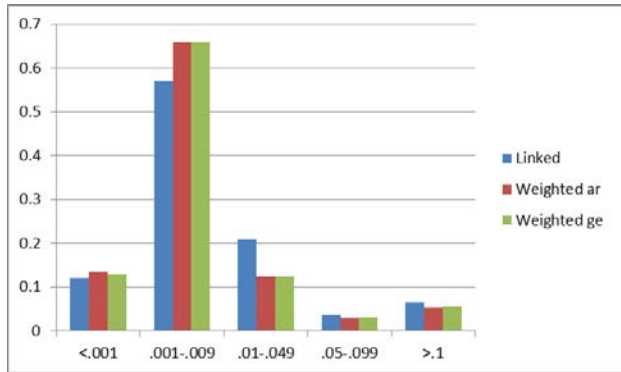
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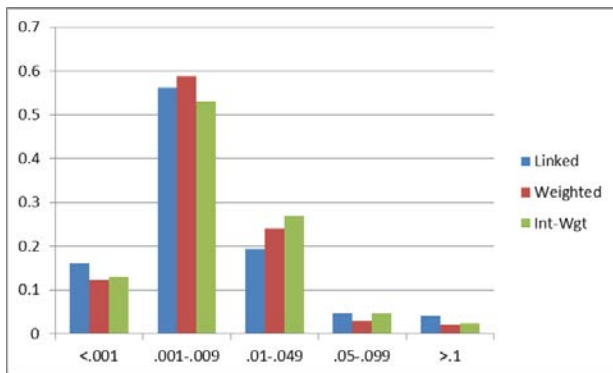
8681



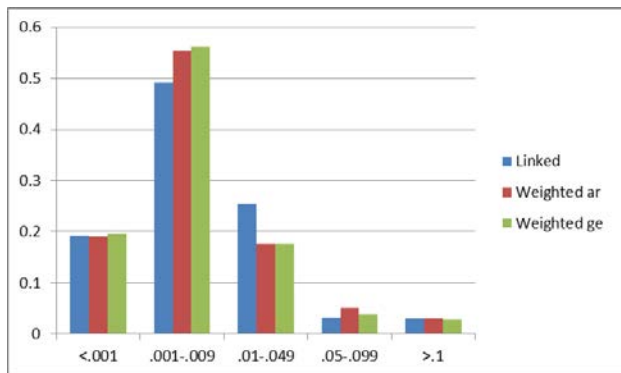
060196



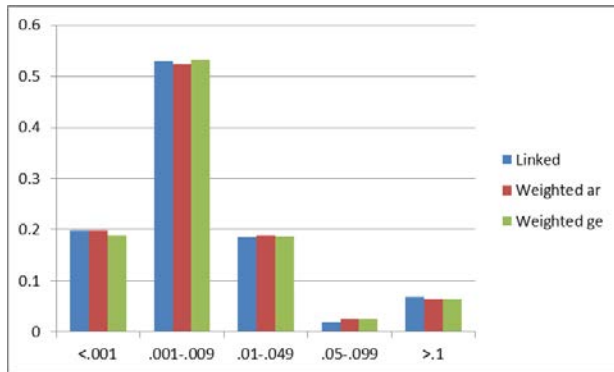
019691



969186



918681



## 2. Sample SAS Code: Cohort 060196

```
libname vera '\\wprdfs08\RO-MAA2013-18 Linkage Bias Longitudinal Census';
libname ver2 '\\wprdfs08\DataLab-MA\MAA2013-18 Linkage Bias Longitudinal
Census\Vera\Updated data dec 2013';
libname vernzdep '\\wprdfs08\RO-MAA2013-18 Linkage Bias Longitudinal
Census\Updated data dec 2013';
libname created '\\wprdfs08\DataLab-MA\MAA2013-18 Linkage Bias Longitudinal
Census\Vera\Created data sets';
```

```
data wgt060196 (keep = ID linkind0601 linkind0196 wgt0601 wgt0196
wgt060196_armean wgt060196_gemean) ;
set ver2.wgtfull;
wgt060196_armean = (wgt0601+wgt0196)/2;
if ~(linkind0601=1 and linkind0196=1) then wgt060196_armean = .;
wgt060196_gemean = (wgt0601*wgt0196)**(.5);
if ~(linkind0601=1 and linkind0196=1) then wgt060196_gemean = .;
if linkind0601 ~=.;
run;
```

```
proc means data= wgt060196;
var wgt060196_armean wgt060196_gemean linkind0601;
run;
```

```
proc corr data= wgt060196;
var wgt060196_armean wgt060196_gemean;
run;
```

```
data aa;
set ver2.individual_linkind0601_2006;
run;
data datasex (keep=ID sex);
set ver2.spine_dataset;
run;
data dataeth (keep=ID eur06_06 Mao06_06 Pac06_06 Asian06_06 MELAA06_06
Other06_06 EthNS06);
set ver2.ethnicity_info;
run;
```

```
data datanzdep (keep=MB06 nzdep2006);
set vernzdep.nzdep2006_mb06;
nzdep2006=nzdep2006_mb06;
if nzdep2006=. then nzdep2006=99;
run;
```

```
data datamb (keep=id mb06); *adding this new dataset to the work library;
set ver2.geogr_linkspine_0601;
mb06=URSmb06_06;
run;
proc sort data=datamb; by mb06; run;
proc sort data=datanzdep; by mb06; run;
data data_mb_nzdep; *merging to form a dataset with ID mb06 nzdep2006;
```

```

merge datamb datanzdep;
by mb06;
run;
proc sort data=data_mb_nzdep;by ID;run;
data data2_mb_nzdep; *removing those meshblocks which no IDs live in;
set data_mb_nzdep;
if id ~=.;
run;

proc sort data=aa;by ID;run;
proc sort data=datalsex;by ID;run;
proc sort data=dataeth;by ID;run;
proc sort data=data2_mb_nzdep;by ID;run;

data aa2; *merging all datasets together;
merge aa datalsex dataeth data2_mb_nzdep;
by ID;
run;
data aa3; *reducing dataset down to those that exist in 2006;
set aa2;
if Linkind0601~=.;
run;

data aa4;
set aa3;
age06=input(age_code_06,f4.0);
if 5<=age06<=9 then age06=1; if 10<=age06<=14 then age06=2; if 15<=age06<=19
then age06=3; if 20<=age06<=24 then age06=4; if 25<=age06<=29 then age06=5;
if 30<=age06<=34 then age06=6; if 35<=age06<=39 then age06=7; if
40<=age06<=44 then age06=8; if 45<=age06<=49 then age06=9; if 50<=age06<=54
then age06=10;
if 55<=age06<=59 then age06=11; if 60<=age06<=64 then age06=12; if
65<=age06<=69 then age06=13; if 70<=age06<=74 then age06=14; if 75<=age06<=79
then age06=15;
if 80<=age06<=84 then age06=16; if 85<=age06<=120 then age06=17;

adult06=0;
if individual_rec_type_code_06='3' then adult06=1;

yrs_at_addr06=input(years_at_addr_code_06,F4.0);
if 1<=yrs_at_addr06<=5 then yrs_at_addr06=1; if 6<=yrs_at_addr06<=10 then
yrs_at_addr06=2; if 11<=yrs_at_addr06<=20 then yrs_at_addr06=3; if
21<=yrs_at_addr06<=98 then yrs_at_addr06=4; if yrs_at_addr06 in(777,999) then
yrs_at_addr06=9;
same_addr_5yrs_ago06=input(addr_5years_ago_code_06,f4.0);
if same_addr_5yrs_ago06=2 then same_addr_5yrs_ago06=0; if
same_addr_5yrs_ago06 in (5,99) then same_addr_5yrs_ago06=9;
NZ_born06=0;
if birth_country_code_06='1201' then NZ_born06=1; if
birth_country_code_06='9999' then NZ_born06=9;
yrs_in_NZ06=input(years_in_NZ_code_06,f4.0);
if 0<=yrs_in_NZ06<=9 then yrs_in_NZ06=1; if 10<=yrs_in_NZ06<=19 then
yrs_in_NZ06=2; if 20<=yrs_in_NZ06<=97 then yrs_in_NZ06=3; if yrs_in_NZ06=888
then yrs_in_NZ06=4; if yrs_in_NZ06 in (777,999) then yrs_in_NZ06=9;

