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Original Research

Inequity in healthcare use among the indigenous population living in non-remote areas of Australia

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ABSTRACT

Objectives: Although several studies have examined the gap in healthcare use between indigenous and non-indigenous people, empirical evidence on inequity in healthcare use within indigenous populations is limited. This study aims to fill this gap in the literature by investigating income-related inequity (unequal use for equal need) in healthcare use among indigenous Australians living in non-remote areas.
Study design: This is a cross-sectional study.
Methods: This study used data from the Australian Aboriginal and Torres Strait Islander Health Survey, 2012–13. Logistic regression analysis was used to determine the association of income with the probability of a general practitioner (GP) visit, a specialist visit and inpatient admission. The horizontal inequity (HI) index and decomposition analysis were also used to quantify and explain inequity in healthcare use.
Results: No consistent association was found between income and the probability of GP visit or inpatient admission after controlling for health need. However, the likelihood of visiting a specialist was about three times (odds ratio = 2.96, $P = 0.028$) higher for the richest compared with the poorest population subgroups. The inequity index was 0.016 ($P < 0.001$), indicating a pro-rich inequity for the probability of visiting a specialist. Income inequality, unequal distribution of private health insurance and inequality in education were the main factors explaining the pro-rich inequity in specialist utilisation.
Conclusions: Although there was no income-related inequity in GP visits or inpatient admissions, wealthier indigenous Australians had a higher probability of visiting a specialist than their poorer counterparts, after adjusting for need. Specific policies and initiatives are required to address the inequity faced by low-income indigenous people in Australia.

Introduction

The health of the Australian Aboriginal and Torres Strait Islanders (hereafter indigenous Australians) is significantly worse than non-indigenous Australians. The gap in life expectancy between indigenous and non-indigenous Australians is wider than that seen in other developed countries, such as Canada, New Zealand and the US.[1] Indigenous people are more likely to experience disability and reduced quality of life due to ill health, as well as die at younger ages.[2] For example, in 2011, the disability-adjusted life-years rate was 2.3 times higher among indigenous than non-indigenous populations.[3] In addition, the likelihood of indigenous Australians reporting excellent or very good health was approximately 50% lower than for non-indigenous Australians in 2012–2013,[4] and the prevalence of obesity was about 1.5 times higher among indigenous than non-indigenous Australians.[5] The incidence of chronic diseases, such as respiratory and circulatory diseases, diabetes, kidney disease and cancer, is higher among indigenous populations.[2] Similar to many other indigenous populations around world, indigenous Australians experience significant social exclusion, discrimination, multidimensional poverty and unemployment.[6,7]

In theory, indigenous Australians should have higher utilisation of healthcare services because of their poorer health and thus increased need.[8] However, it has been found that indigenous people living in both remote and non-remote areas of Australia experience lower use of healthcare services,[9] including low use of

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preventive care services, reduced access to specialist services, longer waiting times for surgeries and poor access to eye care services. Despite higher hospitalisation rates among indigenous people, their rate of specific surgical procedures was lower during the stay in hospital.[10] For example, indigenous people in the Australian state of Queensland were found to receive less cancer care than non-indigenous people, regardless of socio-economic background.[11]

Owing to several initiatives by the Australian Government, progress has recently been made in increasing access to and use of healthcare services among this vulnerable group.[12] The gap in the utilisation between indigenous and non-indigenous Australians has reduced for some healthcare services. For example, the rate of primary care service utilisation is slightly higher among indigenous Australians than non-indigenous Australians.[2] Despite this small improvement in healthcare service utilisation, there remains the possibility of inequity in healthcare services within the indigenous community of Australia.

Inequity in the use of healthcare services within the indigenous population may help explain why the gap in healthcare use between indigenous and non-indigenous populations persists in the Australia.[13] Examining heterogeneity and inequity in healthcare use within indigenous populations would inform us whether all members of this community are similarly disadvantaged in terms of using healthcare services.[14,15] Understanding the extent and causes of inequity in healthcare service utilisation is also important from a policy perspective.

A number of studies have examined inequity in healthcare related to socio-economic status (SES) in the general population.[16] There are also several studies on inequity in healthcare use and expenditure between the indigenous and non-indigenous populations in Australia.[14,17–19] However, to our knowledge, there are no previous studies analysing socio-economic inequity in the use of healthcare services within indigenous communities in Australia or other similar countries. Therefore, the objective of this study is to fill this gap in the literature by investigating socio-economic–related inequity in healthcare use among indigenous populations living in non-remote areas of Australia. This study also examined the role of income and other socio-economic factors on the degree and direction of inequity.

Methods

Study design and data

Indigenous Australians were defined as those who self-reported (or were identified by another household member) as being of Aboriginal, Torres Strait Islander or of Aboriginal and Torres Strait Islander origin. Indigenous Australians constitute approximately 3% of the total Australian population.[20] This study used data from the Australian Aboriginal and Torres Strait Islander Health Survey (AATSIHS), 2012–2013, which is a nationally representative cross-sectional survey of indigenous Australians. The Australian Bureau of Statistics (ABS) used a multistage stratified sampling technique to randomly select 10,362 households from both remote and non-remote areas of Australia.[4] With the response rate of 79.5%, a total of 12,947 individuals, aged ≥2 years, were interviewed from 8237 households.[4] About 8200 respondents aged ≥18 years completed the full questionnaire in the survey. Data were collected by face-to-face interviews with participants who lived in private dwellings. The AATSIHS collected a wide range of data on general health, long-term health conditions, health risk factors, healthcare services use and SES.[4]

Sample

The present study restricted the sample to indigenous individuals who lived in non-remote areas because information on some variables (e.g. private health insurance) was only available for the non-remote subpopulation. Data on visits to primary healthcare providers and specialists were also only available for the non-remote sample. Moreover, there are special arrangements for delivering healthcare services to remote areas of Australia and some of these services have different funding mechanisms. We also constrained our sample to participants aged ≥18 years as certain variables (e.g. mental health conditions) were not available for individuals aged <18 years who participated in the survey. Therefore, the final study population consisted of 2823 adult indigenous individuals living in non-remote areas of Australia. We excluded about 2% of the sample from the multivariate analysis due to missing data on income. However, distributions of outcome variables and other independent variables of the removed participants were not significantly different from the remaining participants.

