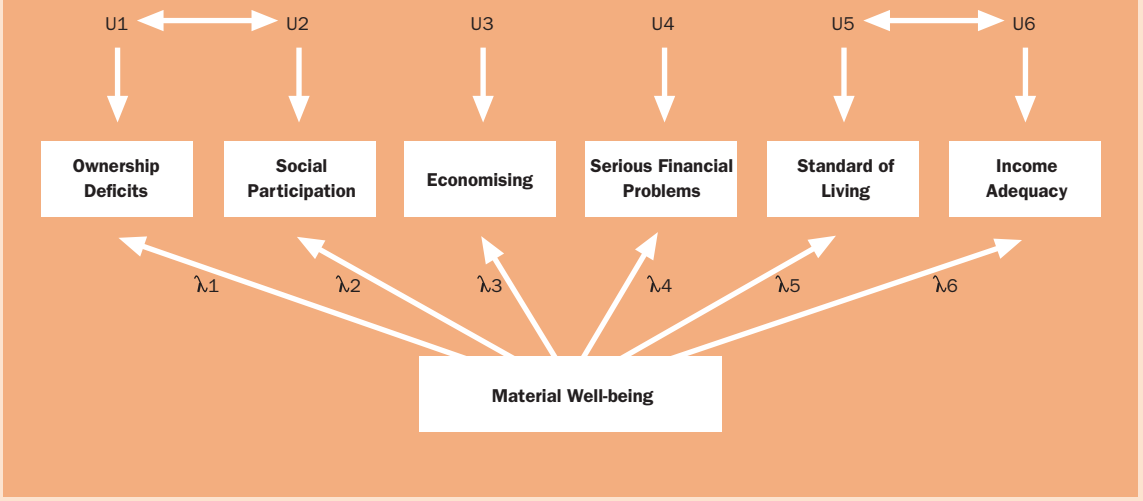
Technical Appendix

Measurement model

The model

The model fitted to the data on older Māori is shown in Figure A.1. This model is based on the model used for all older New Zealanders (see Fergusson et al, 2001b, pages 65-69). This model assumes that variations in the living standards of older Māori is a latent variable whose properties are reflected in the observed measures of: ownership restrictions; social participation restrictions; economising; financial hardship; self-rated living standards; self-rated adequacy of income. The coefficients (i represent the factor loadings linking the observed indicators to the non-observed factor. The terms Ui represent the errors or disturbances of the model. The model permits the disturbance terms of: a) ownership restrictions and social participation restrictions; and b) the ratings of standard of living and income adequacy, to be correlated (as was the case for the analysis of all other New Zealanders; see Fergusson et al, 2001b, pages 73-75).

Figure A.1: Model of Material Well-being for Older Māori



Model fitting

The model in Figure A.1 was fitted to the matrix of correlations of the indicator measures. These correlations are shown in Table A.1. Since the indicator variables were non-normally distributed, model fitting conducted using Asymptotic Distribution Free (ADF) estimates. All analyses were conducted using LISREL 8 (Joreskog and Sorbom, 1993).

Table A.1: Matrix of correlations, means and standard deviations of six indicator measures

Variable	Ownership Restrictions	Social Participation Restrictions	Economising	Serious Financial Problems	Standard of Living	Income Adequacy
Ownership restrictions	1.00					
Social participation restrictions	0.53	1.00				
Economising	0.61	0.53	1.00			
Serious financial problems	0.40	0.33	0.49	1.00		
Standard of living	0.39	0.32	0.46	0.34	1.00	
Income adequacy	0.43	0.40	0.53	0.27	0.38	1.00
Mean	1.21	1.07	26.74	0.37	2.02	1.92
Standard deviation	1.94	1.48	8.62	0.93	0.72	0.86

All correlations are statistically significant ($p<0.001$)

Model fit

The model in Figure A.1 was found to have adequate fit to the data in Table A.1 on the basis of a series of goodness of fit measures including the log likelihood ratio chi square goodness of fit; the root mean squared error of approximation (RMSEA); the adjusted goodness of fit index (AGFI); and the root mean squared standardised residual (RMSR). These goodness of fit measures are shown in Table A.2.

