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ORIGINAL ARTICLE

# Socioeconomic disparities in self-reported arthritis for Indigenous and non-Indigenous Australians aged 18–64

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## Abstract

*Objective* To examine socioeconomic disparities in arthritis among non-remote Indigenous and non-Indigenous Australian adults aged 18–64.

*Methods* Weighted data on self-reported arthritis and several socioeconomic measures from two nationally representative surveys conducted in 2004–2005 were analysed using logistic regression.

*Results* Current diagnosed arthritis was more commonly reported by Indigenous than non-Indigenous people across all age groups. After adjusting for age and sex, arthritis was significantly more common among those of lower socioeconomic status (SES) in the non-Indigenous population for all SES variables examined. In the Indigenous population, associations between SES and arthritis were significant for household income and employment status, but not for education, post-school qualifications, home ownership, area-level disadvantage, or area of residence.

*Conclusions* The SES disparities were less consistent in the Indigenous than the non-Indigenous population, and within the Indigenous population, they were less consistent for arthritis than those previously reported for diabetes among the same survey participants. Although some of the differences may be due to self-reporting of disease, these findings also suggest the potential salience of factors occurring *across* the SES spectrum, especially among Indigenous Australians.

**Keywords** Indigenous Australian · Arthritis · Socioeconomic status · Health disparities

## Introduction

Arthritis is an important cause of long-term disability worldwide. In 2004, an estimated 175 million people had osteoarthritis (OA) or rheumatoid arthritis (RA), with about 55 million of them (31%) experiencing moderate or severe disability (World Health Organization 2008). In Australia, an estimated 3 million people have arthritis, and OA and RA together accounted for over $1.3 billion in direct expenditure on health services in 2004–2005 (Australian Institute of Health and Welfare 2009).

Significantly higher prevalence of arthritis among those of lower socioeconomic status (SES) has been found in a number of developed countries, including the US (Callahan et al. 2008; CDC 2002; Sturm and Gresenz 2002), Canada (Cañizares et al. 2008), Germany (Schneider et al. 2006), Denmark (Pedersen et al. 2006), Sweden (Bengtsson et al. 2005), and Australia (Busija et al. 2007).

In general, those of lower SES are exposed to more challenging physical and social environments than those of higher SES, but they have fewer financial, social, psychological, and biological resources to deal with them (Adler and Snibbe 2003). Such a situation may alter chronic disease risk through a range of neuroendocrine, autonomic, metabolic, immune, and/or behavioural pathways (Brunner and Marmot 1999). Of particular interest with respect to arthritis is the apparent inverse relationship between SES and markers of inflammation, such as C-reactive protein and fibrinogen (Nazmi and Victora 2007; Pollitt et al. 2007; Tabassum et al. 2008). Inflammation is a core component of RA, and while OA has traditionally been

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thought of as a degenerative disease, it is increasingly being viewed as having an important inflammatory component (Katz et al. 2010; Sowers and Karvonen-Gutierrez 2010). Indeed, Katz et al. (2010) have suggested that OA and the metabolic syndrome share common pathogenic mechanisms. Thus, a relationship between low SES and arthritis is biologically plausible.

Indigenous Australians, who represent approximately 2.5% of the total Australian population, are disadvantaged relative to other Australians on a range of measures. They have lower education, employment, income, and home ownership, higher levels of smoking, obesity, and injury, poorer health status, and lower life expectancy (Australian Bureau of Statistics and Australian Institute of Health and Welfare 2008). They are more likely to report arthritis than their non-Indigenous counterparts after adjusting for age, but are less likely to be hospitalised or receive a total knee or hip replacement (Australian Institute of Health and Welfare 2009).

Little is known about the relationship between SES and arthritis within the Indigenous population. Previous reports have shown significant relationships between low SES and increased prevalence of other chronic conditions including diabetes (Cunningham et al. 2008; Cunningham 2010a), cardiovascular disease (Cunningham 2010b), and end-stage kidney disease (Cass et al. 2001, 2002), but not asthma (Cunningham 2010c).