Outcome measures

Data on healthcare use were self-reported in the AATSIH, 2012–2013. The probability of healthcare use was used as the dependant variable (binary outcome: use vs non-use). The following three binary measures of healthcare use were analysed: (1) whether the respondent consulted (visited) a general practitioner (GP) (i.e. the probability of GP visit) in the 2 weeks preceding the survey; (2) whether the participant had consulted (visited) a medical specialist (i.e. the probability of specialist visit) in the 2 weeks preceding the survey; and (3) whether the participant had stayed at least one night in the hospital (i.e. probability of inpatient admission) in the 12 months preceding of the survey.

Need and non-need variables

This study followed the current Australian and international literature[21–25] to select need and non-need variables. Variables measuring the need for healthcare services included age, gender, self-assessed health (SAH), mental health condition, disability status and diabetes diagnosis. SAH was stratified into five categories, ranging from excellent health to poor health. The mental health condition of participants was assessed using the Kessler Psychological Distress Scale (Kessler-5 or K5), which is a continuous variable ranging from 5 to 25, with higher scores indicating a greater level of psychological distress.[26] Disability status was measured as limitations in daily activities due to health problems and was recoded into three categories of none, moderate and severe. It is worth mentioning that earlier studies[21,22,25] used self-reported number of long-term health conditions to adjust for health need in the analysis; however, this variable could not be included in the current analysis because of missing information.

This study used equivalised household income in deciles as the measure of income. Individuals belonging to decile 1 were the poorest, whereas participants in decile 10 were the richest. The ABS applied modified Organisation for Economic Co-operation and Development (OECD) equivalence to calculate equivalised total weekly income of the households in the 2012–2013 AATSIHS.[4]

This study also included several non-need variables that may influence healthcare utilisation, namely, employment status, education, concession card status and private health insurance status. The Australian Federal Government offers concession cards to individuals with low income, pensioners and those receiving public allowances. Out-of-pocket (OOP) costs for concession cards are low or zero, particularly for GP visits.[27]

Statistical analyses

Stata/MP, version 13.1 (StataCorp LP, Texas, USA) was used for performing all the statistical analyses. The horizontal inequity (HI) method was used to measure and explain income-related inequity in healthcare use. HI refers to unequal use of healthcare services by income given the same level of need.[28,29] For this purpose, healthcare utilisation was modelled as a function of income, need and non-need variables:

$$y_i = \alpha + \beta income_i + \sum_k \lambda_k Z_{k,i} + \sum_\rho \delta_p X_{p,i} + \varepsilon_i \quad (1)$$

In Eq. (1), Z_k and X_p are the vectors of non-need and need variables, β, λ, and δ are the model coefficients, and ε_i is the error term. Logistic regression models were used to examine the relationship between healthcare utilisation and income after controlling for need and non-need variables. A statistically significant estimate of β would indicate inequity in healthcare use after adjusting for health need. The odds ratio (OR) is reported to present the results of the multivariate logistic regression models.

To measure inequity, an indirect standardisation method was used to adjust need for healthcare services.[30] Using the coefficients from Eq. (1), we obtained need-standardised use, $\widehat{y}_i^{IS}$, seen in Eq. (2):

$$\widehat{y}_i^{IS} = y_i - \widehat{y}_i^{X} + \widehat{y}^m \quad (2)$$

In Eq. (2), $\widehat{y}_i^{X}$ is the need-predicted utilisation for each individual based only on need variables. This was obtained by setting the values of income and other non-need variables equal to their sample average and setting the value of all need variables at the actual value for each individual. $\widehat{y}^m$ is the mean of predicted utilisation. Need-standardised refers to the average level of healthcare services an individual would have received given his or her health need.[30]

The concentration curve (CC) and the concentration index (CI) were used to present and quantify the level of inequality and inequity in healthcare use. The CC plots the cumulative proportion of healthcare use in the vertical axis against the cumulative share of population in the horizontal axis, ranked from lowest to highest by income.[30] The distribution of healthcare use would be equally distributed if the CC coincides with the 45-degree line or line of equality. Healthcare use would be concentrated among richer people if the CC is below the line of equality. In other words, there is a pro-rich inequality in health service utilisation. When need-standardised utilisation is plotted instead of the actual use, it shows inequity.

The extent of income-related inequity was quantified by estimating the HI index. To clarify, the CI of actual use measures income-related inequality, whereas the CI of need-standardised utilisation gives us the estimate of HI. The CI could be estimated as the covariance between the fractional rank of income and healthcare utilisation:

$$CI(y) = \frac{\mu}{2}\mathrm{cov}(y_i, r_i) \quad (3)$$

In Eq. (3), y_i refers to healthcare use by the individual i, r_i is the fractional rank of the individual in the income distribution and μ is the mean of the healthcare variable. CI ranges between −1 and +1; a positive value indicates a pro-rich inequality and a negative value implies pro-poor inequality. The HI index could be calculated by replacing y_i with $\widehat{y}_i^{IS}$ in Eq. (3). A positive (negative) and statistically significant HI index would suggest pro-rich (pro-poor) inequity in healthcare use. In other words, a positive HI index indicates a higher concentration of healthcare use among richer individuals, despite the same healthcare needs between the rich and the poor.

