Study design

The Health, Work and Retirement longitudinal study has recruited multiple participant cohorts for follow-up over time. Table S1 indicates birth cohorts and associated age at recruitment for each recruitment wave conducted 2006-2016 who were considered for inclusion in the current analyses. Random samples within indicated birth years were drawn from a nationally representative sampling frame. Over samples of persons of Māori descent were drawn to ensure adequate representation of the older Māori population. Response weights are derived with reference to characteristics (age, gender, Māori descent and area-level indices of socioeconomic deprivation) of the random samples drawn, and design weights derived with reference to the sampling frame.

Table S1 Illustration of cohort recruitment and calendar year of survey

		Survey Period (calendar year)												
Study cohort		2006	-	2008	2009	2010	-	2012	2013	2014	-	2016	-	2018
2006														
Ages	*55-70*	✓	-	✓	-	✓	-	✓	✓	✓	-	✓	-	✓
Birth	*1936-1952*													
2009														
Ages	*49-74*				✓	✓	-	✓	-	✓	-	✓	-	✓
Birth	*1935-1954*													
2010														
Ages	*73-74*					✓	-	✓	-	-	-	-	-	
Birth	*1936-1937*													
2014														
Ages	*55-65*									✓	-	✓	-	✓
Birth	*1949-1959*													
2016														
Ages	*55-65*											✓	-	✓
Birth	*1951-1960*													

Note: Ages and birth cohorts noted in Table S1 include those for participants considered for inclusion in the current analyses (i.e., 2+ observations between ages 55-76. See [1] for a full description of age/birth cohorts sampled in Health, Work and Retirement longitudinal study recruitment waves.

Analysis design

Accelerated longitudinal cohort designs are used to efficiently assess trajectories over substantive periods by recruiting participant cohorts from adjacent 'developmental' periods. Researchers observe cohorts over shorter periods of time while ensuring overlap at ages of observation between cohorts. Data are considered missing by design, and trajectories estimated based upon observed values. Risks to inference associated with biased attrition over time are minimised by shorter follow up periods and overlap in ages of observation between early and late follow up waves. However, where trajectories differ by birth cohorts, inferences derived from these models may be confounded.

Current analyses utilised data from several cohorts surveyed over 2-12 years of follow-up. Data were restructured into 2-year age-brackets to explore trends in material wellbeing and health over observations by age, spanning 22 years. Birth cohorts represented in the current sample included cases born over a 28 year period 1934-1961.

Consideration of risk to inference associated with age, period and cohort in later life living standards and health in an accelerated longitudinal design

The potential for current models of individual's living standards and health with age to be influenced by contextual attributes of time (period of observation and birth cohort) were considered. While linearly dependant and intractable, consideration of the likely impact of age, period and cohort on models, and the associated viability of constraining the influence of one of these factors to zero to enable examination of the remaining two components on inference, have been acknowledged as sensible approaches to assessing potential confounds in interpretation of models of effects of time [2,3].

We consider age, a proxy for biological and social capacities of individuals as shaped across their life course, as a key factor in individual changes in economic living standards and health over time. Year of birth may influence the context (social, economic, political, scientific, and medical etc.) in which these lives have been lived. To assess effects associated with birth cohort, we divided *n* = 4811 cases into three birth cohorts, each spanning approximately 10 years: born 1934-1943 (*n* = 1065 cases); born 1944-1953 (*n* = 2250 cases), and; born 1954-1961 (*n* = 1496 cases). The substantial overlap in ages of observation by birth cohorts in the current design is illustrated in **Error! Reference source not found.**, noting the number of observed ELSI-SF scores by age and birth cohort for the overall sample.

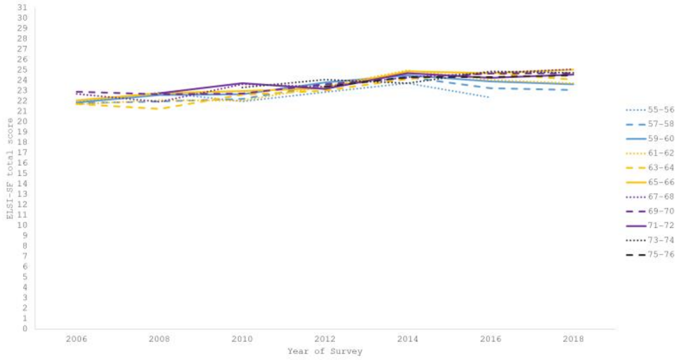
Table S2 Number of observed ELSI-SF scores by age and birth cohort (n = 4811 cases)

