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Trends in Health Poverty in Australia, 2001-2018

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Abstract

Good health is a fundamental aspect of quality of life. Although there are measures of poverty in several aspects of life, there is no established measure of health poverty. We use data on 30,005 adults from the Household, Income and Labor Dynamics in Australia (HILDA) to track trends in health poverty in Australia over 18 years from 2001 to 2018.

We define health poverty as dying within one year or reporting the lowest levels of health in any of the six health domains of the Short-Form Six Dimension (SF-6D). We show how rates of health poverty have changed over time for the population as a whole and for sub-groups of the population defined by gender, age, indigenous status, rurality and State of residence.

The proportion of the adult population experiencing health poverty in any one of the dimensions was 41% in 2001, falling to 36% in 2009 and then rising to 42% in 2018. The level of health poverty was higher for women than for men (42% vs. 36%), for older age groups (37% among 15 to 29-year-olds vs. 49% among those aged 60 years and over), for indigenous people (52% vs. 39%) and in South Australia (41% vs. 39%—the average rate of all the other states).

The six domains of health are: physical function, role function, social function, pain, mental health, and vitality. Most (51%) people experiencing health poverty reported poverty in more than one of the six dimensions. Poverty in role functioning was the most commonly reported domain. Lack of vitality and role functioning were the domains most commonly reported as the only deficit causing an individual to be in health poverty, by 24% and 39% respectively of individuals experiencing health poverty. These domains were also the main reasons for higher rates of poverty over time and between women and men. Poor mental health and role functioning were the main reasons for higher health poverty amongst Indigenous people.

The analysis shows which groups in Australia experience health poverty and in which aspects of their lives. We hope that this framework, together with regular monitoring and evaluation, could be used by Australian Governments to target and minimize health poverty.

Introduction

The goal of this project is to develop a framework for the assessment of health poverty–particularly medium- and long-term–that could be used by Australian Government to monitor trends. This framework can be usefully implemented and produces valuable results for monitoring trends and for the policy design.

Historically, Australian poverty research has been based on a single dimension of poverty. Definitions of relative poverty have been used to define the poverty line relative to the median or average household disposable income (Henderson 1975; Henderson Harcourt and Harper 1970; Wilkins 2007). There is a need for a health poverty measure that should be investigated separately from other dimensions of poverty.

In this report, we adapt the concept of health poverty proposed by Clarke and Erregyers (2020) and use the simpler headcount definition. The advantage of this approach to measuring health inequality is that it requires setting a minimum standard of health and monitoring the proportions of populations that fall below this minimum standard. Health poverty is defined as the condition of being in 'poor health', i.e. of having a health status worse than what is minimally acceptable. This new measure of health poverty has the attractive property of being 'additively decomposable' and therefore suitable for calculating the contribution of population sub-groups to the overall level of poverty.

Measurement of health poverty

Previous measures of health poverty

Using the HILDA Survey, Brotherhood of St. Laurence showed poor health and disability remain strongly linked to social exclusion in Australia. They find that 52 % of Australians who have a long-term health condition or disability encounter some degree of exclusion when assessing social exclusion. Deep social isolation is faced by over 16 % of this group. The rate of social exclusion in this group with a long-term health condition has fluctuated since 2008, but has been above 50 % except for one year.

More specifically, Scutella et al. (2009) construct a multidimensional measure of social exclusion using HILDA data. The seven dimensions include material resources, employment, education, health, social, community, and personal safety. They use the `counting' or `sum of scores' method. The `counting' approach creates binary indicators of exclusion equal to one if the domain is below a certain threshold and zero otherwise. The `sum-score' approach assumes all domains are important contributors to the social exclusion.

With the HILDA data, Heady (2006) assessed poverty and disadvantage based on a multidimensional approach. This paper modifies Sen's approach and redefines poverty and disadvantage. He points out the

importance of defining a broad range of *capabilities*. Lack of *capabilities* can lead to a disadvantaged group. Heady (2006) is the first paper that specifically defined the list of capabilities or functioning.

Other researchers have also examined levels and trends in health inequalities in Australia. Turrell et al (2006) analyzes health-related inequalities by area-level socioeconomic disadvantage, young adults, working-age adults, and older persons for the periods 1989-90, 1995, and 2001. They show that most of the health burden in the Australian population is attributable to socioeconomic disadvantage. Harris and Simpson (2002) discuss the role of health promotion in addressing these health inequalities in Australia.

The Clarke-Erreygers health poverty measure

Clarke and Erreygers (2020) proposed health measures with ratio-scale properties so that the distance of individuals from a minimum standard is meaningful and that the minimum standards might vary across individuals or groups. If the individual has health below the minimum standard, their health poverty gap is calculated as the distance of their health below the minimum standard divided by the value of the standard. The gap is zero if the individual is at or above the minimum standard value.

There are a variety of summary measures of these gaps. P0 is the headcount ratio and measures the incidence of health poverty. P1 is the poverty gap ratio and is described as measuring the intensity of poverty. P2 is the squared gap measure reflecting level of inequality in health poverty.

The additive decomposability of the health poverty index means that the overall level of health poverty can be expressed as a population-weighted average of the levels of health poverty in population sub-groups.