The measurement of inequality and inequity using the CI and HI is problematic when a healthcare use indicator is binary. In this case, the value of the index is influenced by the mean healthcare use and may not lie between +1 and −1.[31] An increase in the mean causes the value of the CI to shrink.[31] This problem can be addressed by applying either Wagstaff's[31] correction or Erreyger's normalisation.[32] In this study, we applied Erreygers's normalisation to address the aforementioned problem. The Erreygers's version of the CI (hereafter Erreygers's index or EI) and the HI (hereafter Erreygers's horizontal index or EHI) could be estimated as:

$$EI(y) = \frac{4\mu}{(b_y - a_y)} CI(y) = 4{*}\mu{*}CI(y) \quad (4)$$

In Eq. (4), b_y and a_y are the upper and lower bounds of the healthcare use variable.

Finally, we explained inequity using the decomposition approach, which partitions the factors contributing to inequity in healthcare use.[24,33] Using the model from Eq. (1), the decomposition Erreygers's index[34,35] could be written as:

$$EI(y) = 4\left[\beta * income^m * CI_{income} + \sum_k \lambda_k * Z_k^m * CI_{Z_k} + \sum_p \delta_p * X_p^m * CI_{X_p} + GCI_\varepsilon\right] \quad (5)$$

In Eq. (5), β, λ, and δ are the average of the marginal effects (AMEs) of income, other non-need and need variables, respectively, from the logistic regression model.[24,36] We used the margin command in Stata to calculate the AME. m denotes mean of the respective variable and GCI is the generalised CI. In the decomposition analysis, a factor explains inequality through the interaction of its marginal effect on healthcare use and own unequal distribution by income. In Eq. (5), the first part is the direct contribution of income, the second part is the contribution of other non-need variables, the third part is the contribution of need variables and the final part is the generalised CI of the residual term representing the unexplained component. The contribution of need variables is legitimate as healthcare utilisation should only depend on need.[29] The contributions of income and other non-need indicators are considered as illegitimate or unfair sources of inequality in healthcare use.[37]

Results

Table 1 shows that the proportion of indigenous Australians visiting a GP or specialist in the 2 weeks preceding the survey was about 25% and 7%, respectively. Approximately 23% of participants had been admitted to hospital as an inpatient in the 12 months before the survey. The proportion of healthcare use was higher among participants who reported fair or poor health compared with those reporting excellent or good health. There appears to be an income gradient in the probability of visiting a specialist. The results show that about 7% of individuals from the poorest households (decile 1) consulted a specialist compared with approximately 14% of participants in the richest households (decile 10). The proportion of indigenous Australians visiting a specialist was almost two-fold greater among private health insurance holders than those without private health insurance. Approximately 9% of indigenous individuals with ≥12 years of education visited a specialist; this was only about 2% for those who had received no formal education.

Table 1
Percentage distribution of healthcare service utilisation by independent variables (unadjusted).

Characteristic	No. of observation	GP visit[a]	Specialist visit[a]	Inpatient admission[b]
	(N)	(%)	(%)	(%)
Total	2823	24.67%	6.84%	22.66%
Gender				
Male	1155	19.50%	6.43%	17.88%
Female	1668	29.61%	7.23%	27.22%
Age				
18–24 years	486	20.11%	6.08%	19.78%
25–34 years	618	22.58%	5.07%	24.46%
35–44 years	638	22.87%	6.41%	22.74%
45–54 years	517	26.49%	8.56%	22.47%
55–65 years	316	34.67%	8.93%	26.37%
≥65 years	248	36.24%	10.20%	21.30%
Self-assessed health (SAH)				
Excellent	265	18.83%	3.64%	19.99%
Very good	692	16.27%	5.41%	18.49%
Good	1028	22.97%	5.62%	19.62%
Fair	567	33.69%	8.26%	28.74%
Poor	271	44.69%	17.16%	37.82%
Disability				
None	1414	17.98%	3.52%	16.53%
Moderate	1152	29.08%	7.63%	28.22%
Severe	257	47.00%	24.68%	35.60%
Psychological distress [c]				
Low/moderate	1920	20.53%	5.27%	18.73%
High	903	33.16%	10.07%	31.13%
Diabetes				
No	2566	22.00%	6.13%	20.77%
Yes	257	35.00%	9.91%	30.76%
Household income				
Decile 1 (Poorest)	717	26.42%	7.13%	27.14%
Decile 2	382	25.74%	4.32%	22.94%
Decile 3	363	29.73%	9.79%	22.14%
Decile 4	341	21.72%	6.36%	19.79%
Decile 5	236	29.99%	4.06%	18.13%
Decile 6	198	20.18%	8.26%	25.01%
Decile 7	173	18.79%	6.39%	15.29%
Decile 8	157	21.86%	8.56%	26.18%
Decile 9	113	15.82%	5.83%	25.63%
Decile 10 (richest)	69	19.96%	13.53%	19.64%
Private health insurance				
No	2244	24.22%	5.86%	23.24%
Yes	579	26.44%	10.77%	20.64%
Concession card				
No	1101	19.56%	6.07%	16.63%
Yes	1722	28.51%	7.52%	27.06%
Education				
Year 12 or older	731	23.66%	9.02%	21.16%
Year 9–11	1666	23.95%	5.75%	22.93%
Year 8 or younger	404	30.33%	7.12%	23.75%
Never attended	23	24.97%	2.47%	42.51%
Employment				
Employed	1273	20.05%	5.18%	17.69%
Unemployed	299	20.83%	5.58%	19.42%
Out of labour force	1253	31.76%	9.35%	30.00%

[a] In the 2 weeks preceding the survey.
[b] In the 12 months preceding the survey.
[c] Assessed using the Kessler Psychological Distress Scale.