	Age										
Birth cohort	**55-56**	**57-58**	**59-60**	**61-62**	**63-64**	**65-66**	**67-68**	**69-70**	**71-72**	**73-74**	**75-76**
1934-1943					*268*	*503*	*694*	*767*	*735*	*709*	*606*
1944-1953	*541*	*899*	*1206*	*1442*	*1486*	*1439*	*1247*	*830*	*524*	*301*	*124*
1954-1961	*678*	*892*	*993*	*850*	*573*	*261*					

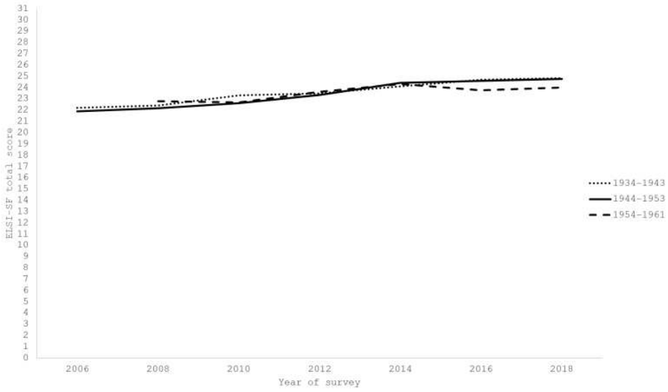
Temporal changes attributable to events associate with periods of observation may reflect discrete, impactful events such as major economic crises, disasters or significant policy changes. During the follow-up period, retirement income polices were highly stable in New Zealand. However, other events may have influenced living standards and health among older adults in New Zealand over the follow-up period 2006-2018, such as the events of the Global Financial Crisis (2007-2008) and Christchurch earthquakes (2010-2011). Two factor models of economic living standards and health outcomes with age by period and both cohort by period (Figures S1-S3). Plots indicate no systematic differences in outcomes across age or birth cohorts by survey period.

In light of these exploratory findings, the study’s focus on later life development, and risks associated with the study design, we determined to assess variations in models of living standards trajectory Class (C3) by age and birth cohort, imposing an assumption of no period effects on living standards and health over the follow up period. To assess the impact of birth cohort membership, we assess representation of birth cohorts within living standards trajectory class membership and how models of living standards and heath with age vary by class and birth cohorts.

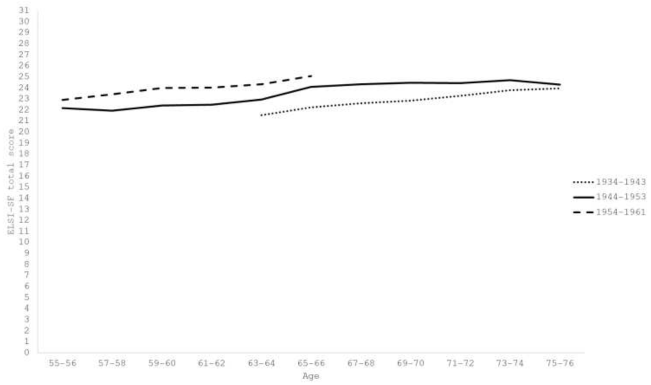
Figure S1 Two-factor models of Economic Living Standards Index Short Form



Line graph of mean ELSI-SF scores with survey period by age.

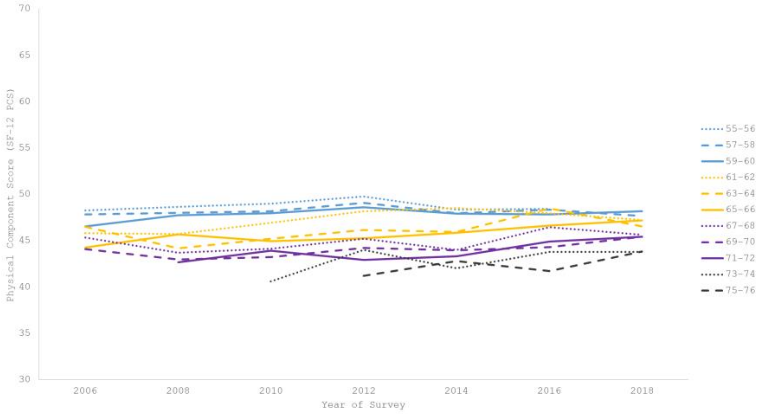


Line graph of mean ELSI-SF total scores with survey period by birth cohort.