Clarke and Erreygers (2020) highlight a small number of studies that have calculated trends in health poverty using categorical measures of health, such as self-assessed health. Other studies took place in Britain and Spain (Brzezinski, 2015; Pascual, Cantarero, and Lanza, 2017). This concept has not been applied to more complete measures of health such as the Quality Adjusted Life Year (Simões, et al., 2016).

Clarke and Erreygers (2020) apply their new measure to two health indicators: changes in the risk of cardiovascular disease in the United States between 2005-06 and 2013-14, and health-related quality of life and life expectancy in Australia between 2001 and 2016 using the first 15 waves of the HILDA Survey. In their Australian application, Clarke and Erreygers (2020) calculate the level of health poverty in Australia using the SF-6D and life expectancy, decompose it by gender, smoking habits and ethnicity, and estimate the extent to which health poverty is related to income.

The use of the SF-6D utility index by Clarke and Erreygers (2020) is relatively straightforward. Life expectancy is calculated from the HILDA data with a proportional hazards survival regression model using a Gompertz parametric form. The survival models were based on explanatory variables reported in the first wave of HILDA, including age, year of birth, socioeconomic conditions (marital status, education level, income), lifestyle choices (smoking), and health (general health status, bodily pain, social functioning). Separate models were estimated by gender.

Poverty thresholds are set differently for reference groups defined by gender and age. The poverty threshold is assumed to be a fraction below the average health achievement of the reference group. In the main analysis this fraction is set at 95%, though other values are explored. At the average age, this is equivalent to being 0.04 units lower than the mean SF-6D utility score and 4 years shorter than average life expectancy.

Separate values are produced for each year between 2001 and 2015. For the SF-6D, the headcount ratio fluctuates around one-third. Health poverty declines to 2009 and then rises back to the original level. Health poverty in life expectancy is lower at around 22%. This fluctuates over time in a similar way to SF-6D poverty but to a smaller degree. Headcount poverty in life expectancy is decomposed by gender, smoking status and Indigenous status. There is very substantially more poverty experienced by smokers and Indigenous people.

Our approach to health poverty measurement

We use HILDA as the primary data source for our report. An additional three waves of data are now available such that we can cover the period 2001 to 2018.

We focus primarily on the responses to the original SF-36 questions that comprise the SF-6D, rather than the SF-6D utility score, as we believe the use of the utility score is less understandable as a measure of reported health poverty.

We also select an absolute minimum standard that we apply to all of the population as we believe this has clearer external validity. The P1 and P2 measures are preferred in some circumstances because they are more sensitive than the P0 headcount measure to increase in the amount that individuals drop below the minimum standard. They are, however, less easy to translate in intuitive terms. While recognizing its limitation, we focus on the headcount measure in this report because of its simpler and more intuitive interpretation.

In summary, our application differs from Clarke and Erreygers (2020) in the following ways: (1) we have used additional three years of data, (2) we use absolute minimum health standards, and (3) we consider more policy relevant population sub-groups. With this measure, we highlight the gradual increase in health

poverty since 2009 and the increased rate of health poverty among some important socio-demographic groups, such as the rise in mental health poverty among young adults.

Data

The HILDA survey is a broad social and economic longitudinal survey with a particular focus on family, income and work (Summerfield et al., 2019). The surveyed population is a large national probability sample of Australian households within private dwellings.

The detailed explanation about the variables that we have used in our analysis is in Appendix 2. To ensure that the results are representative of the Australian population, we use the survey weights provided with HILDA. These weights are derived from the probability of selecting the households into the sample. We use the cross-section population weights for all people who responded in the relevant wave.

Our measure of health status consists of SF-6D responses derived from questions in the SF-36 health survey that is a widely used measure of health-related quality of life. The SF-6D is composed of six multi-level dimensions: physical functioning, role limitations, social functioning, pain, mental health and vitality (Brazier et al., 2002). Brazier et al. (2002) derive an index anchored at 1 for full health and 0 for dead. More formally, they create a univariate health status variable, SF-6D, ranging between 0 (a state of very poor health equivalent to death) and 1 (full health).

Brazier and Roberts (2004) explain more in detail about how they derived the SF-6D from the SF-12. A representative sample of respondents were asked to value five health states compared to full health and the worst possible health state using a Standard Gamble mechanism. Mean valuations were then modelled using two sets of explanatory variables: (1) a set of binary dummy variable that describes each level and dimension of health state, and (2) a binary variable to examine any additional effect when one or more dimension of health is at the most severe level. The responses are modelled using ordinary least squares regression and the explanatory power is measured using the adjusted R squared. The binary variable indicating that one of more dimensions is at its worst level is included to account for additional severity associated with the worst levels of health.

We chose this indicator of health at its worse level on any of the six dimensions as our threshold for defining health poverty. We additionally considered whether the respondent had not experienced an additional year of life following completion of the survey. Thus, our measure of health poverty considers seven aspects of health in total.