Table 2 reports the ORs with 95% confidence intervals from the logistic regression models. The likelihood of visiting a GP was 1.5 times (OR: 1.47, $P = 0.021$) higher for women than men. Individuals with poor health visited a GP or specialist more than those with better health. For example, the odds of visiting a specialist for people reporting poor health was about 2.3 (OR: 2.29, $P = 0.038$) times higher than for those reporting excellent health. Results show that high Kessler 5 scores, moderate or severe disability status and presence of diabetes significantly increased the likelihood of using all three types of healthcare services.

Household income was not correlated with the likelihood of visiting a GP or inpatient admission (Table 2). However, a significant association was found between income and the probability of visiting a healthcare specialist. For example, the likelihood of visiting a specialist was about 3 times (OR: 2.96, $P = 0.028$) higher for respondents from the highest income decile compared with their counterparts in the lowest income decile. Private health insurance was a significant predictor of GP and specialist visits. For example, the probability of visiting a specialist was more than double (OR: 2.14, $P = 0.001$) for private health insurance holders compared to those with no private health insurance. Participants with higher levels of education had a significantly higher likelihood of visiting a specialist (Table 2); however, education was not significantly associated with GP visits or inpatient admissions.

Table 2
Correlates of the probability of healthcare service utilisation (logistic regression models).

Characteristic	GP visit	Specialist visit	Inpatient admission
	Adjusted OR (95% confidence interval)	Adjusted OR (95% confidence interval)	Adjusted OR (95% confidence interval)
Gender			
Female	1.47*** (1.21–1.77)	0.85 (0.61–1.17)	1.33*** (1.10–1.63)
Age			
18–24 years	Reference	Reference	Reference
25–34 years	1.26 (0.93–1.71)	0.97 (0.57–1.67)	1.31 (0.98–1.75)
35–44 years	1.03 (0.75–1.41)	0.81 (0.46–1.41)	0.84 (0.62–1.14)
45–54 years	1.34 (0.96–1.87)	0.96 (0.55–1.71)	0.75 (0.54–1.06)
55–65 years	1.23 (0.84–1.79)	0.84 (0.44–1.59)	0.78 (0.53–1.15)
≥65 years	1.84*** (1.20–2.82)	0.91 (0.41–2.00)	0.65 (0.41–1.03)
Self-assessed health (SAH)			
Excellent	Reference	Reference	Reference
Very good	1.22 (0.83–1.79)	0.79 (0.39–1.61)	1.00 (0.70–1.43)
Good	1.29 (0.89–1.87)	1.13 (0.59–2.16)	0.85 (0.60–1.21)
Fair	1.64** (1.10–2.46)	1.32 (0.65–2.66)	1.06 (0.72–1.57)
Poor	1.92*** (1.21–3.05)	2.29** (1.05–4.98)	1.37 (0.87–2.16)
Psychological distress[a]	1.05*** (1.02–1.07)	1.04** (1.00–1.08)	1.02 (1.00–1.04)
Disability			
No	Reference	Reference	Reference
Moderate	1.56*** (1.26–1.92)	2.08*** (1.38–3.15)	1.75*** (1.40–2.18)
Severe	2.84*** (2.03–3.97)	4.84*** (2.80–8.36)	2.20*** (1.55–3.13)
Diabetes Yes	1.48*** (1.20–1.84)	1.49** (1.03–2.14)	1.32** (1.05–1.66)
Household Income			
Decile 1 (Poorest)	Reference	Reference	Reference
Decile 2	0.99 (0.74–1.32)	1.14 (0.68–1.93)	0.70** (0.51–0.94)
Decile 3	1.09 (0.81–1.47)	1.13 (0.65–1.96)	0.84 (0.62–1.14)
Decile 4	0.93 (0.67–1.30)	1.47 (0.82–2.64)	0.72 (0.51–1.02)
Decile 5	1.24 (0.84–1.83)	1.04 (0.46–2.35)	0.88 (0.57–1.35)
Decile 6	1.01 (0.66–1.55)	2.64*** (1.29–5.39)	1.16 (0.74–1.83)
Decile 7	0.95 (0.60–1.52)	2.11 (0.95–4.66)	0.94 (0.56–1.56)
Decile 8	0.82 (0.49–1.36)	1.68 (0.74–3.82)	1.42 (0.87–2.31)
Decile 9	1.04 (0.60–1.80)	2.70** (1.13–6.48)	1.57 (0.89–2.77)
Decile 10 (Richest)	1.20 (0.64–2.26)	2.96** (1.13–7.77)	1.44 (0.74–2.80)
Private health insurance	1.38** (1.07–1.78)	2.14*** (1.38–3.31)	1.03 (0.78–1.36)
Concession card	1.12 (0.85–1.46)	1.25 (0.74–2.12)	1.13 (0.84–1.51)
Education			
Year 12 or above	Reference	Reference	Reference
Year 9–11	0.88 (0.70–1.10)	0.68** (0.46–1.00)	0.91 (0.72–1.14)
Year 8 or below	0.81 (0.58–1.13)	0.52** (0.29–0.94)	0.73 (0.51–1.05)
Never attended	0.88 (0.33–2.30)	0.27 (0.03–2.41)	1.74 (0.67–4.50)
Employment			
Employed	Reference	Reference	Reference
Unemployed	0.95 (0.66–1.38)	1.33 (0.70–2.53)	0.97 (0.65–1.43)
Out of labour force	1.12 (0.85–1.47)	1.23 (0.74–2.03)	1.57*** (1.18–2.08)
Observations	2748	2748	2748
Pseudo R-squared	0.0815	0.107	0.0556
Log likelihood	−1492	−619.1	−1421

OR, odds ratio; GP, general practitioner.
Significance levels: *** $P < 0.01$ and ** $P < 0.05$.
[a] OR for one-point increase in Kessler 5 score.