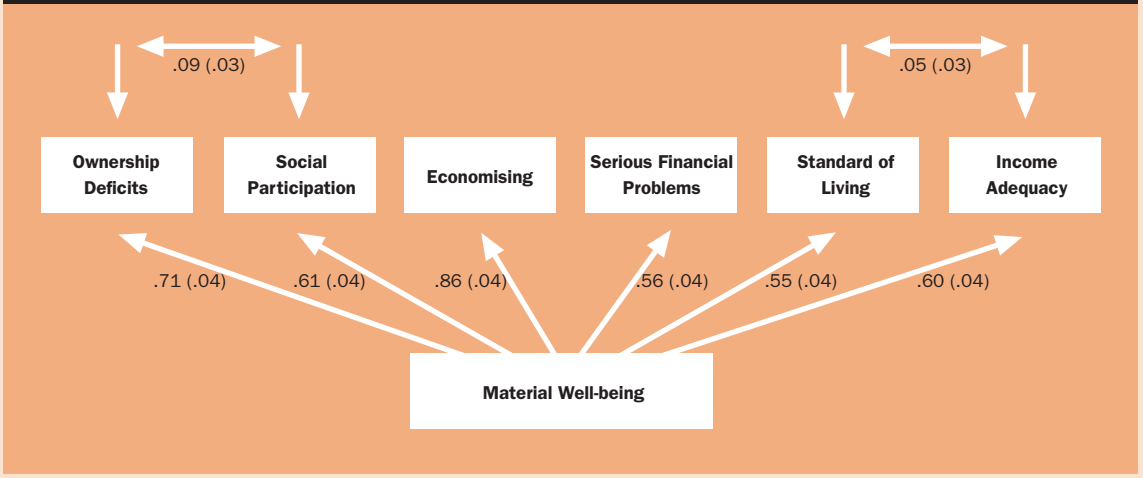
Table A2: Goodness of fit indices

Measure	Result
Log likelihood chi square	9.94; df = 7; p>0.15
RMSEA	0.028 (p>0.80)
AGFI	0.98
RMSR	0.018

Model estimates

The estimated standardised model parameters and standard errors are shown in Figure A.2. The standardised factor loadings have the interpretation of being the correlations between the non-observed latent factor and the observed test measures.

Figure A.2: Fitted Confirmatory Factor Model of Material Well-being for Older Māori. (All parameters are standardised; standard errors are in parentheses)



Equivalence of Māori and non-Māori scales

An important issue raised by the analysis above concerns the extent to which the model for older Māori in Figure A.2 was the same as the model for all older New Zealanders. This issue was tested using a multiple group modelling method to test model equivalence across populations. This model suggested that the same general factor structure fitted both Māori and non-Māori populations but that there were some (relatively minor) differences in factor loadings between populations. These differences are shown in Table A.3 which compares the factor loadings for the Māori sample with those for the corresponding non-Māori sample aged 65-69 years.

The table shows the presence of relatively small differences in factor loadings between the two populations. The largest difference is for the measure of severe financial problems, which proves to be more discriminating for Māori than for non-Māori.

Table A.3: Comparison of factor loadings for Māori and non-Māori aged 65-69 years

	Loading	
Indicator	**Māori**	**Non-Māori**
Ownership restrictions	0.71	0.60
Social participation restrictions	0.61	0.68
Economising	0.86	0.86
Severe financial problems	0.56	0.36
Standard of living (rating)	0.55	0.51
Adequacy of income (rating)	0.60	0.61
Test of equality of loadings	Log likelihood chi squared = 199.5; df = 6; p<0.0001	

However, the test of equality of factor loadings shows that the differences between the two populations were statistically significant. Despite this test of significance, differences between the two populations proved to be inconsequential in terms of the scale scores derived for the two populations. This was tested by devising a series of alternative scale scores for the Māori and non-Māori populations. These scale scores were:

1. scale scores for Māori using weights derived from the Māori sample
2. scale scores for Māori using the weights for the non-Māori sample
3. scale scores for non-Māori using weights derived from the Māori sample
4. scale scores for non-Māori using weights derived from the non-Māori sample.