Method

We define health poverty as follows: an individual is classified as experiencing health poverty if they meet any of the following conditions:

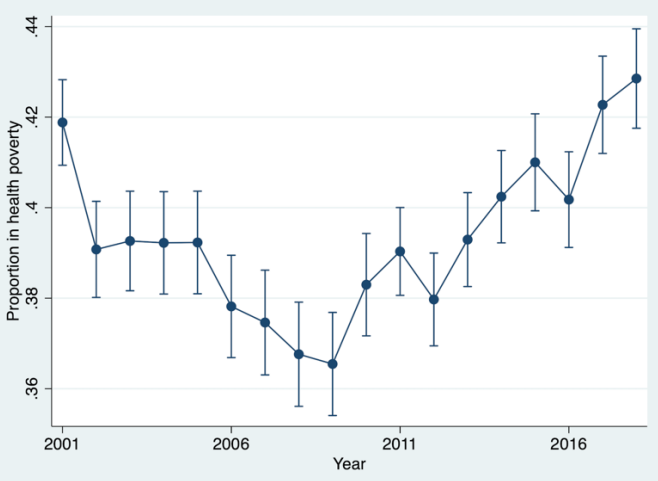
- They died within 365 days of the interview date
- Physical: They reported "Limited a lot" to "Health limits moderate activities (hlsf3b)" or they reported "Limited a lot" or "Limited a little" to "Health limits bathing (hlsf3j)".
- Role: They reported "Yes" to "Role-emotional: Accomplished less than would like (hlsf5b)".
- Social: They reported "All of the time" or "Most of the time" to "Physical/emotional problems interfered with social activities (hlsf9j)".
- Pain: They reported "Quite a bit" or "Extremely" to "How much did pain interfere with normal work" (hlsf8)
- Mental health: They reported "All of the time" or "Most of the time" to "Been a nervous person" (hlsf9b) or to "Felt down" (hlsf9f)
- Vitality: They reported "A little of the time" or "None of the time" to "Have a lot of energy" (hlsf9e)

The measure of health poverty is equal to one if one of these factors is equal to one and zero otherwise. The measure covers seven aspects of health. The six health status elements were chosen for the development of the SF6D, which is a simplified version of the 36-item SF36. Each of the six dimensions has been shown to be associated in its own way with decrements in health utility as follows: physical functioning -0.117; role functioning -0.053; social functioning -0.087; pain -0.171; mental health -0.118; vitality -0.092. In addition, answering in this way to any of these questions is associated with an additional utility decrement of -0.061 in the scoring algorithm. Therefore, regardless of how a respondent qualifies as experiencing health poverty, they are living in a health state associated with a significant reduction in health utility.

We summarise how this measure of health poverty changes over time for the entire population and for specific population groups. We divide the sample by gender, age, indigenous status, rurality and States of residence. We use probit regressions to generate 95% confidence intervals. We include all respondents except for those who did not report all the SF-6D measures.

Results

Figure 1. Change in Overall Measures of Health Poverty



Notes: HILDA 2001-2018. 95% confidence intervals obtained using probit regression.

Figure 1 shows the changes in health poverty over 18 years. Just under 41% of the population experienced health poverty in 2001. Until wave 9 (2009), the level of health poverty decreased reaching its lowest level at 36% of the population. It has gradually increased since then and in 2018 exceeded the 2001 value at 43%. This overall small but consistent increase in health poverty can be found in other reports. For example, AIHW (2020b) shows the age-standardized rate of diabetes was 3.3 % in 2001 while it went up to 4.4% in 2017-18. That paper also shows that drug-induced death gradually increased from 2001 to 2017. From 2013 to 2017-18, other measures in healthcare and status are also in line with the recent increase in health poverty as shown in Figure 1. For instance, from 2014 to 2018, healthcare spending on hospitals increased by 2.1 %, hospitalization rose by 3.3 %, and spending on mental health related services has increased of 1.1 % annually.

Trends in health poverty for population sub-groups

Trends in health poverty for different subgroups of the population are presented in Figure 2.

In Panel A, in recent years, health poverty among women has become more evident. About 44 % of female population experienced health poverty in 2001, while less than 40 % of males experienced it. Until 2010, the level of health poverty decreased reaching its lowest level at 40 % (33 % for male) of the female population. It has increased since then and in the most recent year exceeded the 2001 value at 46 %. Across the overall period, the health poverty gap between gender does not decrease.

Panel B reveals that there has been a sharp rise in health poverty among young people whose age is below 30. In 2001, about 38 % of the young population experienced health poverty, while more than 52 % of the

older people (aged at/above 60) experienced it. Until 2010, the level of health poverty increased slightly among the young population decreased and from 2011 it has increased and reached at 44 %. Across the period, the health poverty gap between young and old has decreased.