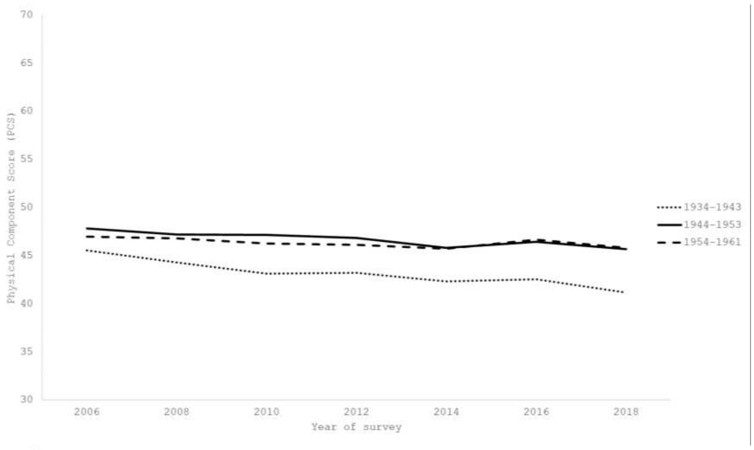


Line graph of mean ELSI-SF total scores with age by birth cohort

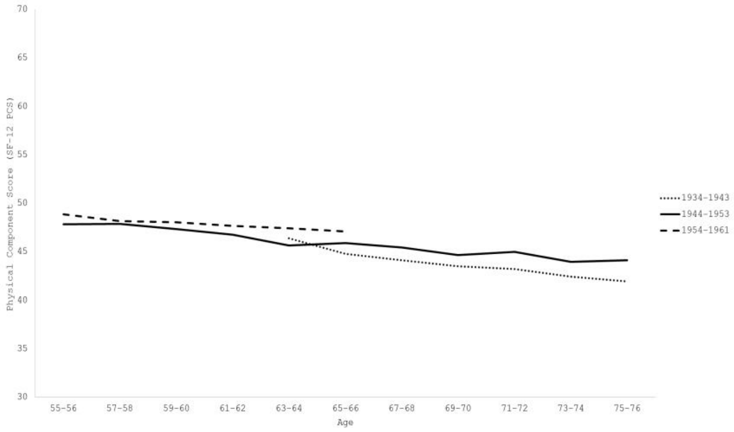
Figure S2 Two-factor models of Physical Component Score



Line graph of mean SF-12 PCS scores with survey period by age bands remained stable across survey period.