```

```

offic_lang_dummy=input(official_language_code_06,f4.0);
if offic_lang_dummy in (2,5) then language_indicator06=1; if offic_lang_dummy
in (1,3,4,6) then language_indicator06=2; if offic_lang_dummy in (7,8) then
language_indicator06=3; if offic_lang_dummy in (97,98,99) then
language_indicator06=9;
Language_count06=input(languages_count_code_06,f4.0);
if 3<=Language_count06<=6 then Language_count06=3; if 7<=Language_count06<=9
then Language_count06=9;
maori_descent06= input(recode_maori_descent_code_06, f4.0);
if maori_descent06=2 then maori_descent06=0; if maori_descent06 in (4,7,9)
then maori_descent06=9;
iwi_ind06=input(iwi_ind_code_06,f4.0);
if iwi_ind06=2 then iwi_ind06=0; if iwi_ind06=7 then iwi_ind06=9;
iwi_count06=input(iwi_count_code_06,f4.0);
if 3<=iwi_count06<=5 then iwi_count06=3; if iwi_count06 in (9) then
iwi_count06=0; if iwi_count06 in (7,8) then iwi_count06=9;
*Created the variable so that if not maori, then iwi_count=0;
religious06=1;
if religion1_code_06='00000' then religious06=0; if religion1_code_06 in
('94444','95555','97777','98888','99999') then religious06=9;
live_with_parents06=0;
if living_arrangement6_code_06='0411' then live_with_parents06=1;
live_with_partner06=0;
if living_arrangement1_code_06='0211' then live_with_partner06=1; if
living_arrangement2_code_06='0211' then live_with_partner06=1; if
living_arrangement3_code_06='0212' then live_with_partner06=1; if
living_arrangement4_code_06='0211' then live_with_partner06=1; if
living_arrangement5_code_06='0212' then live_with_partner06=1;
live_with_siblings06=0;
if living_arrangement8_code_06='0511' then live_with_siblings06=1;
live_with_children06=0;
if living_arrangement7_code_06='0311' then live_with_children06=1;
live_alone06=0;
if living_arrangement11_code_06='0111' then live_alone06=1;
live_with_flatmates06=0;
if living_arrangement9_code_06='0611' then live_with_flatmates06=1;
live_with_other06=0;
if living_arrangement10_code_06='7777' then live_with_other06=1;
difficulty_acty_count06=0;
if difficulty_acty1_code_06='1' then
difficulty_acty_count06=difficulty_acty_count06+1;
if difficulty_acty2_code_06='2' then
difficulty_acty_count06=difficulty_acty_count06+1;
if difficulty_acty3_code_06='3' then
difficulty_acty_count06=difficulty_acty_count06+1;
if difficulty_acty4_code='4' then
difficulty_acty_count06=difficulty_acty_count06+1;
if difficulty_acty_count in (4,0) then difficulty_acty_count06=9;
if difficulty_acty4_code='4' then difficulty_acty_count06=0;
disability06=0;
if dsblty_code_06='1' then disability06=1; if dsblty_code_06 in ('7','9')
then disability06=9;
disability_ind06=input(dsblty_ind_code_06,f4.0);
if disability_ind06=7 then disability_ind06=9;
smoke06=input(smoking_Status_code_06, f4.0);
if smoke06 in (2,3) then smoke06=0; if smoke06 in (7,9) then smoke06=9;
own_residence06=input(tenure_holder_code_06,f4.0);

```

```

if own_residence06=2 then own_residence06=0; if own_residence06 in (7,9) then
own_residence06=9;
marital_status_legal06=input(legal_marital_status_code_06,f4.0);
if marital_status_legal06 in (2) then marital_status_legal06=0; if
marital_status_legal06 in (1,3) then marital_status_legal06=3; if
marital_status_legal06 in (6) then marital_status_legal06=1; if
marital_status_legal06 in (4,5) then marital_status_legal06=2; if
marital_status_legal06 in (7,9) then marital_status_legal06=9;
children_born06=input(fertility_code_06,f4.0);
if 2<=children_born06<=10 then children_born06=2; if children_born06 in
(55,77,88,99) then children_born06=9;
had_children06=children_born06;
if children_born06=2 then had_children06=1;
highest_qual06=input(highest_qual_code_06, f4.0);
if highest_qual06 in (1,2,3,4) then highest_qual06=1; if highest_qual06 in
(5,6,7,8,9,10) then highest_qual06=2; if highest_qual06 in (11,12,13,14) then
highest_qual06=3; if highest_qual06 in (97,99) then highest_qual06=9;
income_source_count06=input(income_srce_count_code_06, f4.0);
if 3<=income_source_count06<=10 then income_source_count06=3; if
income_source_count06=99 then income_source_count06=9;
benefit_income06=0;
if income_srce7_code_06='07' then benefit_income06=1; if
income_srce8_code_06='08' then benefit_income06=1; if
income_srce9_code_06='09' then benefit_income06=1; if
income_srce10_code_06='10' then benefit_income06=1; if
income_srce11_code_06='11' then benefit_income06=1; if
income_srce12_code_06='12' then benefit_income06=1;
if adult06=0 then benefit_income06=.;
ttl_personal_income06=input(total_income_code_06,f4.0);
if ttl_personal_income06 in (1,2) then ttl_personal_income06=0; if
3<=ttl_personal_income06<=8 then ttl_personal_income06=1; if
9<=ttl_personal_income06<=14 then ttl_personal_income06=2; if
ttl_personal_income06=99 then ttl_personal_income06=9;
income_support06=input(income_support_count_code_06,f4.0);
if 1<=income_support06<=6 then income_support06=1;
hrs_work_mainjob06=input(work_hrs1_code_06,f4.0);
if 1<=hrs_work_mainjob06<=29 then hrs_work_mainjob06=1; if
30<=hrs_work_mainjob06<=49 then hrs_work_mainjob06=2; if
50<=hrs_work_mainjob06<=168 then hrs_work_mainjob06=3; if hrs_work_mainjob06
in (777) then hrs_work_mainjob06=9; if hrs_work_mainjob06=999 then
hrs_work_mainjob06=0;
if wklfs_code_06='3' then work_labour_force_status06=0; if wklfs_code_06='4'
then work_labour_force_status06=1; if wklfs_code_06='1' then
work_labour_force_status06=2; if wklfs_code_06='2' then
work_labour_force_status06=3; if wklfs_code_06='9' then
work_labour_force_status06=9;
travel_work06=input(travel_work_code_06,f4.0);
if travel_work06 in (1,2) then travel_work06=0; if travel_work06 in (3,4,5,8)
then travel_work06=1; if travel_work06 in (6,7) then travel_work06=2; if
travel_work06 in (9,10) then travel_work06=3; if travel_work06 in (15,77,99)
then travel_work06=9;
unpaid_acty_count06=0;
if unpaid_acty1_code_06='01' then unpaid_acty_count06=unpaid_acty_count06+1;
if unpaid_acty2_code_06='02' then unpaid_acty_count06=unpaid_acty_count06+1;
if unpaid_acty3_code_06='03' then unpaid_acty_count06=unpaid_acty_count06+1;
if unpaid_acty4_code_06='04' then unpaid_acty_count06=unpaid_acty_count06+1;
if unpaid_acty5_code_06='05' then unpaid_acty_count06=unpaid_acty_count06+1;

```

```

if unpaid_acty6_code_06='06' then unpaid_acty_count06=unpaid_acty_count06+1;
if unpaid_acty_count06=0 then unpaid_acty_count06=9;
if unpaid_acty7_code_06='00' then unpaid_acty_count06=0;
if adult06=0 then unpaid_acty_count06=.;
if unpaid_acty_count06 in (3,4,5,6) then unpaid_acty_count06=3;
sex_female06=0;
if sex='2' then sex_female06=1;
Eur06=input(Eur06_06,f4.0);
if Eur06=. then Eur06=0;
Mao06=input(Mao06_06,f4.0);
if Mao06=. then mao06=0;
Pac06=input(Pac06_06,f4.0);
if Pac06=. then Pac06=0;
Asian06=input(Asian06_06,f4.0);
if Asian06=. then Asian06=0;
MELAA06=input(MELAA06_06,f4.0);
if MELAA06=. then MELAA06=0;
Other06=input(Other06_06,f4.0);
if Other06=. then Other06=0;
EthNS2006=input(ethNS06,f4.0);
if EthNS2006=. then EthNS2006=0;