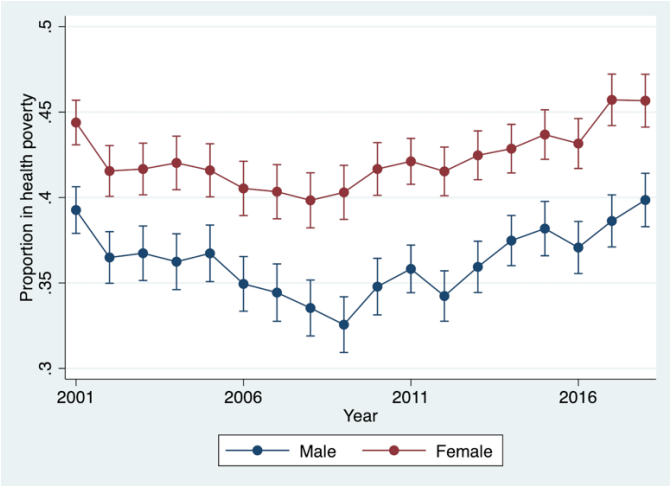
Panel C shows that there has been a sharp rise in health poverty among indigenous people. In 2001, about 50 % of the indigenous people experienced health poverty which is about 10 percentage points higher than the people without indigenous origin. From 2007, health poverty dramatically increased among indigenous people and in 2018, it reached almost 60 % where the gap between these two groups reached about 20 percentage points.

Panel D reveals that Northern Territory and Australian Capital Territory experienced relatively low health poverty from 2001 to 2018. Although it slightly decreased in 2007 at around 36 %, people in Tasmania experienced relatively higher health poverty most of the time.

As shown in Panel E, we can see that people living in rural areas often experience higher health poverty. This is true across all time periods except 2002. Health poverty in rural areas reached 45 % in 2018, which is the highest point across the period.

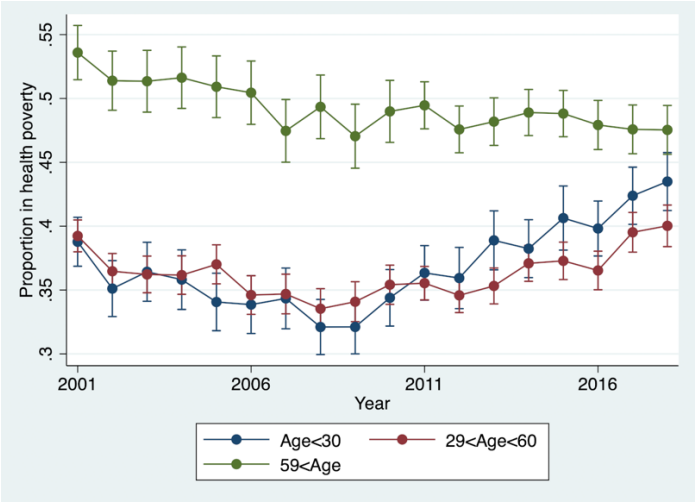
Figure 2. Trends in Health Poverty for Population Subgroups

2-A. Changes in the Health Poverty Measure by Gender



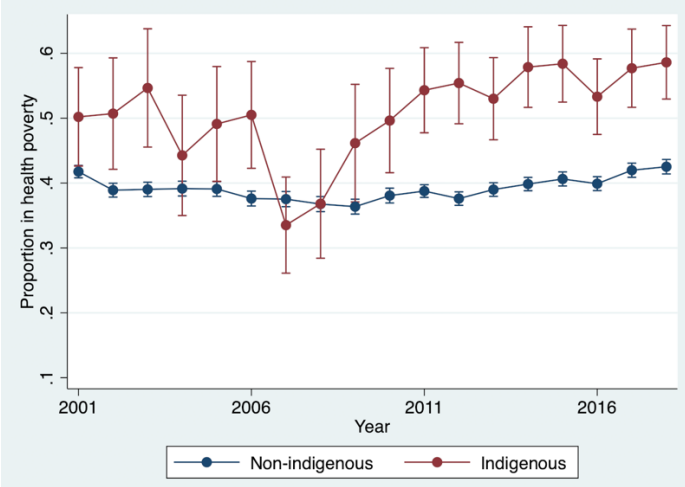
Notes: HILDA 2001-2018. 95% confidence intervals obtained using probit regression.

2-B Changes in the Health Poverty Measure by Age



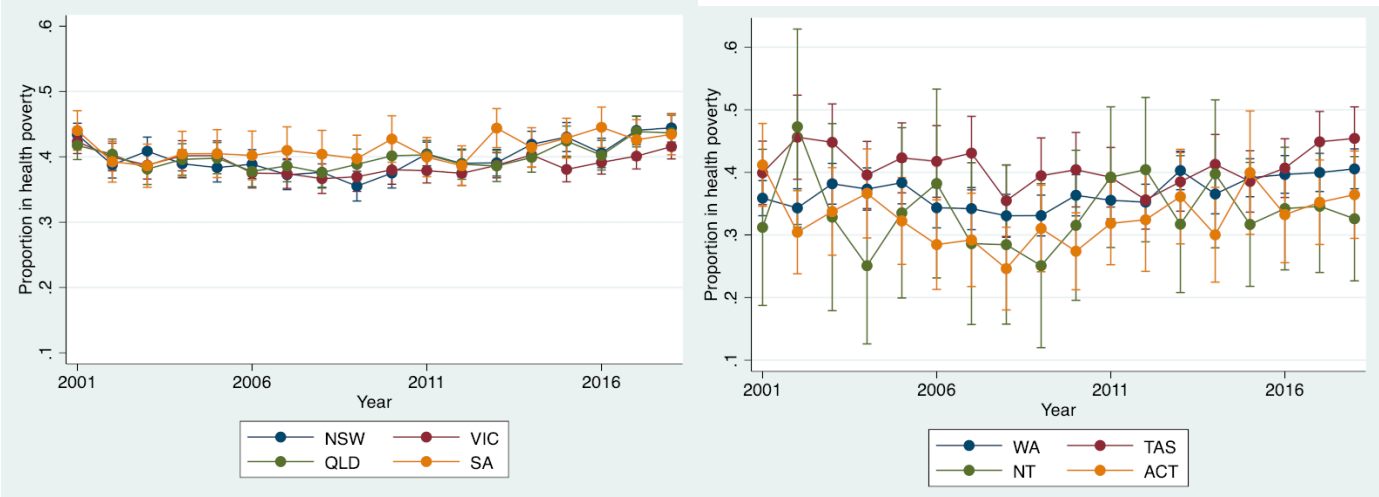
Notes: HILDA 2001-2018. 95% confidence intervals obtained using probit regression.