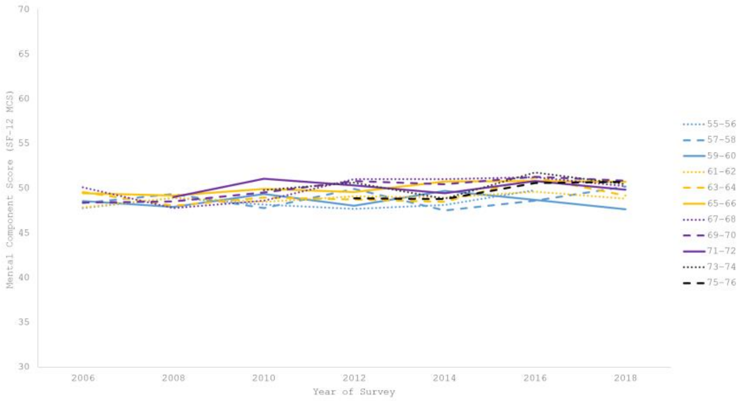


Line graph of mean SF-12 PCS scores with survey period by birth cohort

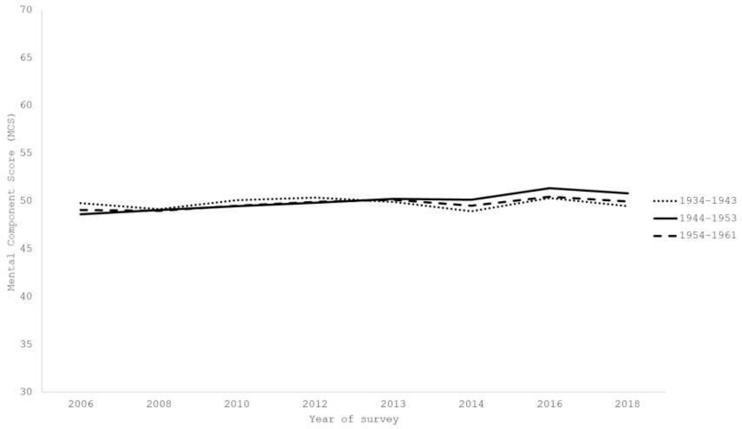


Line graph of mean SF-12 PCS scores with age by birth cohort

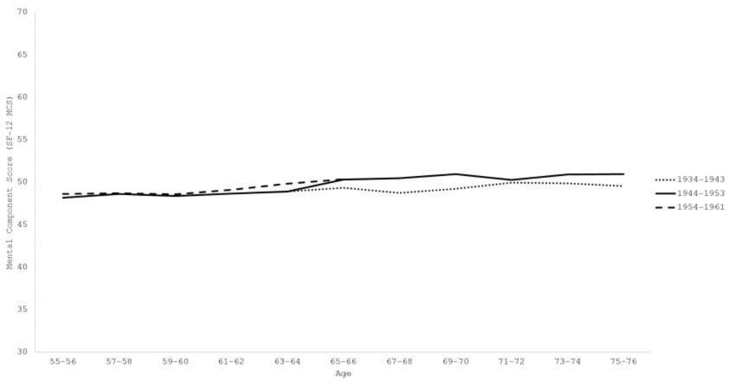
Figure S3 Two-factor models of Mental Component Score



Line graph of mean SF-12 MCS scores with survey period by age



Line graph of mean SF-12 MCS scores with survey period by birth cohort.



Line graph of mean SF-12 MCS scores with age by birth cohort.

Economic living standards with age by Class (C3) and birth cohort

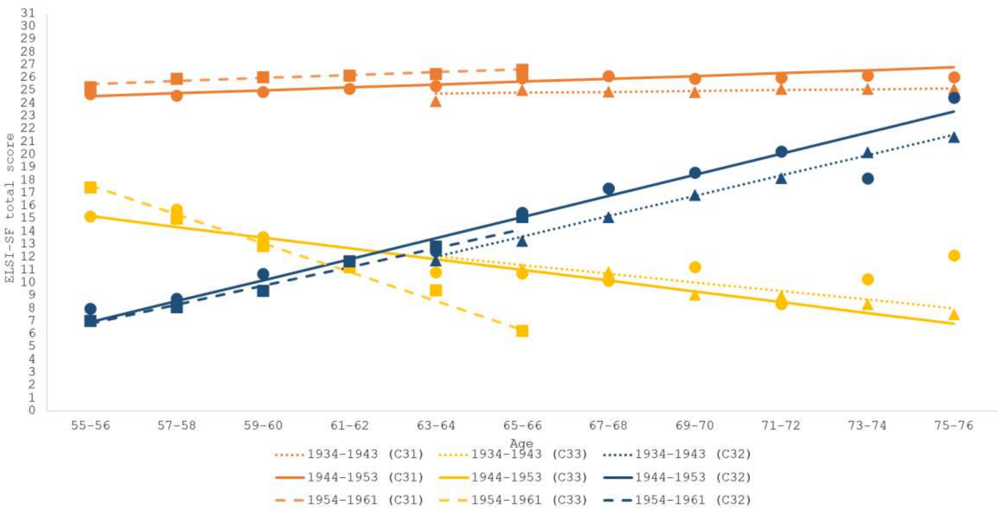
We inspected numbers of observations by birth cohort and age by living standards class (Table S3) and estimated linear trends in economic living standards by birth cohort (Figure S4). As formation of living standards trajectory classes were based on intercepts and trends in ELSI-SF scores with age, the common trajectories and intercepts for birth cohorts within classes were expected. Chi-square analyses indicated that birth cohort membership was not associated with response and design weighted class proportions ($\chi^2(4) = 9.7$, $p = .053$, Cramer's $V = 0.031$).

Table S3 Number of ELSI-SF score observations by age and birth cohort, weighted for response characteristics relative to original random samples from the electoral roll

$C3_1$											
Birth cohort	**55-56**	**57-58**	**59-60**	**61-62**	**63-64**	**65-66**	**67-68**	**69-70**	**71-72**	**73-74**	**75-76**
1934-1943					*210*	*387*	*552*	*619*	*596*	*592*	*515*
1944-1953	*437*	*716*	*969*	*1157*	*1218*	*1207*	*1039*	*699*	*440*	*261*	*109*
1954-1961	*569*	*745*	*857*	*728*	*488*	*231*					
$C3_2$											
Birth cohort	**55-56**	**57-58**	**59-60**	**61-62**	**63-64**	**65-66**	**67-68**	**69-70**	**71-72**	**73-74**	**75-76**
1934-1943					*31*	*68*	*89*	*90*	*88*	*79*	*62*
1944-1953	*57*	*116*	*141*	*178*	*162*	*139*	*133*	*83*	*52*	*28*	*8**
1954-1961	*76*	*96*	*95*	*79*	*55*	*18**					
$C3_3$											
Birth cohort	**55-56**	**57-58**	**59-60**	**61-62**	**63-64**	**65-66**	**67-68**	**69-70**	**71-72**	**73-74**	**75-76**
1934-1943					*27*	*49*	*53*	*58*	*51*	*38*	*30*
1944-1953	*46*	*67*	*96*	*107*	*107*	*93*	*75*	*48*	*32*	*13**	*7**
1954-1961	*33*	*52*	*41*	*43*	*30*	*11**					

Note: * cell n < 20 cases

Figure S4 Estimated linear trends for economic living standards by age, Class and birth cohort.