The aim of the current study was to examine socioeconomic disparities in arthritis among a nationally representative sample of Indigenous Australian adults in non-remote areas and compare these with corresponding disparities among non-Indigenous Australians. It cannot be assumed that the relationships are the same in the two populations because specific measures of SES are not necessarily equivalent in different population groups; for example, they may have different meanings in different social groups, and they may not adequately measure all relevant aspects of what they purport to measure (Braveman et al. 2005; Williams et al. 2010). In addition, some potentially relevant exposures, such as racism and discrimination (Paradies 2006), stress (Walker et al. 1999; Fitzgerald 2009), and a legacy of loss, grief and dispossession (Human Rights and Equal Opportunity Commission 1997), may occur among Indigenous people across the SES spectrum.

## Methods

Data for Indigenous and non-Indigenous adults aged 18–64 were taken from two national surveys conducted in parallel by the Australian Bureau of Statistics (ABS) in 2004–2005: the National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and the National Health Survey (NHS). These two surveys had very similar content, and in most cases, the wording of questions on particular topics was identical (Australian Bureau of Statistics 2006a). This analysis is limited to responses to questions deemed by the ABS to be comparable in the two surveys (Australian Bureau of Statistics 2006b). Although the NATSIHS was conducted in both remote and non-remote areas, there were some differences in survey methodology in the two areas, and information on arthritis sub-type was only collected in non-remote areas (Australian Bureau of Statistics 2006c). Thus, only participants from non-remote areas are considered here, and the section below describes the methodology used in non-remote areas.

Extensive details on survey methodology have been published elsewhere (Australian Bureau of Statistics 2006a, b, c, d, e, f). Briefly, both surveys were conducted using multi-stage sampling strategies, with the first stage involving random selection of census collection districts and subsequent stages involving selection of dwellings and individuals within households (Australian Bureau of Statistics 2006c, f). Both surveys were limited to usual residents of private dwellings, were conducted by trained ABS interviewers, and used computer-assisted interview techniques. Adults aged 18 and above were personally interviewed. More details about the design, conduct, and results of the surveys are available elsewhere (Australian Bureau of Statistics 2006a, b, c, d, e, f).

To allow interested researchers to access data, the ABS created a confidentialised unit record file (CURF) for the NATSIHS, which includes unit records for Indigenous respondents of the 2004–2005 NATSIHS and the 2004–2005 NHS, as well as unit records for non-Indigenous respondents from the 2004–2005 NHS (Australian Bureau of Statistics 2006b). Although the CURF contains unit records for participants of all ages ($n = 35{,}950$), this analysis is limited to the 18,340 respondents (3,220 Indigenous and 15,120 non-Indigenous) who were aged 18–64 and living in non-remote areas. The exclusion of those aged 65 and above ($n = 4{,}178$) was due to uncertainty about the applicability of socioeconomic indicators among older people, as well as the relatively small size of this group in the Indigenous population (Australian Bureau of Statistics and Australian Institute of Health and Welfare 2008). Children under 18 years ($n = 10{,}923$) were excluded due to very low prevalence of the outcomes of interest, as well as to inadequate information on SES. The exclusion of those living in remote areas ($n = 2{,}509$) was due to lack of data on specific types of arthritis, as noted above.

### Definition of arthritis, OA, and RA

Participants were classified as having the outcomes of interest based on their responses to a series of questions.

Respondents were first asked whether they had ever had arthritis, rheumatism, or gout. Those who responded positively to arthritis were then asked to indicate what type of arthritis they had: OA, RA, or another type (to be specified). All respondents reporting any history of arthritis were then asked whether their arthritis was current, and whether they had been told they had arthritis by a doctor or nurse (Australian Bureau of Statistics 2006c).

For the purposes of the analyses reported here, arthritis was defined as any self-reported current arthritis diagnosed by a doctor or nurse. Similarly, OA and RA were defined as current diagnosed arthritis for which the type was reported as OA or RA, respectively. The comparison group included only those participants who reported that they did not currently have the condition of interest. For example, those who reported current RA but said it had not been diagnosed by a doctor or nurse were excluded from the primary analysis of RA. Additional sensitivity analysis was conducted comparing those with any current arthritis/OA/RA with those with no current arthritis/OA/RA, and comparing current diagnosed arthritis/OA/RA with all others (including those with current arthritis/OA/RA that was not diagnosed); results did not change appreciably (data not shown).