The CC for the observed probability of a specialist visit is below the line of equality in the lower and upper part of the distribution, but is tangential to the line of equality in the middle of the distribution (see Fig. 1). The value of the EI for actual visit to a specialist is 0.020 ($P = 0.086$), which suggests a pro-rich inequality in the probability of visiting a specialist. The distribution of need-predicted visit was concentrated among the poorer subgroup as the CC lies above the 45-degree line. On the other hand, the CC of the probability of visiting a specialist after adjusting for need (need-standardised) is below the line of equality. These results indicate a pro-rich inequity in the distribution of probability for visiting a specialist. For example, the poorest 40% of indigenous Australians only had a 22% probability of visiting a specialist when their level of need for this service was same as the richest subpopulation; the EHI index measuring inequity is 0.016 ($P < 0.001$). This confirms that the distribution of specialist visits was concentrated among richer indigenous individuals, although their level of need was similar to poorer indigenous people.

Table 3 presents results from the Erreygers's decomposition analysis of income-related inequality for the probability of visiting a specialist. A variable contributed (column D) to the inequality when it was associated with a specialist visit (the AME in column B) and was unequally distributed by across the income groups (the CI in column C). The contributions were calculated as the product of columns A, B and C. Variation in specialist visits due to need is expected. Therefore, the contributions of need variables explain a legitimate part of the inequality. However, contributions by income and other non-need factors lead to the inequity because use of specialists should not be dependent upon these variables. In Fig. 2, we summarised the contributions of inequity to specialist visit probability using the subtotal of each non-need variable of column D in Table 3.

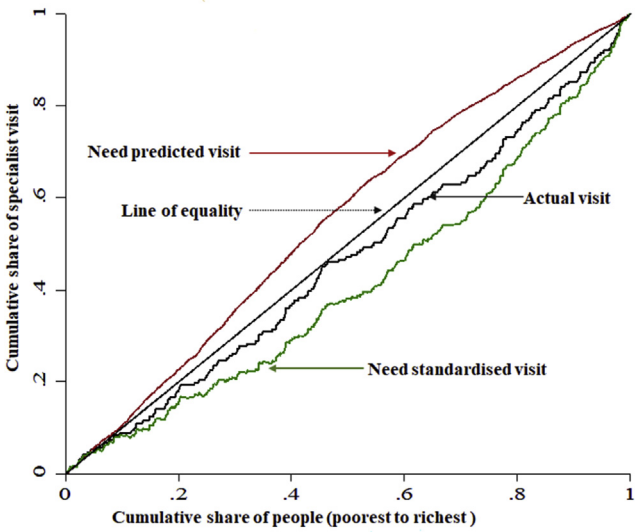

Fig. 1. Concentration curves for the probability of specialist visit.

Need-related variables had a mostly negative contribution to the overall inequality as need was more concentrated among individuals with lower incomes (negative CIs). Among the need indicators, disability status (52%) accounted for the highest contribution, followed by SAH (42%). Fig. 2 shows that income was the largest contributor of pro-rich inequity in specialist healthcare visits, and this was a positive contribution. In other words, inequality in income and its positive association with specialist visits was accountable for pro-rich inequity. If the likelihood of visiting a specialist was equal across all income groups, the distribution of the bar representing income would be zero in Fig. 2. Private health insurance accounted for about 89% of the pro-rich inequity in specialist visits. This is due to the fact that the probability of visiting a specialist increased with private health insurance (positive AME) and the distribution of private health insurance was pro-rich (positive CI). The contribution of education to inequity was also pro-rich. On the other hand, concession cards and employment negatively contributed towards the inequity observed in visiting a specialist, which moved inequity towards poorer individuals. However, the AMEs of concession card and employment indicate that these variables were not associated with specialist visit probability.

Discussion

Although several studies have examined the gap in healthcare access between indigenous and non-indigenous people, there was no empirical evidence on inequity in healthcare use within the indigenous community in developed countries. This study used data from a unique survey to examine, measure and explain income-related inequity in healthcare use among the indigenous populations living in non-remote areas of Australia. The results show that the probability of visiting a GP in the last 2 weeks and inpatient admission in the last year was not substantially associated with income, after adjusting for need and other socio-economic factors. However, we found a pro-rich inequity in the probability of visiting a specialist. In other words, wealthier indigenous Australians had a higher probability of using specialist services compared to their poorer counterparts, after adjusting for need. Decomposition analysis shows that income inequality, unequal distribution of private health insurance and inequality in education were the main factors contributing to the pro-rich inequity in specialist visit probability.