To examine differences in scaling methods, the different scale estimates for each ethnic group were correlated. This showed that:

1. for Māori, the correlations between the scale using Māori weights and the scale using non-Māori weights was in excess of 0.99.
2. for non-Māori the correlation between the scale using Māori weights and the scale using non-Māori weights was in excess of 0.99.

The above results lead to the general conclusion that although there were minor differences in the factor structure for Māori and non-Māori, for all practical interests and purposes the same scale could be applied to both populations.

Estimation of scale scores

To ensure that the scale scores for older Māori were scored on the same metric as for the total population aged 65+, the following method was used:

1. Scores for Māori were first represented as an unweighted sum of indicators (Xj) standardised relative to the total population:

$$\hat{S}\, i = \sum Xij$$

where Xij was the standardised score of subject i on variable Xj - ie,

$$Xij = \frac{Xij - \bar{X}\, jg}{Sd\ (Xjg)}$$

where $\bar{X}\, jg$ was the mean of Xj for the general population and Sd (Xjg) was the corresponding standard deviation. The values of $\bar{X}\, g$ and Sd (Xjg) were obtained from the previous study of living standards of older people (Fergusson et al, 2001b).

2. This score was then weighted to produce scale values (Ti) that had a mean of 100 and a standard deviation of 10 for the total population:

$$\hat{T}\,i = 100 - \hat{S}\,i * [10/Sd\,(Sg)]$$

where Sd (Sg) was the standard deviation of $\hat{S}$ for the total population.

In effect, what this series of transformations achieves is to place Māori and non-Māori on a common scale of material well-being, with this scale having an overall mean of 100 and a standard deviation of 10 in the total population aged 65 and over. The final scale was scored so that higher scores implied increasing material well-being.

Scale reliability and validity

The reliability of the scale was assessed using internal consistency methods and Cronbach's alpha (Cronbach, 1951). The value of alpha was 0.82, suggesting moderate scale reliability.

To examine test validity, the scale was correlated with a series of concurrent validation measures that were also collected as part of the survey. These measures included:

- whether the respondent reported being unable to save on most months
- whether the respondent reported being unable to find $5,000 in an emergency
- whether the respondent reported health-related financial stress in the past 12 months
- whether the respondent reported having a Community Services Card
- whether the respondent reported feeling worse off than other New Zealanders
- whether the respondent reported being dissatisfied with their standard of living.

These correlations are shown in the top half of Table A.4. The table shows that, in all cases, there were statistically significant correlations ($p<0.0001$) between the scale score and concurrent measures of living standards with these correlations ranging from -0.27 to -0.43.

In addition, to examine the construct validity of the scale, the scale score was correlated with a series of economic factors that one might expect to predict variations in material well-being including measures of: net equivalised income; financial assets; and weekly accommodation. These correlations are shown in the lower half of Table A.4. In all cases these associations were statistically significant ($p<0.0001$), with the correlations (in absolute value) ranging from 0.24 to 0.40.

Collectively, the above results provide considerable reassurance as to the validity and reliability of the scale measure as a description of variations in material well-being amongst older Māori.

Table A.4: Product moment correlations between material well-being score [1] and concurrent, predictive validation measures

Measure	Product Moment Correlation [2]
Concurrent Validation Measures	
Unable to save most months	-0.32
Unable to find $5,000 in an emergency	-0.43
Health-related financial stress	-0.36
Has Community Services Card	-0.27
Feels worse off than other New Zealanders	-0.37
Dissatisfied with standard of living	-0.35
Predictive Validation Measures	
Net annual income ($Log_{10}$$)	0.26
Financial assets ($Log_{10}$$)	0.40
Accommodation costs ($ per week)	-0.24

1 Material well-being scale scored so that an increasing score implies increasing material well-being.

2 All correlations statistically significant ($p<0.0001$).

Variable transformations

Income

Equivalised income is used because it provides a convenient mechanism to place both single and partnered households on a common metric. The equivalised income measure treats all households as if they were partnered; thus, for single respondents income is scaled to an equivalent couple income by an appropriate equivalising factor: Incomes for single respondents have been transformed to an equivalent couple income by the transformation: equivalised income = (net income)/0.65. The transformation factor was chosen on the basis that it was shown in a previous report (Fergusson et al, 2001b) that for single elderly to achieve the same level of material well-being as couples they required an income that was 65% that of couples. In addition the value of 0.65 is that currently used to set the relativity between the levels of New Zealand Superannuation for singles and couples.