### Socio-demographic factors

Information was available on a range of socioeconomic and demographic factors, including age, sex, educational attainment, non-school qualifications, employment status, household income, home ownership (Indigenous respondents only), area of residence, and area-level disadvantage. Information about age, sex, and whether the respondent was currently attending school was provided by 'any responsible adult' within the household; information about the dwelling (including tenure) and the income of non-participant household members (required to calculate household income) was provided by a household 'spokesperson', chosen on the basis of his or her ability to provide accurate information. Information relating to geography (including remoteness classification and area-level disadvantage score) was provided by the ABS based on the census collection district in which the selected dwelling was located. All other information used in this analysis was provided by the respondent (Australian Bureau of Statistics 2006c).

### Statistical analysis

All analyses were conducted using Stata version 10.0 via the ABS's Remote Access Data Laboratory (RADL). Under the RADL system, analysts submit statistical code to the ABS; the code is then run, and the output made available to the analyst through a password-protected web account. Analysts do not have direct access to unit record data at any time, and there are limits placed on the commands and outputs that are allowed in order to protect the security and confidentiality of the data (Australian Bureau of Statistics 2006g).

All analyses used ABS-generated person-weights (or expansion factors) to adjust for disproportionate sampling of some groups. The estimates produced in this manner apply to the population as a whole and not just the sample (Australian Bureau of Statistics 2006b; Donath 2005). Standard errors and 95% confidence intervals (CI) were calculated using replicate weights produced by the ABS using the Jackknife method (250 replicate weights for Indigenous respondents, 60 for non-Indigenous respondents) (Australian Bureau of Statistics 2006b; Donath 2005). These replicate weights allow the estimation of standard errors taking into account the complex design and weighting procedures used in the surveys (Australian Bureau of Statistics 2006c; Donath 2005). Although Stata version 10 incorporates a suite of procedures to analyse complex survey data, these commands are not allowed in the RADL system (Therese Lalor, ABS, personal communication, May 2009). Instead, commands from the *svr* module written by Nick Winter (available using the Stata command: search svr, net) were used.

Logistic regression was conducted separately for Indigenous and non-Indigenous respondents due to the different numbers of replicate weights for the two groups. All models were adjusted for age group and sex, with socioeconomic variables assessed individually and in combination. Participants with missing data were excluded only from analyses involving the variable for which they were missing data.

### Ethics approval

This study was approved by the Human Research Ethics Committee of the Northern Territory Department of Health and Families and the Menzies School of Health Research.

## Results

Among non-remote Australians aged 18–64, about 17% of Indigenous respondents and 14% of non-Indigenous respondents indicated that they had any current arthritis, with the majority reporting it had been diagnosed by a doctor or nurse (Table 1). OA was more common than RA, but type of arthritis was not reported for about a third of respondents who said they had been diagnosed (Table 1).

**Table 1** Self-reported history of arthritis among Indigenous and non-Indigenous adults aged 18–64 living in non-remote areas of Australia, 2004–2005

| | Indigenous percentage (95% CI)[a] | Non-Indigenous percentage (95% CI)[a] |
|---|---|---|
| Any arthritis | | |
| Current, diagnosed by a doctor or nurse | 13.7 (11.9–15.6) | 11.0 (10.5–11.5) |
| Current, not diagnosed by a doctor or nurse | 3.5 (2.5–4.5) | 3.3 (3.0–3.7) |
| Not current | 1.9 (1.3–2.6) | 1.3 (1.1–1.5) |
| No reported history of arthritis | 80.8 (78.8–82.9) | 84.4 (83.7–85.1) |
| Osteoarthritis | | |
| Current, diagnosed by a doctor or nurse | 6.4 (4.9–7.9) | 5.7 (5.3–6.1) |
| Current, not diagnosed by a doctor or nurse | 0.9 (0.5–1.3) | 1.2 (1.0–1.4) |
| Not current | 0.4 (0.1–0.7) | 0.4 (0.3–0.6) |
| No reported history of osteoarthritis | 92.3 (90.7–93.9) | 92.7 (92.2–93.1) |
| Rheumatoid arthritis | | |
| Current, diagnosed by a doctor or nurse | 2.7 (1.7–3.7) | 1.9 (1.6–2.1) |
| Current, not diagnosed by a doctor or nurse | 0.6 (0.2–1.1) | 0.5 (0.4–0.7) |
| Not current | 0.6 (0.3–1.0) | 0.4 (0.3–0.5) |
| No reported history of rheumatoid arthritis | 96.0 (94.9–97.1) | 97.2 (96.9–97.5) |

Source: Weighted data from the National Aboriginal and Torres Strait Islander Health Survey 2004–2005 confidentialised unit record file (CURF) (Australian Bureau of Statistics 2006b), based on 3,220 Indigenous and 15,120 non-Indigenous respondents

*CI* confidence interval

[a] Proportions are weighted to provide population estimates

Current diagnosed arthritis was more commonly reported by Indigenous than non-Indigenous respondents across all age groups (Fig. 1); similar patterns were observed for OA and RA (data not shown).