2-C Changes in the Health Poverty Measure by Indigenous Origin



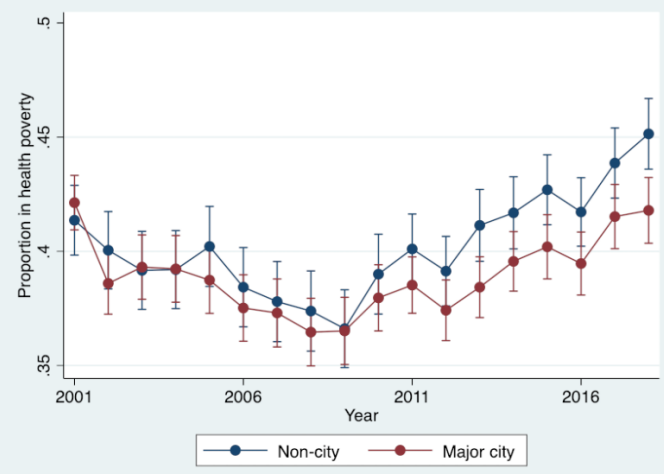
Notes: HILDA 2001-2018. 95% confidence intervals obtained using probit regression.

2-D Changes in the Health Poverty Measure by States



Notes: HILDA 2001-2018. 95% confidence intervals obtained using probit regression.

2-E Changes in the Health Poverty Measure by Major City



Notes: HILDA 2001-2018. 95% confidence intervals obtained using probit regression.

Composition of health poverty

In Table 1 we show the proportions of the whole sample of HILDA observations who experience poverty in each of the seven domains of health poverty. Across the entire dataset, 39.2% of respondents experience health poverty. Lack of role functioning is experienced by 22.2% of respondents. Just 0.4% of respondents die within a year of the HILDA interview.

Table 1. Proportions of Respondents Experiencing Poverty in Each Domain of Health Poverty

Variable	Mean
Lack of Physical Functioning	.120
Lack of Role Functioning	.222
Lack of Social Functioning	.069
Experiencing Pain	.085
Poor Mental Health	.113
Lack of Vitality	.174
Died before next wave	.004
In Health Poverty	.392
Number of observations	234,359

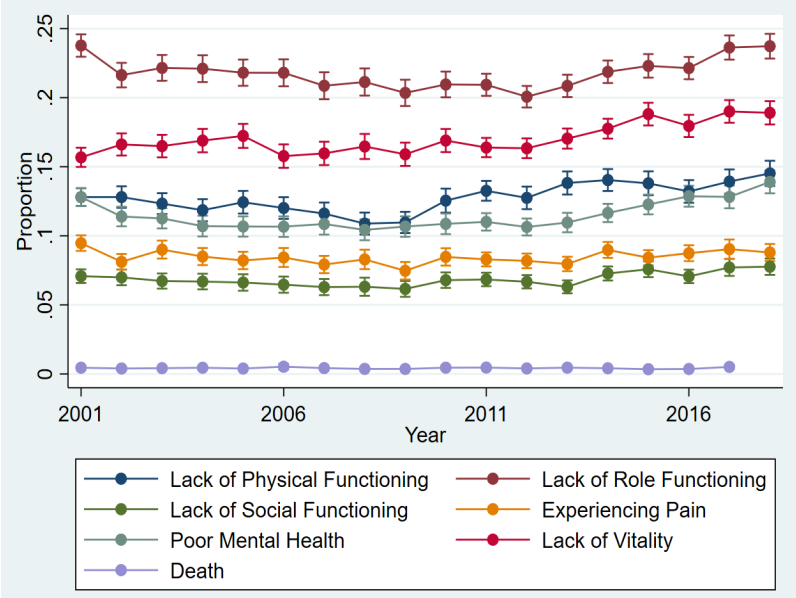
Table 2 examines the 45,709 respondents who are classified as being in poverty because they meet this criterion on only one dimension. Amongst this population, 39 % qualify for health poverty only because of a lack of role functioning, 24 % only qualify because of a lack of vitality, while only 2 % qualify only due to a lack of social functioning.

Table 2. Classification of Respondents Experiencing Health Poverty in Only One Domain

Domain of health poverty	**Freq.**	%
Lack of Vitality	10,836	23.71
Poor Mental Health	6,070	13.28
Experiencing Pain	2,333	5.10
Lack of Social functioning	987	2.16
Lack of Role functioning	17,926	39.22
Lack of Physical functioning	7,364	16.11
Died before next wave	193	0.42
Number of Observations	45,709	100

We next examine how each of the components that make up the health poverty index has varied over time. We show these results for the entire population in Figure 3.