```

```

if 100000 < occupation2006_code_06 < 200000 then oc06 = 1;
if 200000 < occupation2006_code_06 < 300000 then oc06 = 2;
if 300000 < occupation2006_code_06 < 400000 then oc06 = 3;
if 400000 < occupation2006_code_06 < 500000 then oc06 = 4;
if 500000 < occupation2006_code_06 < 600000 then oc06 = 5;
if 600000 < occupation2006_code_06 < 700000 then oc06 = 6;
if 700000 < occupation2006_code_06 < 800000 then oc06 = 7;
if 800000 < occupation2006_code_06 < 900000 then oc06 = 8;
if 900000 < occupation2006_code_06 < 1000000 then oc06 = 9;
run;

```

```

proc freq data=aa4;
table unpaid_acty1_code_06 unpaid_acty2_code_06 unpaid_acty3_code_06
unpaid_acty4_code_06 unpaid_acty5_code_06 unpaid_acty6_code_06
unpaid_acty7_code_06 unpaid_acty_count06;
run;

```

```

proc contents data=aa3;

```

```

run;

```

```

*reducing to just those variables constructed plus age and yearsinnz;
data aa5 (keep= ID linkind0601 age06 adult06 yrs_at_addr06
same_addr_5yrs_ago06 NZ_born06 yrs_in_NZ06 language_indicator06
Language_count06 maori_descent06 iwi_ind06 iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 smoke06 own_residence06 marital_status_legal06
children_born06 had_children06 highest_qual06 income_source_count06
benefit_income06

```

```
t1_personal_income06 income_support06 hrs_work_mainjob06
work_labour_force_status06 travel_work06 unpaid_acty_count06 sex_female06
eur06 Mao06 Pac06 Asian06 MELAA06 Other06
EthNS2006 nzdep2006 oc06 age_code_06 years_in_NZ_code_06);
set aa4; run;
```

```
proc freq data=aa5;
tables unpaid_acty_count06;
run;
```

```
/* 2001*/
```

```
data a;
set ver2.individual_linkind0196_2001;
run;
```

```
data datasex (keep=ID sex);
set ver2.spine_dataset;
run;
```

```
data dataeth (keep=ID eur06_01 Mao06_01 Pac06_01 Asian06_01 MELAA06_01
Other06_01 EthNS01);
set ver2.ethnicity_info;
run;
```

```
data datanzdep (keep= MB06 nzdep2001);
set vernzdep.nzdep2001_mb01_mb06;
nzdep2001=nzdep2001_mb01;
if nzdep2001=. then nzdep2001=99; ;
run;
```

```
data datamb (keep=id mb06);*creating new dataset in work library;
set ver2.geogr_linkspine_0196;
mb06=URSmb06_01;
run;
```

```
proc sort data=datamb; by mb06; run;
proc sort data=datanzdep; by mb06; run;
data data_mb_nzdep;*merging to form a dataset with ID mb06 nzdep2001;
merge datamb datanzdep;
by mb06;
run;
```

```
proc sort data=data_mb_nzdep;by id;run;
data data2_mb_nzdep; *removing those meshblocks which no IDs live in;
set data_mb_nzdep;
if id ~=.;
run;
proc sort data=data2_mb_nzdep; by nzdep2001;run;
```



```

data data3_mb_nzdep;
set data2_mb_nzdep;
if nzdep2001=. then nzdep2001=99; *recoding those IDs with no identified
nzdeps, as 99;
run;

```

```

proc sort data=a;by ID;run;
proc sort data=datasex;by ID;run;
proc sort data=dataeth;by ID;run;
proc sort data=data3_mb_nzdep;by ID;run;

```

```

data a2;
merge a datasex dataeth data3_mb_nzdep;
by ID;
run;
data a3;*reducing dataset to those IDs only eligible to be linked 0196;
set a2;
if linkind0196~=. ;
run;

```

```

data a4;
set a3;
adult01=0;
if individual_rec_type_code_01='3' then adult01=1;
yrs_at_addr01=input(years_at_addr_code_01,F4.0);
if 1<=yrs_at_addr01<=5 then yrs_at_addr01=1; if 6<=yrs_at_addr01<=10 then
yrs_at_addr01=2; if 11<=yrs_at_addr01<=20 then yrs_at_addr01=3; if
21<=yrs_at_addr01<=98 then yrs_at_addr01=4; if yrs_at_addr01 in(777,999) then
yrs_at_addr01=9;
same_addr_5yrs_ago01=input(addr_5years_ago_code_01,f4.0);
if same_addr_5yrs_ago01=2 then same_addr_5yrs_ago01=0; if
same_addr_5yrs_ago01=5 then same_addr_5yrs_ago01=9;
age01=input(age_code_01,f4.0);
if 5<=age01<=9 then age01=1; if 10<=age01<=14 then age01=2; if 15<=age01<=19
then age01=3; if 20<=age01<=24 then age01=4; if 25<=age01<=29 then age01=5;
if 30<=age01<=34 then age01=6; if 35<=age01<=39 then age01=7; if
40<=age01<=44 then age01=8; if 45<=age01<=49 then age01=9; if 50<=age01<=54
then age01=10;
if 55<=age01<=59 then age01=11; if 60<=age01<=64 then age01=12; if
65<=age01<=69 then age01=13; if 70<=age01<=74 then age01=14; if 75<=age01<=79
then age01=15;
if 80<=age01<=84 then age01=16; if 85<=age01<=120 then age01=17;
NZ_born01=0;
if birth_country_code_01='1201' then NZ_born01=1; if
birth_country_code_01='9999' then NZ_born01=9;
yrs_in_NZ01=input(years_in_NZ_code_01,f4.0);
if 0<=yrs_in_NZ01<=9 then yrs_in_NZ01=1; if 10<=yrs_in_NZ01<=19 then
yrs_in_NZ01=2; if 20<=yrs_in_NZ01<=97 then yrs_in_NZ01=3; if yrs_in_NZ01=999
then yrs_in_NZ01=4; if yrs_in_NZ01=777 then yrs_in_NZ01=9;
*yrs_in_nz=4 means lived here forever(i.e not stated);
offic_lang_dummy=input(official_language_code_01,f4.0);
if offic_lang_dummy in (2,5) then language_indicator01=1; if offic_lang_dummy
in (1,3,4,6) then language_indicator01=2; if offic_lang_dummy in (7,8) then