The findings show no consistent relationship between education and income with GP visit or hospital admission and are in line with a previous study from Australia.[14] Higher concentrations of these services among poorer indigenous individuals is consistent with the results for the general population in Australia.[21,22] In Australia, about 85% of GP visits do not incur any OOP costs, and inpatient hospital services in public hospitals are provided with no OOP payment to public patients.[38] Therefore, the minimal financial burden to use these services should lead to minimal inequity between the rich and poor. These findings are consistent with the evidence found in most of the European countries and Canada.[16,24,39,40] The present study did not find any association between GP utilisation and concession card status, which is in contrast with current evidence showing higher utilisation of GP services by concession care holders (e.g. pensioners, low-income earners) in Australia.[41]

The finding of a pro-rich inequity in specialist visits is in line with results from studies of the general population in Australia and other developed countries.[16,21,22] Utilisation of specialist services could incur substantial OOP costs in the Australian setting.[42] For instance, copayment was required for in approximately 34% of medical specialist visits made by indigenous individuals in non-remote areas in 2012–13.[2] Therefore, inequity in specialist services favouring richer indigenous individuals might be a result of this financial barrier. However, understanding the link between OOP costs and pro-rich bias in the distribution of specialist services requires further investigation.

Language and cultural barriers have the potential to negatively impact access to specialist healthcare services by low-income indigenous individuals.[43] For many indigenous persons, English is a second language. Cultural factors include the indigenous conceptualisation of health (a much more holistic approach that includes spiritual and community well-being), the importance of kinship (and hence of relatives being able to accompany the patient), the separation of affairs into men's and women's business, and the experience of previous racism and disadvantage. All of these factors contribute to the discomfort of the patient and the imbalance of power, leading to greater reluctance to visit specialists.[44]

Results from the decomposition analysis reveal that income inequality was the largest contributor to the observed pro-rich inequity in specialist visit probability within the non-remote indigenous Australians. After income, inequality in private insurance status played a significant role in explaining the extent of pro-rich inequity in specialist visit; the impact of education was also found to be a contributor to this inequity. These results are similar to the findings for pro-rich inequity in specialist visits among other population groups in Australia and several OECD countries.[22,23,25,45]

This study has a few limitations. For example, the cross-sectional design of the AATSIHS precluded the authors to draw causal interpretations from the findings of this study. The availability of longitudinal data could resolve this limitation and a life-course perspective would also be useful to the conclusions. Owing to data limitation, this study used fewer indicators of need (e.g. number of chronic conditions) compared with other studies.[21,22] This study may have underestimated the extent of inequity, as the prevalence of need is generally higher among poorer people.[16] Previous studies have demonstrated a weak relationship between the utilisation of healthcare services and income for indigenous Australians.[14] It is worth noting that errors in income measurement could undermine the identification of a systematic association between income and healthcare use among

Table 3
Factor contributors of inequality in the probability of specialist visit (Erreygers's decomposition analysis).

Contributing factors	A	B	C	D = 4(A*B*C)	E = (D/EI)
	Mean	AME	CI	Contribution	% contribution
Need					
Female (Ref: male)	0.591	−0.010	−0.055	0.001	0.065
Age (Ref: 18–24 years)					
25–34	0.219	−0.002	−0.019	0.000	0.002
35–44	0.226	−0.013	0.088	−0.001	−0.052
45–54	0.183	−0.002	0.082	0.000	−0.006
55–65	0.112	−0.010	−0.047	0.000	0.011
≥65+	0.088	−0.006	−0.148	0.000	0.016
Total of age				*−0.001*	*−0.030*
Self-assessed health (Ref: excellent)					
Very good	0.245	−0.014	0.133	−0.002	−0.091
Good	0.364	0.007	0.010	0.000	0.005
Fair	0.201	0.017	−0.124	−0.002	−0.085
Poor	0.096	**0.050**	−0.255	−0.005	−0.247
Total of self-assessed health				*−0.008*	*−0.418*
Psychological distress	10.190	**0.002**	−0.059	−0.005	−0.240
Disability (Ref: none)					
Moderate	0.408	**0.044**	−0.053	−0.004	−0.190
Severe	0.091	**0.095**	−0.191	−0.007	−0.330
Total of disability				*−0.010*	*−0.521*
Diabetes	0.091	**0.024**	−0.096	−0.001	−0.099
Non-need					
Household Income (Ref: decile 1)					
Decile 2	0.139	0.008	−0.341	−0.002	−0.076
Decile 3	0.132	0.007	−0.069	0.000	−0.013
Decile 4	0.124	0.023	0.187	0.002	0.107
Decile 5	0.086	0.003	0.396	0.000	0.020
Decile 6	0.072	**0.058**	0.554	0.009	0.463
Decile 7	0.063	0.045	0.690	0.008	0.391
Decile 8	0.057	0.031	0.811	0.006	0.287
Decile 9	0.041	**0.060**	0.909	0.009	0.447
Decile 10	0.025	**0.065**	0.975	0.006	0.317
Total of household income				*0.039*	*1.943*
Private health insurance	0.205	**0.046**	0.464	0.018	0.875
Concession card	0.610	0.014	−0.291	−0.010	−0.497
Education (Ref: year 12 or older)	0.259				
Year 9–11	0.590	**−0.024**	−0.039	0.002	0.110
Year 8 or younger	0.143	**−0.039**	−0.264	0.006	0.294
Never attended	0.008	−0.078	−0.374	0.001	0.047
Total of education				*0.009*	*0.452*
Employment (Ref: employed)					
Unemployed	0.106	0.017	−0.336	−0.002	−0.121
Out of labour force	0.444	0.012	−0.330	−0.007	−0.352
Total of employment				*−0.009*	*−0.473*
Generalised CI of residual				−0.002	−0.057

AME, average marginal effect; CI, concentration index.
Significant AMEs are in bold, at the significance level of 0.05.