Figure 3. Changes in Each Aspect of Health Poverty Over Time, 2001-2018



In lack of role functioning, there was a decline from 2001 to 2009 and an increase thereafter. Similar patterns are seen in poor mental health, pain and lack of social functioning. Our results on the gradual increasing trend in "Lack of Physical Functioning" is in line with AIHW (2019) where it shows the fall-related injury cases increased over the period 2008 to 2017 with about 2 to 3 % per year. A slight but gradual increase in the rate of Poor Mental Health from 2009 is comparable to AIHW (2020a) which suggests the rate of overnight mental health-related separations has increased at an annual rate of 3.2 from 2008 to 2018.

Composition of health poverty in population subgroups

In Tables 1 to 5, we examine the contributions to health poverty for each of the population subgroups of interest. In Table 1, most of the measurements show that females are more likely to encounter health poverty except the rate of death within a year.

Table 1. Gender

	Male	**Female**
Lack of Physical Functioning	.126	.130
Lack of Role Functioning	.194	.241
Lack of Social Functioning	.061	.076
Experiencing Pain	.075	.094
Poor Mental Health	.101	.128
Lack of Vitality	.146	.194
Died before next wave	.005	.003
In Health Poverty	.363	.424
Number of observations	109,857	124,502

Notes: Weighted with hhwtrp, a population weight for a responding person. Reported values are the mean of each value.

In Table 2, we can observe that older people (aged over 59) are more inclined to experience poverty in physical activity, role functioning, social functioning, pain, vitality and death compared to the other age groups. In contrast, mental health poverty decreases with age. A relatively high rate of Poor Mental Health among young adults aligns with the results of Hall et al., (2019). They find that the rates of psychological distress among young people have risen 5.5 percent from 2012 to 2018.

Table 2. Age

	Age<30	**29<Age<60**	**59<Age**
Lack of Physical Functioning	.086	.098	.243
Lack of Role Functioning	.196	.199	.287
Lack of Social Functioning	.049	.064	.100
Experiencing Pain	.032	.075	.166
Poor Mental Health	.151	.108	.092
Lack of Vitality	.104	.166	.256
Died before next wave	0	.001	.014
In Health Poverty	.370	.364	.491
Number of observations	59,497	120,159	54,703

Notes: Weighted with hhwtrp, a population weight for a responding person. Reported values are the mean of each value.

Table 3 demonstrates that indigenous Australians are more likely to experience health poverty than non-indigenous Australians except for the death rate.

Table 3. Indigenous Origin

	Indigenous Origin	Non-Indigenous Origin
Lack of Physical Functioning	.182	.127
Lack of Role Functioning	.285	.217
Lack of Social Functioning	.114	.068
Experiencing Pain	.106	.084
Poor Mental Health	.207	.113
Lack of Vitality	.198	.170
Died before next wave	.003	.004
In Health Poverty	.514	.392
Number of observations	4,803	229,556

Notes: Weighted with hhwtrp, a population weight for a responding person. Reported values are the mean of each value.

In Table 4, we can see that health poverty varies by state substantially. For example, health poverty in Southern Australia (SA) is 42 %, while the health poverty in the Australian Capital Territory (ACT) is only about 33 %. Among several dimensions, the lack of vitality and lack of role functioning appear to be two of the most impelling causes of this health poverty difference. Across all states, these two factors consistently work as driving forces for the variation in health poverty. Besides these two factors, ACT outperforms SA across all other dimensions.

Table 4. States

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Lack of Physical Functioning	.146	.121	.122	.136	.106	.151	.083	.090
Lack of Role Functioning	.214	.221	.221	.240	.211	.223	.181	.189
Lack of Social Functioning	.070	.066	.070	.080	.065	.080	.047	.050
Experiencing Pain	.087	.075	.089	.102	.080	.105	.064	.061
Poor Mental Health	.116	.115	.117	.123	.107	.119	.080	.099
Lack of Vitality	.167	.168	.172	.197	.173	.196	.164	.124
Died before next wave	.004	.004	.004	.005	.003	.006	.004	.002
In Health Poverty	.401	.389	.401	.415	.370	.410	.341	.330
Number of observations	69,077	57,973	49,095	21,816	22,268	7,679	1,654	4,797

Notes: Weighted with hhwtrp, a population weight for a responding person. Reported values are the mean of each value.

We do observe a relatively small difference in health poverty between urban and rural areas in Table 5. Across all dimensions, the difference remains consistent, meaning that people in non-city are more likely to experience health poverty.

Table 5. City (Urban vs. Rural)

	City	Non-City
Lack of Physical Functioning	.125	.134
Lack of Role Functioning	.214	.227
Lack of Social Functioning	.066	.075
Experiencing Pain	.077	.100
Poor Mental Health	.117	.110
Lack of Vitality	.163	.187
Died before next wave	.003	.005
In Health Poverty	.390	.404
Number of observations	145,495	88,864

Notes: Weighted with hhwtrp, a population weight for a responding person. Reported values are the mean of each value.