```

```

language_indicator01=3; if offic_lang_dummy in (97,98,99) then
language_indicator01=9;
Language_count01=input(languages_count_code_01,f4.0);
if 3<=Language_count01<=6 then Language_count01=3; if 7<=Language_count01<=9
then Language_count01=9;
religious01=1;
if religion1_code_01='00000' then religious01=0; if religion1_code_01 in
('94444','95555','97777','98888','99999') then religious01=9;
difficulty_acty_count01=0;
if difficulty_acty1_code_01='1' then
difficulty_acty_count01=difficulty_acty_count01+1;
if difficulty_acty2_code_01='2' then
difficulty_acty_count01=difficulty_acty_count01+1;
if difficulty_acty3_code_01='3' then
difficulty_acty_count01=difficulty_acty_count01+1;
if difficulty_acty4_code_01='4' then
difficulty_acty_count01=difficulty_acty_count01+1;
if difficulty_acty_count01 in (4,0) then difficulty_acty_count01=9;
if difficulty_acty4_code_01='4' then difficulty_acty_count01=0;
disability01=0;
if dsblty_code_01='1' then disability01=1; if dsblty_code_01 in ('7','9')
then disability01=9;
disability_ind01=input(dsblty_ind_code_01,f4.0);
maori_descent01= input(maori_descent_code_01, f4.0);
if maori_descent01=2 then maori_descent01=0; if maori_descent01 in
(3,4,5,6,7,9) then maori_descent01=9;
iwi_ind01=input(iwi_ind_code_01,f4.0);
if iwi_ind01=2 then iwi_ind01=0; if iwi_ind01=7 then iwi_ind01=9;
iwi_count01=input(iwi_count_code_01,f4.0);
if 3<=iwi_count01<=5 then iwi_count01=3; if iwi_count01 in (9) then
iwi_count01=0; if iwi_count01 in (7,8) then iwi_count01=9;
live_with_partner01=0;
if living_arrangement1_code_01='0211' then live_with_partner01=1; if
living_arrangement2_code_01='0211' then live_with_partner01=1;
live_with_children01=0;
if living_arrangement3_code_01='0311' then live_with_children01=1;
live_with_parents01=0;
if living_arrangement4_code_01='0411' then live_with_parents01=1;
live_with_siblings01=0;
if living_arrangement5_code_01='0511' then live_with_siblings01=1;
live_with_flatmates01=0;
if living_arrangement6_code_01='0611' then live_with_flatmates01=1;
live_with_other01=0;
if living_arrangement7_code_01='7777' then live_with_other01=1;
live_alone01=0;
if living_arrangement8_code_01='0111' then live_alone01=1;
marital_status_legal01=input(legal_marital_status_code_01,f4.0);
if marital_status_legal01 in (21) then marital_status_legal01=0; if
marital_status_legal01 in (33) then marital_status_legal01=1; if
marital_status_legal01 in (31,32) then marital_status_legal01=2; if
marital_status_legal01 in (11) then marital_status_legal01=3; if
marital_status_legal01 in (77,99) then marital_status_legal01=9;
currently_married=0;
if adult01=0 then currently_married=.;
if legal_marital_status_code_01='21' then currently_married=1; if
legal_marital_status_code_01 in ('77','99') then currently_married=9;
currently_separated=0;

```

```

if adult01=0 then currently_separated=.;
if legal_marital_status_code_01 in ('31','32') then currently_separated=1; if
legal_marital_status_code_01 in ('77','99') then currently_separated=9;
never_married=0;
if adult01=0 then never_married=.;
if legal_marital_status_code_01 in ('11') then never_married=1; if
legal_marital_status_code_01 in ('77','99') then never_married=9;

income_source_count01=input(income_srce_count_code_01, f4.0);
if 3<=income_source_count01<=10 then income_source_count01=3; if
income_source_count01=99 then income_source_count01=9;
income_support01=input(income_support_count_code_01, f4.0);
if 1<=income_support01<=6 then income_support01=1;
benefit_income01=0;
if income_srce7_individual_code_01='07' then benefit_income01=1; if
income_srce8_individual_code_01='08' then benefit_income01=1; if
income_srce9_individual_code_01='09' then benefit_income01=1; if
income_srce10_individual_code_01='10' then benefit_income01=1; if
income_srce11_individual_code_01='11' then benefit_income01=1; if
income_srce12_individual_code_01='12' then benefit_income01=1;
if adult01=0 then benefit_income01=.;
ttl_personal_income01=input(total_income_individual_code_01, f4.0);
if ttl_personal_income01 in (1,2) then ttl_personal_income01=0; if
3<=ttl_personal_income01<=6 then ttl_personal_income01=1; if
6<=ttl_personal_income01<=13 then ttl_personal_income01=2; if
ttl_personal_income01=99 then ttl_personal_income01=9;
own_residence01=input(tenure_holder_code_01, f4.0);
if own_residence01=2 then own_residence01=0; if own_residence01 in (7,9) then
own_residence01=9;
highest_qual01=input(highest_qual_code_01, f4.0);
if highest_qual01 in (1,2,3,4,5) then highest_qual01=1; if highest_qual01 in
(6,7,8,9) then highest_qual01=2; if highest_qual01 in (10,11) then
highest_qual01=3; if highest_qual01 in (97,99) then highest_qual01=9;
if wklfs_code_01='3' then work_labour_force_status01=0; if wklfs_code_01='4'
then work_labour_force_status01=1; if wklfs_code_01='1' then
work_labour_force_status01=2; if wklfs_code_01='2' then
work_labour_force_status01=3; if wklfs_code_01='9' then
work_labour_force_status01=9;
work_at_home01=input(workplace_addr_ind_code_01, f4.0);
if work_at_home01=2 then work_at_home01=0;
hrs_work_mainjob01=input(work_hrs1_code_01, f4.0);
if 1<=hrs_work_mainjob01<=29 then hrs_work_mainjob01=1; if
30<=hrs_work_mainjob01<=49 then hrs_work_mainjob01=2; if
50<=hrs_work_mainjob01<=168 then hrs_work_mainjob01=3; if hrs_work_mainjob01
in (777,888) then hrs_work_mainjob01=9; if hrs_work_mainjob01=999 then
hrs_work_mainjob01=0;
travel_work01=input(travel_work_code_01, f4.0);
if travel_work01 in (1,2) then travel_work01=0; if travel_work01 in (3,4,5,8)
then travel_work01=1; if travel_work01 in (6,7) then travel_work01=2; if
travel_work01 in (9,10) then travel_work01=3; if travel_work01 in (15,99)
then travel_work01=9;
*;
unpaid_acty_count01=input(unpaid_acty_count_code_01, f4.0);
if unpaid_acty_count01 in (3,4,5,6,7,8) then unpaid_acty_count01=3; if
unpaid_acty_count01=99 then unpaid_acty_count01=9;
sex_female01=0;
if sex='2' then sex_female01=1;

```

```

Eur01=input(Eur06_01,f4.0);
if Eur01=. then Eur01=0;
Mao01=input(Mao06_01,f4.0);
if Mao01=. then mao01=0;
Pac01=input(Pac06_01,f4.0);
if Pac01=. then Pac01=0;
Asian01=input(Asian06_01,f4.0);
if Asian01=. then Asian01=0;
MELAA01=input(MELAA06_01,f4.0);
if MELAA01=. then MELAA01=0;
Other01=input(Other06_01,f4.0);
if Other01=. then Other01=0;
EthNS2001=input(ethNS01,f4.0);
if EthNS2001=. then EthNS2001=0;

if 10000 < occupation99_code_01 < 20000 then oc01 = 1;
if 20000 < occupation99_code_01 < 30000 then oc01 = 2;
if 30000 < occupation99_code_01 < 40000 then oc01 = 3;
if 40000 < occupation99_code_01 < 50000 then oc01 = 4;
if 50000 < occupation99_code_01 < 60000 then oc01 = 5;
if 60000 < occupation99_code_01 < 70000 then oc01 = 6;
if 70000 < occupation99_code_01 < 80000 then oc01 = 7;
if 80000 < occupation99_code_01 < 90000 then oc01 = 8;
if 90000 < occupation99_code_01 < 92000 then oc01 = 9;
if 92000 < occupation99_code_01 < 100000 then oc01 = 99;
run;

data a5 (keep= ID linkind0196 age01 adult01 yrs_at_addr01
same_addr_5yrs_ago01 NZ_born01 yrs_in_NZ01 language_indicator01
Language_count01 maori_descent01 iwi_ind01 iwi_count01 religious01
live_with_parents01 live_with_partner01 live_with_siblings01
live_with_children01 live_alone01 live_with_flatmates01 live_with_other01
difficulty_acty_count01 disability01 disability_ind01
own_residence01 marital_status_legal01 highest_qual01 income_source_count01
benefit_income01 ttl_personal_income01 income_support01 hrs_work_mainjob01
work_labour_force_status01 travel_work01 unpaid_acty_count01 sex_female01
eur01 Mao01 Pac01 Asian01 MELAA01 Other01 EthNS2001 nzdep2001 oc01
age_code_01 years_in_NZ_code_01);
set a4; run;

proc sort data=aa5; by ID; run;
proc sort data=a5; by ID; run;

data a;
merge aa5 a5;
by ID;
run;

data b;
set a;
if linkind0601 ne .;

```

```

if age06>=2;
if (yrs_in_NZ06~=1 | linkind0196~=.);
run;

proc sort data=b; by ID; run;
proc sort data=wgt060196; by ID; run;

data mergedwgt060196;
merge b wgt060196;
by ID;
run;

data bb;
set mergedwgt060196;
if age06 ne "";
linkind060196=0;
if (linkind0601=1 and linkind0196=1) then linkind060196=1;
run;

proc means data=bb;
var linkind060196 wgt060196_armean wgt060196_gemean;
run;