Regression fit

The log10 was taken of income, accommodation costs, and asset value in order to improve the fit of the regression model.

Missing values

Missing value imputation (using a regression model) was undertaken where there were around 10% of the cases missing. These were value of assets, accommodation costs, whether either respondent was working at age 50-59, and NZSEI. Overall, however, the imputation of the missing data made little difference to the final model.

Weighting

The survey responses were weighted to ensure that the sample is as near as possible to a random sample of the total population of Māori aged 65-69 years. The original weights were designed by Statistics NZ to ensure that the weighted sample of individuals' tallies to their estimated total number of Māori aged 65-69 in New Zealand at the time of the survey (over 8000). However, such a number makes no sense in a sample survey design as only around 540 individuals were actually sampled. Two things were done to rescale the sample for use in a sample survey design: (a) reweight the sample back to a sensible sample size for analysis (we choose to weight to the original number sampled - 542); (b) reweight to the population of households rather than individuals.

There are four possible scenarios to be considered:

(a) The core economic unit (CEU) comprises a single Māori aged 65-69. In this case a random sample of individuals will also provide a random sample of households.

(b) The CEU comprises a partnership in which one partner is Māori aged 65-69 and the other is non-Māori. In this case, again a random sample of individuals will also lead to a random sample of households of this type.

(c) The CEU comprises a partnership in which both respondents are Māori, but only one is aged 65-69. Again, sampling individuals will lead to a random sample of households of this type.

(d) The CEU comprises a partnership in which both partners are Māori and aged 65-69. Unlike (a)-(c) above, in this instance, if we are randomly sampling individuals, we have two chances of sampling the household because there are two potential respondents. Thus for households of this type, we need to divide the individual weight by 2.

This effectively means that for (a) to (c), the original weighting was left unchanged, for (d) though, the original weight was divided by two. The weights for the entire sample were then adjusted (using an appropriate multiplier) to reflect the sample size of 542.

Multivariate analyses

Multiple linear regression is an advanced statistical technique for uncovering the relationships between a set of independent variables (e.g. income, asset value, etc.) and a dependent variable (Material Well-being Score). In order to find the significant predictors of material well-being for older Māori, a large number of variables collected in the survey of older Māori were analysed. This analysis realised six factors: net annual income; savings and investments; accommodation costs; financial stresses between the ages of 50 and 59; recent financial stresses; and the number of children raised or supported in their lives.

Following a list of those variables considered possible predictors of Material Well-being is a summary of the final model. Also presented are models involving the six significant risk factors and factors found to be related to material well-being but which were not found to be significant predictors of well-being. These models illustrate the finding that these additional variables (gender, single/partnered, cultural identity) did not contribute any further explanation of the relationship between the six risk factors and material well-being.

Possible predictors of material well-being

Economic factors

- net annual income
- savings and investments
- home ownership
- accommodation costs

Financial stressors

- adverse economic events when participant was in their fifties
- recent financial stresses

Socio-demographic factors

- single/partnered
- gender
- number of dependent children
- lives with relatives
- number of children raised or supported
- education
- region (urban/rural)

Cultural factors

- whānau support (financial, around the house, garden or car)
- given money to whānau
- whānau helped with transport
- cultural identity (identified as Māori, knowledge of whakapapa, marae involvement, whānau involvement, Māori land interest, Māori contact, te reo Māori)

Regression models

The first model presented is the final model, which summarises the regression parameters of those predictors found to be significantly related to material well-being. Following this are models with the six significant predictors included, but with variables found to be significantly related to material well-being at the bivariate level added (gender, single/couple, cultural identity). In the hierarchical multiple regressions that follow, the six significant predictor variables are entered as a block, and the addition of each one of the above three correlated variables is demonstrated to be non-significant in each case. As can be seen from these tables, no further explanation of the variation of the Material Well-being Scale is achieved by the inclusion of the three factors.