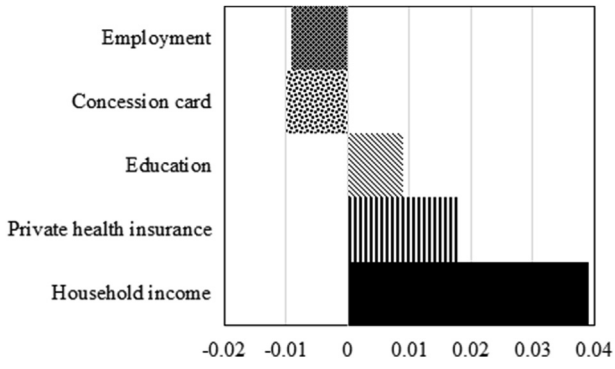

Fig. 2. Contributing factors of inequity in the probability of specialist visit.

indigenous Australians.[46] Traditional definitions of income for the indigenous population could possibly mask this relationship, and further research should explore the issue using different measures of income or SES. Unavailability of data on the cost of using healthcare services precludes understanding the implications of financial barriers to inequity. Finally, we applied the conventional approach to study inequity, which might not be appropriate for analysing inequity in a vulnerable population group, such as indigenous Australians.

Conclusions

This study presents the first analysis of income-related inequity in healthcare service use within the indigenous Australian population from non-remote areas. We found that income was not a significant predictor of the probability of GP visit or inpatient admission. However, the distribution of specialist visit probability was pro-rich, after adjusting for health need. Income inequality, unequal distribution of private health insurance and inequality in education were the key factors of this pro-rich inequity in specialist visit. There is a need for policies to reddress this inequity faced by low-income indigenous people living in non-remote areas of Australia.

Author statements

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Ethical approval

The study used secondary data from the AATSIHS, 2012–2013. As a part of the PhD thesis, this study was approved by the University of Technology Sydney Human Research Ethics Committee (UTS HREC). The ethics application number is UTS HREC ETH17-1317.

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Competing interests

The authors declare that they have no conflicts of interest.