```

*previously done with **1.85;
data cc;
set bb;
wgt060196_armean_scaled = wgt060196_armean+.4697;
wgt060196_gemean_scaled = wgt060196_gemean+.4817;
if wgt060196_armean_scaled>20 then wgt060196_armean_scaled = 20;
if wgt060196_gemean_scaled>20 then wgt060196_gemean_scaled = 20;
run;

proc means data=cc;
var linkind060196 wgt060196_armean wgt060196_gemean wgt060196_armean_scaled
wgt060196_gemean_scaled;
run;

data adultcc;
set cc; if adult06=1; run;

data childcc (keep= ID linkind0601 linkind060196 wgt060196_armean
wgt060196_gemean age06 adult06 yrs_at_addr06 same_addr_5yrs_ago06 NZ_born06
yrs_in_NZ06 language_indicator06 Language_count06 maori_descent06 iwi_ind06
iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 sex_female06 eur06 Mao06 Pac06 Asian06 MELAA06
Other06 EthNS2006 nzdep2006 linkind0196 age01 yrs_at_addr01
same_addr_5yrs_ago01 NZ_born01 yrs_in_NZ01

```


```

```

language_indicator01 Language_count01 maori_descent01 iwi_ind01 iwi_count01
religious01 live_with_parents01 live_with_partner01 live_with_siblings01
live_with_children01
live_alone01 live_with_flatmates01 live_with_other01 difficulty_acty_count01
disability01 disability_ind01 sex_female01 eur01 Mao01 Pac01 Asian01 MELAA01
Other01 EthNS2001
nzdep2001);
set cc; if adult06=0;
run;

```

```

data adultdd; set adultcc; r=ranuni(1018);test=0; if r>.7 then test=1;run;
data childdd; set childcc; r=ranuni(1810);test=0; if r>.7 then test=1;run;
proc freq data = adultdd; table test linkind060196 test*linkind060196 ; run;
proc freq data = childdd; table test linkind060196 test*linkind060196 ; run;

```

```

proc corr data=adultdd (where=(test=1)) noprob;
var age06 yrs_at_addr06 same_addr_5yrs_ago06 NZ_born06 yrs_in_NZ06
language_indicator06 Language_count06 maori_descent06 iwi_ind06 iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 smoke06 own_residence06 marital_status_legal06
children_born06 had_children06 highest_qual06 income_source_count06
benefit_income06
ttl_personal_income06 income_support06 hrs_work_mainjob06
work_labour_force_status06 travel_work06 unpaid_acty_count06 sex_female06
eur06 Mao06 Pac06 Asian06 MELAA06 Other06
EthNS2006 nzdep2006 oc06 age01 yrs_at_addr01 same_addr_5yrs_ago01 NZ_born01
yrs_in_NZ01 language_indicator01 Language_count01 maori_descent01 iwi_ind01
iwi_count01 religious01 live_with_parents01 live_with_partner01
live_with_siblings01 live_with_children01 live_alone01 live_with_flatmates01
live_with_other01
difficulty_acty_count01 disability01 disability_ind01 own_residence01
marital_status_legal01 highest_qual01 income_source_count01 benefit_income01
ttl_personal_income01
income_support01 hrs_work_mainjob01 work_labour_force_status01 travel_work01
unpaid_acty_count01 sex_female01 eur01 Mao01 Pac01 Asian01 MELAA01 Other01
EthNS2001 nzdep2001 oc01;
run;

```

```

proc corr data=adultdd (where=(test=1 & linkind060196=1)) noprob;
var age06 yrs_at_addr06 same_addr_5yrs_ago06 NZ_born06 yrs_in_NZ06
language_indicator06 Language_count06 maori_descent06 iwi_ind06 iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 smoke06 own_residence06 marital_status_legal06
children_born06 had_children06 highest_qual06 income_source_count06
benefit_income06
ttl_personal_income06 income_support06 hrs_work_mainjob06
work_labour_force_status06 travel_work06 unpaid_acty_count06 sex_female06
eur06 Mao06 Pac06 Asian06 MELAA06 Other06