Final model

Table A.5 summarises the results of the linear regression of the six risk factors on material well-being. The regression model itself was significant ($F(6, 458) = 34.283$, $p<0.001$), all six standardised regression coefficients were significant and the regression model explained 30% of the variance in the Material Well-being Scale.

Table A.5: Hierarchical multiple regressions of asset value, accommodation costs, equivalised income, recent financial stressors, past financial stressors, and number of children on Material Well-being showing standardised regression coefficients, R, R^2, and adjusted R^2 for subjects (N = 464)

Predictors	Standardised Coefficients
Equivalised income (log10)	0.193***
Accommodation costs (log10)	-0.186***
Asset value (log10)	0.153***
Recent financial stressors	-0.276***
Adverse events in fifties	-0.096*
Number of children (had ever)	-0.118**
R	0.557
Total R^2	0.310
Adjusted R^2	0.301
F	34.283***

*p<0.05, **p<0.01, ***p<0.001

Gender

Table A.6 summarises the results of the linear regression of the six risk factors and gender on material well-being. The regression model itself was significant ($F(7, 457) = 29.631$, $p<0.001$), all six standardised regression coefficients were significant, and the regression model explained 30% of the variance in the Material Well-being Scale. Given that gender did not explain any additional variance (nor was the standardised coefficient for gender significant), gender was not considered a predictor of material well-being.

Table A.6: Hierarchical multiple regressions of asset value, accommodation costs, equivalised income, recent financial stressors, past financial stressors, number of children, and gender on Material Well-being showing standardised regression coefficients, R, R^2, and adjusted R^2 for subjects (N = 464)

Predictors	Standardised Coefficients
Equivalised income (log10)	0.188***
Accommodation costs (log10)	-0.189***
Asset value (log10)	0.150***
Recent financial stressors	-0.273***
Adverse events in fifties	-0.099*
Number of children (had ever)	-0.119**
Gender	-0.048
R	0.559
Total R^2	0.312
Adjusted R^2	0.301
F	29.631***

*p<0.05, **p<0.01, ***p<0.001

Single/Partnered

Table A.7 summarises the results of the linear regression of the six risk factors and single/partnered on material well-being. The regression model itself was significant ($F(7, 457) = 29.341$, $p<0.001$), all six standardised regression coefficients were significant, and the regression model explained 30% of the variance in the Material Well-being Scale. Given that being single or partnered did not explain any additional variance (nor was the standardised coefficient for single/partnered significant), being single or partnered was not considered a predictor of material well-being.

Table A.7: Hierarchical multiple regressions of asset value, accommodation costs, equivalised income, recent financial stressors, past financial stressors, number of children, and single/partnered on Material Well-being showing standardised regression coefficients, R, R^2, and adjusted R^2 for subjects (N = 464)

Predictors	Standardised Coefficients
Equivalised income (log10)	0.192***
Accommodation costs (log10)	-0.186***
Asset Value (log10)	0.149***
Recent financial stressors	-0.275***
Adverse events in fifties	-0.096*
Number of Children (had ever)	-0.119**
Single/Partnered	0.013
R	0.557
Total R^2	0.310
Adjusted R^2	0.299
F	29.341***

*p<0.05, **p<0.01, ***p<0.001

Cultural identity

Table A.8 summarises the results of the linear regression of the six risk factors and cultural identity on material well-being. The regression model itself was significant ($F(7, 457) = 29.634$, $p<0.001$), all six standardised regression coefficients were significant, and the regression model explained 30% of the variance in the Material Well-being Scale. Given that cultural identity did not explain any additional variance (nor was the standardised coefficient for cultural identity), cultural identity was not considered a predictor of material well-being.