Note: Observed mean scores by age, Class and birth cohort represented for each class by: ■ 1954-1961; ● 1944-1953; ▲ 1934-1943.

SF-12 PCS and SF-12 MCS with age by Class (C3) and birth cohort

Linear trends in physical and mental health with age by birth cohort were estimated (Figure S5 and Figure S6), indicating that linear trends with age by class were consistent across birth cohorts.

Table S4 Number of observations by age and birth cohort, weighted for response characteristics relative to original random samples from the electoral roll (Observations of SF-12 Physical and Mental Component Scores)

$C3_1$											
Birth year	**55-56**	**57-58**	**59-60**	**61-62**	**63-64**	**65-66**	**67-68**	**69-70**	**71-72**	**73-74**	**75-76**
1934-1943	.	.	.	.	*201*	*371*	*526*	*611*	*584*	*587*	*503*
1944-1953	*429*	*695*	*951*	*1126*	*1197*	*1193*	*1032*	*700*	*441*	*262*	*109*
1954-1961	*567*	*745*	*852*	*727*	*487*	*232*	.	.	.	.	.
$C3_2$											
Birth year	**55-56**	**57-58**	**59-60**	**61-62**	**63-64**	**65-66**	**67-68**	**69-70**	**71-72**	**73-74**	**75-76**
1934-1943	.	.	.	.	*30*	*66*	*84*	*92*	*89*	*83*	*61*
1944-1953	*56*	*112*	*137*	*171*	*159*	*139*	*134*	*82*	*53*	*29*	*8**
1954-1961	*74*	*93*	*98*	*81*	*57*	*18**	.	.	.	.	.
$C3_3$											
Birth year	**55-56**	**57-58**	**59-60**	**61-62**	**63-64**	**65-66**	**67-68**	**69-70**	**71-72**	**73-74**	**75-76**
1934-1943	.	.	.	.	*25*	*44*	*50*	*52*	*51*	*39*	*28*
1944-1953	*44*	*65*	*97*	*100*	*103*	*93*	*75*	*50*	*32*	*13**	*7**
1954-1961	*33*	*52*	*41*	*43*	*29*	*11**	.	.	.	.	.

Note: mean scores not plotted where cell n < 20 cases*

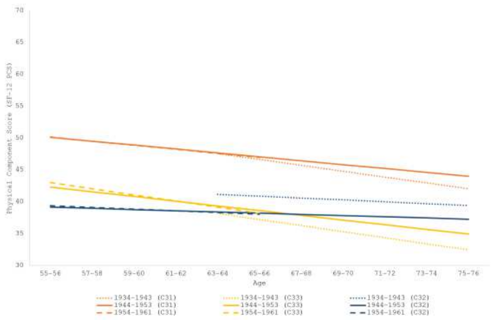


Figure S5 Estimated linear trends for physical component score by age, Class and birth cohort.

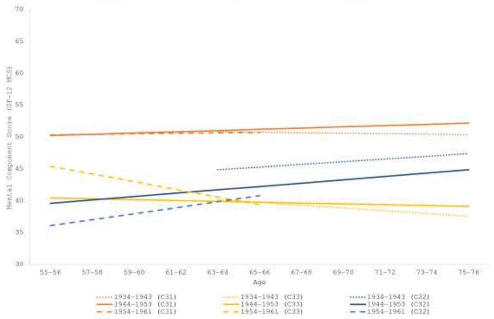


Figure S6 Estimated linear trends for mental component score by age, Class and birth cohort.

References

1. Allen J, Alpass FM, Stephens CV. New Zealand Health, Work and Retirement Longitudinal Study. In: Gu D, Dupre ME, eds. *Encyclopedia of Gerontology and Population Aging.* Cham: Springer International Publishing; 2019:1-7.
2. Bell A, Jones K. Age, Period and Cohort Processes in Longitudinal and Life Course Analysis: A Multilevel Perspective. In: Burton-Jeangros C, Cullati S, Sacker A, Blane D, eds. *A Life Course Perspective on Health Trajectories and Transitions.* Cham: Springer International Publishing; 2015:197-213.
3. Bell A, Jones K. Another 'futile quest'? A simulation study of Yang and Land's Hierarchical Age-Period-Cohort model. *Demographic Research.* 2014;30(11):333-360.