```

```
EthNS2006 nzdep2006 oc06 age01 yrs_at_addr01 same_addr_5yrs_ago01 NZ_born01
yrs_in_NZ01 language_indicator01 Language_count01 maori_descent01 iwi_ind01
iwi_count01 religious01 live_with_parents01 live_with_partner01
live_with_siblings01 live_with_children01 live_alone01 live_with_flatmates01
live_with_other01
difficulty_acty_count01 disability01 disability_ind01 own_residence01
marital_status_legal01 highest_qual01 income_source_count01 benefit_income01
ttl_personal_income01
income_support01 hrs_work_mainjob01 work_labour_force_status01 travel_work01
unpaid_acty_count01 sex_female01 eur01 Mao01 Pac01 Asian01 MELAA01 Other01
EthNS2001 nzdep2001 oc01;
run;
```

```
proc corr data=adultdd (where=(test=1 & linkind060196=1)) noprob;
weight wgt060196_armean;
var age06 yrs_at_addr06 same_addr_5yrs_ago06 NZ_born06 yrs_in_NZ06
language_indicator06 Language_count06 maori_descent06 iwi_ind06 iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 smoke06 own_residence06 marital_status_legal06
children_born06 had_children06 highest_qual06 income_source_count06
benefit_income06
ttl_personal_income06 income_support06 hrs_work_mainjob06
work_labour_force_status06 travel_work06 unpaid_acty_count06 sex_female06
eur06 Mao06 Pac06 Asian06 MELAA06 Other06
EthNS2006 nzdep2006 oc06 age01 yrs_at_addr01 same_addr_5yrs_ago01 NZ_born01
yrs_in_NZ01 language_indicator01 Language_count01 maori_descent01 iwi_ind01
iwi_count01 religious01 live_with_parents01 live_with_partner01
live_with_siblings01 live_with_children01 live_alone01 live_with_flatmates01
live_with_other01
difficulty_acty_count01 disability01 disability_ind01 own_residence01
marital_status_legal01 highest_qual01 income_source_count01 benefit_income01
ttl_personal_income01
income_support01 hrs_work_mainjob01 work_labour_force_status01 travel_work01
unpaid_acty_count01 sex_female01 eur01 Mao01 Pac01 Asian01 MELAA01 Other01
EthNS2001 nzdep2001 oc01;
run;
```

```
proc corr data=adultdd (where=(test=1 & linkind060196=1)) noprob;
weight wgt060196_gemean;
var age06 yrs_at_addr06 same_addr_5yrs_ago06 NZ_born06 yrs_in_NZ06
language_indicator06 Language_count06 maori_descent06 iwi_ind06 iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 smoke06 own_residence06 marital_status_legal06
children_born06 had_children06 highest_qual06 income_source_count06
benefit_income06
ttl_personal_income06 income_support06 hrs_work_mainjob06
work_labour_force_status06 travel_work06 unpaid_acty_count06 sex_female06
eur06 Mao06 Pac06 Asian06 MELAA06 Other06
EthNS2006 nzdep2006 oc06 age01 yrs_at_addr01 same_addr_5yrs_ago01 NZ_born01
yrs_in_NZ01 language_indicator01 Language_count01 maori_descent01 iwi_ind01
```

```
iwi_count01 religious01 live_with_parents01 live_with_partner01
live_with_siblings01 live_with_children01 live_alone01 live_with_flatmates01
live_with_other01
difficulty_acty_count01 disability01 disability_ind01 own_residence01
marital_status_legal01 highest_qual01 income_source_count01 benefit_income01
ttl_personal_income01
income_support01 hrs_work_mainjob01 work_labour_force_status01 travel_work01
unpaid_acty_count01 sex_female01 eur01 Mao01 Pac01 Asian01 MELAA01 Other01
EthNS2001 nzdep2001 oc01;
run;
```

```
proc corr data=adultdd (where=(test=1 & linkind060196=1)) noprob;
weight wgt060196_armean_scaled;
var age06 yrs_at_addr06 same_addr_5yrs_ago06 NZ_born06 yrs_in_NZ06
language_indicator06 Language_count06 maori_descent06 iwi_ind06 iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 smoke06 own_residence06 marital_status_legal06
children_born06 had_children06 highest_qual06 income_source_count06
benefit_income06
ttl_personal_income06 income_support06 hrs_work_mainjob06
work_labour_force_status06 travel_work06 unpaid_acty_count06 sex_female06
eur06 Mao06 Pac06 Asian06 MELAA06 Other06
EthNS2006 nzdep2006 oc06 age01 yrs_at_addr01 same_addr_5yrs_ago01 NZ_born01
yrs_in_NZ01 language_indicator01 Language_count01 maori_descent01 iwi_ind01
iwi_count01 religious01 live_with_parents01 live_with_partner01
live_with_siblings01 live_with_children01 live_alone01 live_with_flatmates01
live_with_other01
difficulty_acty_count01 disability01 disability_ind01 own_residence01
marital_status_legal01 highest_qual01 income_source_count01 benefit_income01
ttl_personal_income01
income_support01 hrs_work_mainjob01 work_labour_force_status01 travel_work01
unpaid_acty_count01 sex_female01 eur01 Mao01 Pac01 Asian01 MELAA01 Other01
EthNS2001 nzdep2001 oc01;
run;
```

```
proc corr data=adultdd (where=(test=1 & linkind060196=1)) noprob;
weight wgt060196_gemean_scaled;
var age06 yrs_at_addr06 same_addr_5yrs_ago06 NZ_born06 yrs_in_NZ06
language_indicator06 Language_count06 maori_descent06 iwi_ind06 iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 smoke06 own_residence06 marital_status_legal06
children_born06 had_children06 highest_qual06 income_source_count06
benefit_income06
ttl_personal_income06 income_support06 hrs_work_mainjob06
work_labour_force_status06 travel_work06 unpaid_acty_count06 sex_female06
eur06 Mao06 Pac06 Asian06 MELAA06 Other06
EthNS2006 nzdep2006 oc06 age01 yrs_at_addr01 same_addr_5yrs_ago01 NZ_born01
yrs_in_NZ01 language_indicator01 Language_count01 maori_descent01 iwi_ind01
iwi_count01 religious01 live_with_parents01 live_with_partner01
live_with_siblings01 live_with_children01 live_alone01 live_with_flatmates01
live_with_other01
```



```
difficulty_acty_count01 disability01 disability_ind01 own_residence01
marital_status_legal01 highest_qual01 income_source_count01 benefit_income01
ttl_personal_income01
income_support01 hrs_work_mainjob01 work_labour_force_status01 travel_work01
unpaid_acty_count01 sex_female01 eur01 Mao01 Pac01 Asian01 MELAA01 Other01
EthNS2001 nzdep2001 oc01;
run;
```

```
data ver2.wgt060196 (keep= ID linkind0601 linkind0196 linkind060196
wgt060196_armean wgt060196_gemean wgt060196_armean_scaled
wgt060196_gemean_scaled) ;
set cc;
```

```
run;
```

```
proc corr data=childdd (where=(test=1)) noprob ;
var yrs_at_addr06 same_addr_5yrs_ago06 NZ_born06 yrs_in_NZ06
language_indicator06 Language_count06 maori_descent06 iwi_ind06 iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 sex_female06 eur06 Mao06 Pac06 Asian06 MELAA06
Other06 EthNS2006 nzdep2006 yrs_at_addr01 same_addr_5yrs_ago01 NZ_born01
yrs_in_NZ01
language_indicator01 Language_count01 maori_descent01 iwi_ind01 iwi_count01
religious01 live_with_parents01 live_with_partner01 live_with_siblings01
live_with_children01
live_alone01 live_with_flatmates01 live_with_other01 difficulty_acty_count01
disability01 disability_ind01 sex_female01 eur01 Mao01 Pac01 Asian01 MELAA01
Other01 EthNS2001
nzdep2001;
run;
```

```
proc corr data=childdd (where=(test=1 & linkind060196=1)) noprob;
var yrs_at_addr06 same_addr_5yrs_ago06 NZ_born06 yrs_in_NZ06
language_indicator06 Language_count06 maori_descent06 iwi_ind06 iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 sex_female06 eur06 Mao06 Pac06 Asian06 MELAA06
Other06 EthNS2006 nzdep2006 yrs_at_addr01 same_addr_5yrs_ago01 NZ_born01
yrs_in_NZ01
language_indicator01 Language_count01 maori_descent01 iwi_ind01 iwi_count01
religious01 live_with_parents01 live_with_partner01 live_with_siblings01
live_with_children01
live_alone01 live_with_flatmates01 live_with_other01 difficulty_acty_count01
disability01 disability_ind01 sex_female01 eur01 Mao01 Pac01 Asian01 MELAA01
Other01 EthNS2001
nzdep2001;
run;
```

```
proc corr data=childdd (where=(test=1 & linkind060196=1)) noprob;
weight wgt060196_armean;
```

```

var yrs_at_addr06 same_addr_5yrs_ago06 NZ_born06 yrs_in_NZ06
language_indicator06 Language_count06 maori_descent06 iwi_ind06 iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 sex_female06 eur06 Mao06 Pac06 Asian06 MELAA06
Other06 EthNS2006 nzdep2006 yrs_at_addr01 same_addr_5yrs_ago01 NZ_born01
yrs_in_NZ01
language_indicator01 Language_count01 maori_descent01 iwi_ind01 iwi_count01
religious01 live_with_parents01 live_with_partner01 live_with_siblings01
live_with_children01
live_alone01 live_with_flatmates01 live_with_other01 difficulty_acty_count01
disability01 disability_ind01 sex_female01 eur01 Mao01 Pac01 Asian01 MELAA01
Other01 EthNS2001
nzdep2001;
run;

```

```

proc corr data=childdd (where=(test=1 & linkind060196=1)) noprob;
weight wgt060196_gemean;
var yrs_at_addr06 same_addr_5yrs_ago06 NZ_born06 yrs_in_NZ06
language_indicator06 Language_count06 maori_descent06 iwi_ind06 iwi_count06
religious06 live_with_parents06 live_with_partner06 live_with_siblings06
live_with_children06 live_alone06 live_with_flatmates06 live_with_other06
difficulty_acty_count06
disability06 disability_ind06 sex_female06 eur06 Mao06 Pac06 Asian06 MELAA06
Other06 EthNS2006 nzdep2006 yrs_at_addr01 same_addr_5yrs_ago01 NZ_born01
yrs_in_NZ01
language_indicator01 Language_count01 maori_descent01 iwi_ind01 iwi_count01
religious01 live_with_parents01 live_with_partner01 live_with_siblings01
live_with_children01
live_alone01 live_with_flatmates01 live_with_other01 difficulty_acty_count01
disability01 disability_ind01 sex_female01 eur01 Mao01 Pac01 Asian01 MELAA01
Other01 EthNS2001
nzdep2001;
run;

```

```
*adults 0601 interactions;
```

```

proc surveysselect data= adult3b out=adult10000 n=14500 seed=919191;run;
data adult10000; set adult10000; if test=0; run;
proc logistic data= adult10000;
class age yrs_at_addr same_addr_5yrs_ago NZ_born yrs_in_NZ language_indicator
Language_count maori_descent iwi_ind iwi_count religious
live_with_parents live_with_partner live_with_siblings live_with_children
live_alone live_with_flatmates live_with_other difficulty_acty_count
disability disability_ind
smoke own_residence marital_status_legal children_born had_children
highest_qual income_source_count benefit_income total_income income_support
hrs_work_mainjob
work_labour_force_status travel_work UNPAID_ACTY_COUNT06 sex_female eur06
Mao06 Pac06 Asian06 MELAA06 Other06 EthNS nzdep2006 oc06 /ref=first;
model linkind0601 (event='1') = age yrs_at_addr same_addr_5yrs_ago NZ_born
yrs_in_NZ language_indicator Language_count maori_descent iwi_ind iwi_count
religious