Table A.8: Hierarchical multiple regressions of asset value, accommodation costs, equivalised income, recent financial stressors, past financial stressors, number of children, and cultural identity on Material Well-being showing standardised regression coefficients, R, R^2, and adjusted R^2 for subjects (N = 464)

Predictors	Standardised Coefficients
Equivalised income (log10)	0.195***
Accommodation costs (log10)	-0.186***
Asset value (log10)	0.141***
Recent financial stressors	-0.271***
Adverse events in fifties	-0.096*
Number of children (had ever)	-0.104**
Cultural identity	-0.052
R	0.559
Total R^2	0.312
Adjusted R^2	0.301
F	29.634***

*p<0.05, **p<0.01, ***p<0.001

References

Belich, J. (1996) *Making Peoples* Auckland: Penguin

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297-334.

Cunningham, C. W. (1996). *Care for Older Māori? A Response to He Anga Whakamana and Care for Older People in New Zealand* (Submission to the National Advisory Committee on Health and Disability). Wellington: Ministry of Health.

Durie, M. H. (1994a). *Kaupapa Hauora Māori: Policies for Māori Health*. Paper presented at the Hui Te Ara Ahu Whakamua: Māori Health Decade Conference, Te Papaiouru Marae, Rotorua.

Durie, M. (1994b) *Whaiora* Oxford: Oxford University Press

Durie, M. (1997) *Te Mana, Te Kawanatanga* Oxford: Oxford University Press.

Durie, M. H. (1999). Kaumātuatanga: Reciprocity: Maori elderly and Whanau. *New Zealand Journal of Psychology* 28(2), 102-106.

Durie, M., Allan, G., Cunningham, C., Edwards, W., Gillies, A., Kingi, T. R., Ratima, M., and Waldon, J. (1996). *Oranga Kaumātua - a report prepared for the Ministry of Health and Te Puni Kōkiri* (TPH 96/3). Palmerston North: Te Pūmanawa Hauora, School of Māori Studies, Massey University.

Fergusson, D., Hong, B., Horwood, J., Jensen, J., Travers, P. (2001a) *Living Standards of Older New Zealanders - A Summary/ Te Noho o nga Kaumatua o Aotearoa* Wellington: Ministry of Social Development.

Fergusson, D., Hong, B., Horwood, J., Jensen, J., Travers, P. (2001b) *Living Standards of Older New Zealanders - A Technical Account/ Te Noho o nga Kaumatua o Aotearoa* Wellington: Ministry of Social Development.

Joreskog, K. G., and Sorbom, D. (1993). Lisrel 8 User's Reference Guide. Chicago, Il: Scientific Software International

Maaka, R. (1993). Te Ao o te Pakeketanga: The World of the Aged. In P. Koopman-Boyden (Ed.), *New Zealand's Ageing Society: The Implications*. Wellington.: Daphne Brasell and Associates Press.

Statistics New Zealand. (1995). *New Zealand Now: 65 Plus*. Wellington.: Statistics New Zealand.

Statistics New Zealand. (2001a). *Māori: Young Population*. Statistics NZ. Retrieved from: http://www.statisticsnz.govt.nz/domino/external/Web/nzstories.nsf

Statistics New Zealand. (2001b). *Population Estimates*. Statistics NZ. Retrieved from: http://www.statisticsnz.govt.nz/domino/external/web/prod_serv.nsf/alltabls4.xls

Stevenson, B. S. (2001). *The relationship between Māori cultural identity and health*. Thesis in partial fulfilment of a Masters of Arts (unpublished). Palmerston North: Massey University.

Te Hoe Nuku Roa [Te Hoe Nuku Roa Research Unit, Massey University] (2002 in press). Towards a better measure of cultural identity. *He Pukenga Kōrero*.

Te Puni Kōkiri. (1994). *Te ara ahu whakamua - decade of Māori development* 1984-1994. Rotorua: Te Puni Kōkiri.

Te Puni Kōkiri. (2000). *Progress Towards closing social and economic gaps between Māori and non-Māori*. Wellington: Te Puni Kōkiri.

Walker, R. (1990) *Ka Whawhai Tonu Matou: Struggle Without End*. Auckland: Penguin.