The socio-demographic profile of the Indigenous population was significantly different from that of the non-Indigenous population, with a younger age distribution, lower educational attainment, and greater levels of disadvantage across a range of indicators (Table 2).

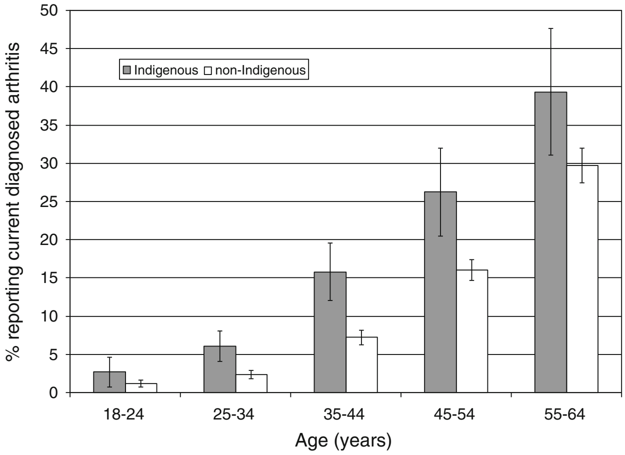

**Fig. 1** Prevalence of self-reported diagnosed arthritis by age for Indigenous and non-Indigenous adults aged 18–64 living in non-remote areas of Australia, 2004–2005. Source: Weighted data from the National Aboriginal and Torres Strait Islander Health Survey 2004–2005 confidentialised unit record file (CURF) (Australian Bureau of Statistics 2006b), based on 3,220 Indigenous and 15,120 non-Indigenous respondents

Age-standardised prevalence of arthritis was generally higher for Indigenous people than non-Indigenous people of the same SES group (data not shown).

After adjusting for age and sex, the relationships between SES variables and arthritis, OA and RA were more consistent among non-Indigenous than Indigenous adults (Table 3). For any arthritis, each of the six SES variables considered were significantly associated with the outcome among non-Indigenous respondents, with those in more disadvantaged positions more likely to report arthritis. For example, the relative odds of arthritis for those in the lowest household income quintile compared with those in the highest three quintiles combined was 2.1 (95% CI 1.7–2.5). Similar patterns were observed for OA and RA although the associations did not always achieve statistical significance (Table 3).

Among Indigenous respondents, only employment status and household income were significantly associated with any arthritis. For example, the relative odds of arthritis for those in the lowest household income quintile compared with those in the highest three quintiles combined was 1.6 (95% CI 1.1–2.4), while the relative odds for those who completed year 12 or more compared with those who did not was 1.0 (95% CI 0.6–1.5).

**Table 2** Socio-demographic characteristics of Indigenous and non-Indigenous adults aged 18–64 living in non-remote areas of Australia, 2004–2005