```

```

live_with_parents live_with_partner live_with_siblings live_with_children
live_alone live_with_flatmates live_with_other difficulty_acty_count
disability disability_ind
smoke own_residence marital_status_legal children_born had_children
highest_qual income_source_count benefit_income total_income income_support
hrs_work_mainjob
work_labour_force_status travel_work UNPAID_ACTY_COUNT06 sex_female eur06
Mao06 Pac06 Asian06 MELAA06 Other06 EthNS nzdep2006 oc06 /selection=stepwise
slentry=.1 slstay=.05 hierarchy=single;
run;

proc logistic data= adult3b;
class age yrs_at_addr same_addr_5yrs_ago NZ_born yrs_in_NZ language_indicator
Language_count maori_descent iwi_ind iwi_count religious
live_with_parents live_with_partner live_with_siblings live_with_children
live_alone live_with_flatmates live_with_other difficulty_acty_count
disability disability_ind
smoke own_residence marital_status_legal children_born had_children
highest_qual income_source_count benefit_income total_income income_support
hrs_work_mainjob
work_labour_force_status travel_work UNPAID_ACTY_COUNT06 sex_female eur06
Mao06 Pac06 Asian06 MELAA06 Other06 EthNS nzdep2006 oc06 /ref=first;
model link0601 (event='1') = age yrs_at_addr same_addr_5yrs_ago NZ_born
yrs_in_NZ language_indicator Language_count maori_descent iwi_ind iwi_count
religious
live_with_parents live_with_partner live_with_siblings live_with_children
live_alone live_with_flatmates live_with_other difficulty_acty_count
disability disability_ind
smoke own_residence marital_status_legal children_born had_children
highest_qual income_source_count benefit_income total_income income_support
hrs_work_mainjob
work_labour_force_status travel_work UNPAID_ACTY_COUNT06 sex_female eur06
Mao06 Pac06 Asian06 MELAA06 Other06 EthNS nzdep2006 oc06

age*yrs_at_addr age*same_addr_5yrs_ago age*NZ_born age*yrs_in_NZ
age*language_indicator age*live_with_parents age*live_with_children age*smoke
age*own_residence age*marital_status_legal age*highest_qual
age*income_source_count age*benefit_income
age*UNPAID_ACTY_COUNT06 age*sex_female age*eur06 age*Mao06 age*Pac06

yrs_at_addr*same_addr_5yrs_ago yrs_at_addr*NZ_born yrs_at_addr*yrs_in_NZ
yrs_at_addr*language_indicator yrs_at_addr*live_with_parents
yrs_at_addr*live_with_children
yrs_at_addr*smoke yrs_at_addr*own_residence yrs_at_addr*marital_status_legal
yrs_at_addr*highest_qual yrs_at_addr*income_source_count
yrs_at_addr*benefit_income
yrs_at_addr*UNPAID_ACTY_COUNT06 yrs_at_addr*sex_female yrs_at_addr*eur06
yrs_at_addr*Mao06 yrs_at_addr*Pac06

same_addr_5yrs_ago*NZ_born same_addr_5yrs_ago*yrs_in_NZ
same_addr_5yrs_ago*language_indicator same_addr_5yrs_ago*live_with_parents
same_addr_5yrs_ago*live_with_children same_addr_5yrs_ago*smoke
same_addr_5yrs_ago*own_residence same_addr_5yrs_ago*marital_status_legal
same_addr_5yrs_ago*highest_qual same_addr_5yrs_ago*income_source_count
same_addr_5yrs_ago*benefit_income
same_addr_5yrs_ago*UNPAID_ACTY_COUNT06 same_addr_5yrs_ago*sex_female
same_addr_5yrs_ago*eur06 same_addr_5yrs_ago*Mao06 same_addr_5yrs_ago*Pac06

```

NZ\_born\*yrs\_in\_NZ NZ\_born\*language\_indicator NZ\_born\*live\_with\_parents  
NZ\_born\*live\_with\_children NZ\_born\*smoke NZ\_born\*own\_residence  
NZ\_born\*marital\_status\_legal NZ\_born\*highest\_qual NZ\_born\*income\_source\_count  
NZ\_born\*benefit\_income NZ\_born\*UNPAID\_ACTY\_COUNT06  
NZ\_born\*sex\_female NZ\_born\*eur06 NZ\_born\*Mao06 NZ\_born\*Pac06

yrs\_in\_NZ\*language\_indicator yrs\_in\_NZ\*live\_with\_parents  
yrs\_in\_NZ\*live\_with\_children yrs\_in\_NZ\*smoke yrs\_in\_NZ\*own\_residence  
yrs\_in\_NZ\*marital\_status\_legal yrs\_in\_NZ\*highest\_qual  
yrs\_in\_NZ\*income\_source\_count yrs\_in\_NZ\*benefit\_income  
yrs\_in\_NZ\*UNPAID\_ACTY\_COUNT06 yrs\_in\_NZ\*sex\_female yrs\_in\_NZ\*eur06  
yrs\_in\_NZ\*Mao06 yrs\_in\_NZ\*Pac06

language\_indicator\*live\_with\_parents language\_indicator\*live\_with\_children  
language\_indicator\*smoke language\_indicator\*own\_residence  
language\_indicator\*marital\_status\_legal language\_indicator\*highest\_qual  
language\_indicator\*income\_source\_count language\_indicator\*benefit\_income  
language\_indicator\*UNPAID\_ACTY\_COUNT06 language\_indicator\*sex\_female  
language\_indicator\*eur06  
language\_indicator\*Mao06 language\_indicator\*Pac06

live\_with\_parents\*live\_with\_children live\_with\_parents\*smoke  
live\_with\_parents\*own\_residence live\_with\_parents\*marital\_status\_legal  
live\_with\_parents\*highest\_qual live\_with\_parents\*income\_source\_count  
live\_with\_parents\*benefit\_income  
live\_with\_parents\*UNPAID\_ACTY\_COUNT06 live\_with\_parents\*sex\_female  
live\_with\_parents\*eur06 live\_with\_parents\*Mao06 live\_with\_parents\*Pac06

live\_with\_children\*smoke live\_with\_children\*own\_residence  
live\_with\_children\*marital\_status\_legal live\_with\_children\*highest\_qual  
live\_with\_children\*income\_source\_count live\_with\_children\*benefit\_income  
live\_with\_children\*UNPAID\_ACTY\_COUNT06  
live\_with\_children\*sex\_female live\_with\_children\*eur06  
live\_with\_children\*Mao06 live\_with\_children\*Pac06

smoke\*own\_residence smoke\*marital\_status\_legal smoke\*highest\_qual  
smoke\*income\_source\_count smoke\*benefit\_income  
smoke\*UNPAID\_ACTY\_COUNT06 smoke\*sex\_female smoke\*eur06 smoke\*Mao06  
smoke\*Pac06

own\_residence\*marital\_status\_legal own\_residence\*highest\_qual  
own\_residence\*income\_source\_count own\_residence\*benefit\_income  
own\_residence\*UNPAID\_ACTY\_COUNT06 own\_residence\*sex\_female  
own\_residence\*eur06 own\_residence\*Mao06 own\_residence\*Pac06

marital\_status\_legal\*highest\_qual marital\_status\_legal\*income\_source\_count  
marital\_status\_legal\*benefit\_income  
marital\_status\_legal\*UNPAID\_ACTY\_COUNT06 marital\_status\_legal\*sex\_female  
marital\_status\_legal\*eur06 marital\_status\_legal\*Mao06  
marital\_status\_legal\*Pac06