Conclusions

The goal of this research was to propose a new measure of health poverty for use in tracking trends and differences between population groups in Australia. We created an intuitive minimum standard value based on reporting the lowest level on any of the six dimensions of the Short-Form Six Dimension health instrument and on whether the respondent died within a year of the interview. These are the conditions that a representative sample of Australians identified as causing particularly large decrements in health-related quality of life.

We applied this health poverty measure to eighteen waves of the HILDA survey. We tracked changes over time for the general population and then we examined differences between population subgroups based on five classifications. We found that over 40% of the Australian population experienced health poverty during this period. The rate of health poverty decreased between 2001 and 2009 but rose substantially thereafter. Women experienced more health poverty than men and the gap in health poverty between older and younger people narrowed substantially over the period. Indigenous people experienced substantially higher rates of health poverty reaching over 60 % towards the end of the study period. We found differences in rates of health poverty between urban and rural areas and between States, but these were smaller than the differences by personal characteristics.

The measures of healthy poverty that we have produced are intuitive but have simpler measurement properties compared to previous work. Our approach, for example, treats all seven dimensions as equally important in qualifying as being in health poverty. We also only identify whether or not individuals are experiencing health poverty; we do not consider the extent of poverty, for example in the number of dimensions on which they qualify or in the severity of their conditions on which they qualify as experiencing health poverty. A further difference from previous work is that we do not “standardize” across groups defined by gender or age. We have identified absolute minimum standards that we apply to all

individuals. The changes over time and differences in groups might therefore reflect that the populations have different age-gender compositions and age or gender is associated with the incidence of health poverty.

Our investigations of what aspects of health were contributing to health poverty suggests lack of role functioning and vitality were the most important elements. They account for much of the change over time, the differences between groups, and the differences in trends between groups. For indigenous people, poor mental health also played a significant part in explaining higher rates of health poverty compared to non-indigenous people. These findings should be explored further in future research.

Poverty indices often provide a way to calculate the degree to which a population's health could be improved by treating all persons at risk. The health poverty measures in this article provide a useful set of indices that are likely to have an intuitive appeal among policy makers. They also allow analysts to draw on useful properties such as decomposition by population subgroup. Through measuring health poverty and seeking to understand its causes, policy makers can pay more attention to those who are worst off in terms of health.

References

[1] Australian Institute of Health and Welfare. 2019. *Trends in hospitalised injury due to falls in older people, 2007-08 to 2016-17.* Injury research and statistics series no. 126. Cat. No. INJCAT 206. Canberra: AIHW.

[2] Australian Institute of Health and Welfare. 2020 (a). *Mental health services in Australia.* Canberra: AIHW. Viewed 25 December 2020, https://www.aihw.gov.au/reports/mental-health-services/mental-health-services-in-australia

[3] Australian Institute of Health and Welfare. 2020 (b). *Australia's health 2020: in brief.* Australia's health series no. 17 Cat. no. AUS 232. Canberra: AIHW.

[4] Brazier J, Roberts J, Deverill M. 2002. *The estimation of a preference-based measure of health from the SF-36.* Journal Health Econ. Mar; 21(2):271-92. doi: 10.1016/s0167-6296(01)00130-8. PMID: 11939242.

[5] Brazier, John, Roberts, Jennifer. 2004. *The Estimation of a Preference-Based Measure of Health From the SF-12,* Medical Care 42 (9): 851-859. doi:10.1097/01.mlr.0000135827.18610.0d

[6] Brzezinski, M. 2015. *Accounting for trends in health poverty: a decomposition analysis for Britain, 1991-2008*. European Journal of Health Econ. 6, 153–159.

[7] Brotherhood of St.Laurence, https://www.bsl.org.au/research/our-research-and-policy-work/social-exclusion-monitor/who-experiences-social-exclusion/health/

[8] Clarke P, Erreygers G. 2020. *Defining and measuring health poverty.* Social Science & Medicine 244-112633.

[9] Hall, S.Fildes, J., Perrens, B., Plummer, J., Carlisle, E., Cockayne, N., and Werner-Seidler, A. 2019. *Can we Talk?* Seven Year Youth Mental Health Report – 2012-2018. Mission Australia: Sydney, NSW.

[10] Harris, Elizabeth and Sarah Simpson. 2002. *Centre for Health Equity Training Research and Evaluation,* University of New South Wales and Division of Population Health, South Western Sydney Area Health Service, New South Wales

[11] Headey, Bruce. 2006. *A framework for assessing poverty disadvantage and low capabilities in Australia.* Melbourne Institute. https://melbourneinstitute.unimelb.edu.au/assets/documents/hilda-bibliography/other-publications/pre2010/Headey_Framework_for_assessing_poverty_no6.pdf

[12] Henderson, R.F. 1975. *Poverty in Australia: First Main Report, April 1975*, Commission of Inquiry into Poverty, AGPS, Canberra.

[13] Henderson, R.F., Harcourt, A. and Harper, R.J.A. 1970. *People in Poverty: A Melbourne Survey*, Cheshire, Melbourne.