References

1. Hill K, Barker B, Vos T. Excess Indigenous mortality: are Indigenous Australians more severely disadvantaged than other Indigenous populations? *Int J Epidemiol* 2007 Jun;**36**(3):580–9.
2. Australian Health Ministers' Advisory Council. *Aboriginal and Torres Strait islander health performance framework 2017*. Report [Internet]. Canberra. 2017. Available from: https://www.niaa.gov.au/resource-centre/indigenous-affairs/health-performance-framework-2017-report.
3. Australian Institute of Health and Welfare. *Australian burden of disease study: impact and causes of illness and death in aboriginal and Torres Strait islander people 2011* [Internet]. Canberra. 2016 (Australian Burden of Disease Study series). Report No.: 6. Cat. no. BOD 7. Available from: https://www.aihw.gov.au/reports/burden-of-disease/australian-bod-study-2011-indigenous-australians/contents/table-of-contents.
4. Australian Bureau of Statistics. *Australian aboriginal and Torres Strait islander health survey: users' guide, 2012-13* [Internet]. Canberra: Australian Bureau of Statistics. 2013 [cited 2019 Jul 20]. Available from: https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4727.0.55.002main+features12012-13.
5. Thurber KA, Joshy G, Korda R, Eades SJ, Wade V, Bambrick H, et al. Obesity and its association with sociodemographic factors, health behaviours and health status among Aboriginal and non-Aboriginal adults in New South Wales, Australia. *J Epidemiol Community Health* 2018 Jun 1;**72**(6):491–8.
6. Zhao Y, Vemuri SR, Arya D. The economic benefits of eliminating Indigenous health inequality in the Northern Territory. *Med J Aust* 2016 Sep;**205**(6):266–9.
7. Biddle N, Taylor J. Demographic consequences of the 'closing the gap' indigenous policy in Australia. *Popul Res Pol Rev* 2012 Aug;**31**(4):571–85.
8. Gubhaju L, McNamara BJ, Banks E, Joshy G, Raphael B, Williamson A, et al. The overall health and risk factor profile of Australian Aboriginal and Torres Strait Islander participants from the 45 and up study. *BMC Publ Health* 2013 Dec;**13**(1):661.
9. Kelaher M, Ferdinand A, Taylor H. Access to eye health services among indigenous Australians : an area level analysis. *BMC Ophthalmol* 2012;**12**(1):1.
10. Cunningham J. Diagnostic and therapeutic procedures among Australian hospital patients identified as indigenous. *Med J Aust* 2002 Jan;**176**(2):58–62.
11. Moore SP, Green AC, Bray F, Garvey G, Coory M, Martin J, et al. Survival disparities in Australia: an analysis of patterns of care and comorbidities among indigenous and non-indigenous cancer patients. *BMC Canc* 2014 Dec;**14**(1):517.
12. Australian Institute of Health and Welfare. *Australia's health 2016*. Canberra. 2016. Report No.: Australia's health series no. 15. Cat. no. AUS 199.
13. Marrone S. Understanding barriers to health care: a review of disparities in health care services among indigenous populations. *Int J Circumpolar Health* 2012;**66**(3):188–98.
14. Whelan S, Wright DJ. Health services use and lifestyle choices of Indigenous and non-Indigenous Australians. *Soc Sci Med* 2013 May;**84**:1–12.
15. Zhao Y, You J, Wright J, Guthridge SL, Lee AH. Health inequity in the Northern territory, Australia. *Int J Equity Health* 2013;**12**(1):79.
16. Devaux M. Income-related inequalities and inequities in health care services utilisation in 18 selected OECD countries. *Eur J Health Econ* 2015 Jan;**16**(1):21–33.
17. Ou L, Chen J, Hillman K, Eastwood J. The comparison of health status and health services utilisation between Indigenous and non-Indigenous infants in Australia. *Aust N Z J Publ Health* 2010;**34**(1):50–6.
18. Angell B, Laba TL, Lung T, Brown A, Eades S, Usherwood T, et al. Healthcare expenditure on Indigenous and non-Indigenous Australians at high risk of cardiovascular disease. *Int J Equity Health* 2017;**16**(1):108.
19. Sveticic J, Milner A, De Leo D. Contacts with mental health services before suicide: a comparison of Indigenous with non-Indigenous Australians. *Gen Hosp Psychiatr* 2012 Mar 1;**34**(2):185–91.
20. Australian Bureau of Statistics. *The census of population and housing*. 2016 [Internet]. Canberra. 2017 [cited 2019 Jul 20]. Available from: https://www.abs.gov.au/websitedbs/censushome.nsf/home/2016.
21. Hajizadeh M, Connelly LB, Butler JRG. Health policy and horizontal inequities of health-care utilization in Australia: 1983–2005. *Appl Econ Lett* 2012;**19**:1765–75.
22. van Doorslaer E, Clarke P, Savage E, Hall J. Horizontal inequities in Australia's mixed public/private health care system. *Health Pol* 2008;**86**(1):97–108.
23. Allin S, Hurley J. Inequity in publicly funded physician care: what is the role of private prescription drug insurance? *Health Econ* 2009 Oct;**18**(10):1218–32.
24. van Doorslaer E, Koolman X, Jones AM. Explaining income-related inequalities in doctor utilisation in Europe. *Health Econ* 2004 Jul;**13**(7):629–47.
25. Pulok MH, van Gool K, Hall J. Inequity in physician visits: the case of the unregulated fee market in Australia. *Soc Sci Med* 2020 Jun 1;**255**:113004.
26. Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SLT, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol Med* 2002 Aug;**32**(6):959–76.
27. Mu C, De Abreu Lourenco R, van Gool K, Hall J. Is low-priced primary care bad for quality? Evidence from Australian general practice. *Appl Econ* 2018 Jan;**50**(5):475–91.
28. Wagstaff A, van Doorslaer E. Measuring and testing for inequity in the delivery of health care. *J Hum Resour* 2000;**35**(4):716–33.
29. Pulok MH, van Gool K, Hajizadeh M, Allin S, Hall J. Measuring horizontal inequity in healthcare utilisation: a review of methodological developments and debates. *Eur J Health Econ* 2020;**21**(2):171–80.
30. O'Donnell O, van Doorslaer E, Wagstaff A, Lindelow M. *Analyzing health equity using household survey data: a guide to techniques and their implementation*. Washington, D.C.: The World Bank; 2008.
31. Wagstaff A. The bounds of the concentration index when the variable of interest is binary, with an application to immunization inequality. *Health Econ* 2005 Apr;**14**(4):429–32.
32. Erreygers G. Correcting the concentration index. *J Health Econ* 2009;**28**(2):504–15.
33. Wagstaff A, van Doorslaer E, Watanabe N. On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam. *J Econom* 2003 Jan;**112**(1):207–23.
34. García-Gómez P, Hernández-Quevedo C, Jiménez-Rubio D, Oliva-Moreno J. Inequity in long-term care use and unmet need: two sides of the same coin. *J Health Econ* 2015;**39**:147–58.
35. van de Poel E, van Doorslaer E, O'Donnell O. Measurement of inequity in health care with heterogeneous response of use to need. *J Health Econ* 2012;**31**(4):676–89.
36. Walsh B, Silles M, O'Neill C. The role of private medical insurance in socio-economic inequalities in cancer screening utilisation in Ireland. *Health Econ* 2012 Oct;**21**(10):1250–6.
37. Fleurbaey M, Schokkaert E. Unfair inequalities in health and health care. *J Health Econ* 2009 Jan;**28**(1):73–90.
38. Wong CY, Hall J. Does patients' experience of general practice affect the use of emergency departments? Evidence from Australia. *Health Pol* 2018 Feb;**122**(2):126–33.
39. Allin S. Does equity in healthcare use vary across Canadian provinces? *Healthc Policy* 2008 May;**3**(4):83–99.
40. Jiménez-Rubio D, Smith PC, Van Doorslaer E, Jimnez-Rubio D, Smith PC, Van Doorslaer E. Equity in health and health care in a decentralised context: evidence from Canada. *Health Econ* 2008 Mar;**17**(3):377–92.
41. Korda RJ, Banks E, Clements MS, Young AF. Is inequity undermining Australia's 'universal' health care system? Socio-economic inequalities in the use of specialist medical and non-medical ambulatory health care. *Aust N Z J Publ Health* 2009 Oct;**33**(5):458–65.
42. Freed GL, Allen AR. Variation in outpatient consultant physician fees in Australia by specialty and state and territory. *Med J Aust* 2017 Mar;**206**(4):176–80.

43. Li J-L. Cultural barriers lead to inequitable healthcare access for aboriginal Australians and Torres Strait Islanders. *Chin Nurs Res* 2017 Dec;**4**(4):207–10.
44. Laverty M, McDermott DR, Calma T. Embedding cultural safety in Australia's main health care standards. *Med J Aust* 2017 Jul 3;**207**(1):15–16.e1.
45. Allin S, Masseria C, Mossialos E. Equity in health care use among older people in the UK: an analysis of panel data. *Appl Econ* 2011 Jul;**43**(18):2229–39.
46. Taylor J, Gray M, Hunter B. *Health expenditure, income and health status among indigenous and other Australians. Canberra.* , Australia: ANU Press; 2004. p. 1–84.