highest\_qual\*income\_source\_count highest\_qual\*benefit\_income  
highest\_qual\*UNPAID\_ACTY\_COUNT06  
highest\_qual\*sex\_female highest\_qual\*eur06 highest\_qual\*Mao06  
highest\_qual\*Pac06

```
income_source_count*benefit_income  income_source_count*UNPAID_ACTY_COUNT06
income_source_count*sex_female
income_source_count*eur06  income_source_count*Mao06  income_source_count*Pac06
```

```
benefit_income*UNPAID_ACTY_COUNT06  benefit_income*sex_female
benefit_income*eur06  benefit_income*Mao06  benefit_income*Pac06
```

```
UNPAID_ACTY_COUNT06*sex_female  UNPAID_ACTY_COUNT06*eur06
UNPAID_ACTY_COUNT06*Mao06  UNPAID_ACTY_COUNT06*Pac06  sex_female*eur06
sex_female*Mao06  sex_female*Pac06
eur06*Mao06  eur06*Pac06  Mao06*Pac06;
output out=adult5 pred=p ;
run;
```

```
data ver2.interactionwgt06 (keep= ID linkind0601 interactionwgt0601 );
set adult5;
```

```
interactionwgt0601=1/p;
```

```
run;
```

```
proc means data= ver2.wgt06; var interactionwgt0601; run;
proc means data= ver2.wgt06 (where=(linkind0601=1)); var interactionwgt0601;
run;
```

```
data adult6; set adult5; wgt = 1/p; run;
```

```
proc corr data=adult6 (where=(test=1 & linkind0601=1));
weight wgt;
var age yrs_at_addr same_addr_5yrs_ago NZ_born yrs_in_NZ language_indicator
Language_count maori_descent iwi_ind iwi_count religious
live_with_parents live_with_partner live_with_siblings live_with_children
live_alone live_with_flatmates live_with_other difficulty_acty_count
disability disability_ind
smoke own_residence marital_status_legal children_born had_children
highest_qual income_source_count benefit_income total_income income_support
hrs_work_mainjob
work_labour_force_status travel_work UNPAID_ACTY_COUNT06 sex_female eur06
Mao06 Pac06 Asian06 MELAA06 Other06 EthNS nzdep2006 oc06;
run;
```

```
**0601 childrens interaction model;
```

```
*testing for important two-way interactions in sample of 10000;
```

```
proc surveystest data= child2 out=child10000 n=14500 seed=909090;run;
data child10000; set child10000; if test=0; run;
```

```
proc logistic data= child10000;
class age yrs_at_addr same_addr_5yrs_ago NZ_born yrs_in_NZ language_indicator
Language_count maori_descent iwi_ind iwi_count religious
live_with_parents live_with_partner live_with_siblings live_with_children
live_alone live_with_flatmates live_with_other difficulty_acty_count
disability disability_ind
sex_female eur06 Mao06 Pac06 Asian06 MELAA06 Other06 EthNS nzdep2006
/ref=first;
model linkind0601 (event='1') = age yrs_at_addr same_addr_5yrs_ago NZ_born
yrs_in_NZ language_indicator Language_count maori_descent iwi_ind iwi_count
religious
live_with_parents live_with_partner live_with_siblings live_with_children
live_alone live_with_flatmates live_with_other difficulty_acty_count
disability disability_ind
sex_female eur06 Mao06 Pac06 Asian06 MELAA06 Other06 EthNS nzdep2006
/selection=stepwise slentry=.1 slstay=.05 hierarchy=single ;
run;
```

```
proc logistic data= child2;
class yrs_at_addr same_addr_5yrs_ago yrs_in_NZ maori_descent iwi_ind
religious
live_with_parents live_with_partner live_with_siblings disability eur06 Mao06
Other06 nzdep2006 /ref=first;
model link0601 (event='1') = yrs_at_addr same_addr_5yrs_ago yrs_in_NZ
maori_descent iwi_ind religious
live_with_parents live_with_partner live_with_siblings disability eur06 Mao06
Other06 nzdep2006
yrs_at_addr*same_addr_5yrs_ago yrs_at_addr*yrs_in_NZ
yrs_at_addr*maori_descent yrs_at_addr*iwi_ind yrs_at_addr*religious
yrs_at_addr*live_with_parents
yrs_at_addr*live_with_partner yrs_at_addr*live_with_siblings
yrs_at_addr*disability yrs_at_addr*eur06 yrs_at_addr*Mao06
yrs_at_addr*Other06 yrs_at_addr*nzdep2006

same_addr_5yrs_ago*yrs_in_NZ same_addr_5yrs_ago*maori_descent
same_addr_5yrs_ago*iwi_ind same_addr_5yrs_ago*religious
same_addr_5yrs_ago*live_with_parents
same_addr_5yrs_ago*live_with_partner same_addr_5yrs_ago*live_with_siblings
same_addr_5yrs_ago*disability same_addr_5yrs_ago*eur06
same_addr_5yrs_ago*Mao06
same_addr_5yrs_ago*Other06 same_addr_5yrs_ago*nzdep2006

yrs_in_NZ*maori_descent yrs_in_NZ*iwi_ind yrs_in_NZ*religious
yrs_in_NZ*live_with_parents yrs_in_NZ*live_with_partner
yrs_in_NZ*live_with_siblings
yrs_in_NZ*disability yrs_in_NZ*eur06 yrs_in_NZ*Mao06 yrs_in_NZ*Other06
yrs_in_NZ*nzdep2006

maori_descent*iwi_ind maori_descent*religious maori_descent*live_with_parents
maori_descent*live_with_partner maori_descent*live_with_siblings
maori_descent*disability
```

```

maori_descent*eur06 maori_descent*Mao06 maori_descent*Other06
maori_descent*nzdep2006

iwi_ind*religious iwi_ind*live_with_parents iwi_ind*live_with_partner
iwi_ind*live_with_siblings iwi_ind*disability iwi_ind*eur06 iwi_ind*Mao06
iwi_ind*Other06 iwi_ind*nzdep2006

religious*live_with_parents religious*live_with_partner
religious*live_with_siblings religious*disability religious*eur06
religious*Mao06 religious*Other06 religious*nzdep2006

live_with_parents*live_with_partner live_with_parents*live_with_siblings
live_with_parents*disability live_with_parents*eur06 live_with_parents*Mao06
live_with_parents*Other06
live_with_parents*nzdep2006

live_with_partner*live_with_siblings live_with_partner*disability
live_with_partner*eur06 live_with_partner*Mao06 live_with_partner*Other06
live_with_partner*nzdep2006

live_with_siblings*disability live_with_siblings*eur06
live_with_siblings*Mao06 live_with_siblings*Other06
live_with_siblings*nzdep2006

disability*eur06 disability*Mao06 disability*Other06 disability*nzdep2006
eur06*Mao06 eur06*Other06 eur06*nzdep2006 Mao06*Other06 Mao06*nzdep2006
Other06*nzdep2006
;
output out=child5 pred=p ;
run;

*Storing the weights for the Interaction model weighted correlations;

data ver2.interactionchildwgt06 (keep= ID linkind0601 interactionwgt0601 );
set child5;

interactionwgt0601=1/p;

run;

proc means data= ver2.interactionchildwgt06; var interactionwgt0601; run;
proc means data= ver2.interactionchildwgt06 (where=(linkind0601=1)); var
interactionwgt0601; run;

data child6; set child5; wgt = 1/p; run;

proc corr data=child6 (where=(test=1 & linkind0601=1));
weight wgt;
var age yrs_at_addr same_addr_5yrs_ago NZ_born yrs_in_NZ language_indicator
Language_count maori_descent iwi_ind iwi_count religious
live_with_parents live_with_partner live_with_siblings live_with_children
live_alone live_with_flatmates live_with_other difficulty_acty_count
disability disability_ind

```

```
sex_female eur06 Mao06 Pac06 Asian06 MELAA06 Other06 EthNS nzdep2006;  
run;
```

```
proc logistic data= child2;  
class yrs_at_addr same_addr_5yrs_ago yrs_in_NZ maori_descent iwi_ind  
religious  
live_with_parents live_with_partner live_with_siblings disability eur06 Mao06  
Other06 nzdep2006 /ref=first;  
model link0601 (event='1') = yrs_at_addr same_addr_5yrs_ago yrs_in_NZ  
maori_descent iwi_ind religious  
live_with_parents live_with_partner live_with_siblings disability eur06 Mao06  
Other06 nzdep2006  
yrs_at_addr*same_addr_5yrs_ago ;  
output out=child5 pred=p ;  
run;
```

```
data child6; set child5; wgt = 1/p; run;
```

```
proc corr data=child6 (where=(test=1 & linkind0601=1));  
weight wgt;  
var age yrs_at_addr same_addr_5yrs_ago NZ_born yrs_in_NZ language_indicator  
Language_count maori_descent iwi_ind iwi_count religious  
live_with_parents live_with_partner live_with_siblings live_with_children  
live_alone live_with_flatmates live_with_other difficulty_acty_count  
disability disability_ind  
sex_female eur06 Mao06 Pac06 Asian06 MELAA06 Other06 EthNS nzdep2006;  
run;
```