[14] Pascual, M., Cantarero, D., Lanza, P. 2017. *The Dynamics of Health Poverty in Spain during the Economic Crisis (2008-2016).* University of Cantabria, Department of Economics 25EEB-70.

[15] Scutella, Rosanna, Roger Wilkins and Weiping Kostenko. 2009. *Estimates of Poverty and Social Exclusion in Australia: A Multidimensional Approach* Melbourne Institute Working Paper No.26/09

[16] Simões, N., Crespo, N., Moreira, S.B., Varum, C.A. 2016. *Measurement and determinants of health poverty and richness: evidence from Portugal.* Empir. Econ. 50, 1331-1358.

[17] Summerfield, Michelle, Sarah Bright, Markus Hahn, Nathan La, Ninette Macalalad, Nicole Watson, Roger Wilkins, Mark Wooden. 2019. HILDA User Manual -Release 18., Melbourne Institute Applied Economic & Social Research.

[18] Turrell G, Stanley L, de Looper M & Oldenburg B. 2006. *Health Inequalities in Australia: Morbidity, health behaviours, risk factors and health service use.* Health Inequalities Monitoring Series No. 2. AIHW Cat. No. PHE 72.

Canberra: Queensland University of Technology and the Australian Institute of Health and Welfare. https://www.aihw.gov.au/getmedia/0cbc6c45-b97a-44f7-ad1f-2517a1f0378c/hiamhbrfhsu.pdf.aspx?inline=true

[19] Wilkins, R. 2007. `*The Changing Socio-Demographic Composition of Poverty in Australia: 1982 to 2004',* Australian Journal of Social Issues, Vol. 42, No. 4, 481–501.

Appendix 1.

Number of observations by sub-groups

States		**City**		**Gender**		**Age**		**Indigenous Origin**	
NSW	69,077	City	145,495	Male	109,857	Age<30	59,497	Indigenous Origin	4,803
VIC	57,973	Non-City	88,864	Female	124,502	29<Age<60	120,159	Non-Indigenous origin	229,556
QLD	49,095					59<Age	54,703		
SA	21,816								
WA	22,268								
TAS	7,679								
NT	1,654								
ACT	4,797								

Appendix 2.

We use the following variables from the SF-36 questions in HILDA that comprise the SF-6D

sf3 "SF36 Health limits vigorous activities (hlsf3a)"
sf4 "SF36 Health limits moderate activities (hlsf3b)"
sf12 "SF36 Health limits bathing (hlsf3j)"
sf15 "SF36 Health limits kind of work (hlsf4c)"
sf18 "SF36 Mental health mean accomplish less (hlsf5b)"
sf21 "SF36 Pain last 4 weeks (hlsf7)"
sf22 "SF36 Pain interferes with work (hlsf8)"
sf24 "SF36 nervy (hlsf9b)"
sf27 "SF36 energy (hlsf9e)"
sf28 "SF36 downhearted (hlsf9f)"
sf32 "SF36 limit social activities (hlsf9j)"

The variables sf24, sf27 and sf28 in the questionnaire have six categories. They need to be converted to five categories. This is done by splitting those who report original category 3 randomly in half between original category 2 and original category 4. We draw a random number from a uniform distribution for each respondent and allocate their scores upwards or downwards depending on whether this random number exceeds 0.5.

We created a Physical function dimension. This has six categories as follows

Physical function dimension	Based on
1	sf3==3
2	sf3==2 or sf3==1
3	sf4==2
4	sf4==1
5	sf12==2
6	sf12==1

We created a role dimension. This has four categories.

Role function dimension	Based on
1	(sf15==2) & (sf18==2)
2	sf15==1
3	sf18==1
4	sf15==1 & sf18==1

We created a social dimension. This is a five category variable. It is a reverse coded version of SF32

We created a pain dimension. This has six categories.

Pain dimension	Based on
1	sf21==1
2	sf21==2 | sf21==3 | sf21==4 | sf21==5 | sf21==6
3	sf22==2
4	sf22 == 3
5	sf22==4
6	sf22==5
Missing	sf22 ==.

We created a mental health dimension. This has five categories.

Mental health dimension	Based on

1	sf24r==5 or sf28r==5
2	sf24r==4 | sf28r==4
3	sf24r==3 | sf28r==3
4	sf24r==2 | sf28r==2
5	sf24r==1 | sf28r==1

This uses the converted versions of these variables
> lab var sf24 "SF36 nervy (hlsf9b)"
> lab var sf28 "SF36 downhearted (hlsf9f)"

We created a vitality dimension. This five-category variable is the converted version of SF27.We then identified the respondents who died within a year of the interview.

We then create a binary measure which is only defined when a respondent has non-missing data for all six SF6D dimensions. It is zero unless the respondent has one or more of the following seven conditions:

- Physical dimension equal to 4, 5 or 6
- Role dimension equal to 3 or 4
- Social dimension equal to 4 or 5
- Pain dimension equal to 5 or 6
- Mental health dimension equal to 4 or 5
- Vitality dimension equal to 4 or 5
- Dies within 365 days of the interview date

For all analyses we use the survey weights provided by HILDA. Based on the HILDA user Manual 18, we svyset with the state cluster as follows:

svyset xwaveid [pweight=hhwtrp], strata(xhhstrat)