| | Indigenous percentage (95% CI)[a] | Non-indigenous percentage (95% CI)[a] |
|---|---|---|
| Age (years) | | |
| 18–24 | 23.9 (22.3–25.5) | 15.1 (14.8–15.4) |
| 25–34 | 28.0 (27.0–29.0) | 22.4 (22.3–22.6) |
| 35–44 | 22.8 (21.7–24.0) | 23.5 (23.3–23.7) |
| 45–54 | 16.3 (15.5–17.1) | 22.0 (21.8–22.1) |
| 55–64 | 8.9 (7.0–10.9) | 17.0 (16.9–17.1) |
| Male | 46.8 (45.3–48.3) | 49.8 (49.6–50.1) |
| Highest year of school completed | | |
| Year 12 | 26.8 (23.9–29.8) | 52.8 (51.4–54.1) |
| Year 11 | 12.4 (10.7–14.0) | 10.8 (10.2–11.5) |
| Year 10 | 31.2 (28.9–33.6) | 24.6 (23.7–25.6) |
| Year 9 | 14.2 (12.5–15.9) | 6.2 (5.7–6.7) |
| Year 8 or less, or never went to school | 15.4 (13.6–17.1) | 5.6 (5.0–6.1) |
| Level of highest non-school qualification | | |
| Bachelor's degree or higher | 5.8 (4.4–7.2) | 21.0 (20.1–21.8) |
| Diploma | 5.6 (4.2–7.0) | 9.7 (9.1–10.3) |
| Certificate | 26.0 (23.6–28.4) | 26.0 (24.9–27.0) |
| No qualifications | 62.6 (59.7–65.4) | 43.4 (42.3–44.4) |
| Employment status | | |
| Employed | 54.4 (51.3–57.5) | 76.0 (75.3–76.8) |
| Unemployed | 8.4 (7.0–9.9) | 3.0 (2.7–3.4) |
| Not in the labour force | 37.1 (34.3–40.0) | 20.9 (20.1–21.7) |
| Housing tenure[b] | | |
| Owner/purchaser | 31.6 (28.1–35.1) | N/A |
| Renter or other tenure | 68.4 (64.9–71.9) | N/A |
| Equivalised household income quintile[c] | | |
| 1 (lowest) | 32.4 (29.6–35.1) | 11.2 (10.7–11.8) |
| 2 | 20.0 (17.6–22.4) | 13.2 (12.5–13.8) |
| 3 | 16.4 (13.9–18.9) | 16.9 (16.1–17.7) |
| 4 | 11.0 (8.8–13.1) | 19.4 (18.7–20.2) |
| 5 (highest) | 6.0 (4.4–7.6) | 21.7 (20.7–22.8) |
| Not known/not stated | 14.1 (11.9–16.3) | 17.6 (16.6–18.5) |
| SEIFA quintile[d] | | |
| 1 (most disadvantaged) | 41.8 (35.1–48.4) | 17.0 (15.6–18.4) |
| 2 | 21.8 (16.9–26.6) | 18.9 (17.2–20.6) |
| 3 | 20.8 (15.8–25.8) | 20.2 (18.3–22.1) |
| 4 | 10.4 (7.5–13.4) | 21.3 (19.5–23.1) |
| 5 (least disadvantaged) | 5.2 (2.9–7.5) | 22.6 (20.1–25.0) |
| Area of residence[e] | | |
| Major cities | 42.3 (40.6–44.1) | 70.2 (68.6–71.8) |
| Inner regional | 27.9 (26.4–29.4) | 19.5 (17.9–21.0) |

**Table 2** continued

| | Indigenous percentage (95% CI)[a] | Non-indigenous percentage (95% CI)[a] |
|---|---|---|
| Outer regional | 29.8 (28.4–31.1) | 10.4 (9.2–11.5) |

Source: Weighted data from the National Aboriginal and Torres Strait Islander Health Survey 2004–2005 confidentialised unit record file (CURF) (Australian Bureau of Statistics 2006b), based on 3,220 Indigenous and 15,120 non-Indigenous respondents

*CI* confidence interval, *N/A* not available, *SEIFA* socioeconomic index for areas, index of relative disadvantage

[a] Proportions are weighted to provide population estimates. Totals are based on those with non-missing data, except for equivalised household income, for which a separate category is shown

[b] Home ownership was based on whether the home was owned or being purchased by any of its occupants (not necessarily the respondent) (Australian Bureau of Statistics 2006e)

[c] Gross weekly equivalised cash income of household, which takes into account household size and composition, was estimated using the OECD scale (Australian Bureau of Statistics 2006c). Quintiles are based on all-Australian figures

[d] SEIFA score for the census collection district of the selected dwelling from the 2001 Census was used as a measure of area-level disadvantage (Australian Bureau of Statistics 2006c). Quintiles are based on all-Australian figures

[e] Area of residence was classified according to the Australian Standard Geographical Classification remoteness classification (based on the ARIA + index) into major cities, inner regional, outer regional, and remote/very remote (Australian Bureau of Statistics 2006e). Participants in the remote/very remote category are not shown and were excluded from all analyses

## Discussion

The results presented here indicate that, for every measure of SES examined, SES was significantly inversely associated with self-reported arthritis among non-Indigenous Australians. Among Indigenous Australians, the relationship between SES and self-reported arthritis was less consistent across measures, with significant associations for household income and employment status, but not for education, post-school qualifications, home ownership, area-level disadvantage, or area of residence.

The findings for non-Indigenous Australians are generally consistent with those from other studies of SES and arthritis in developed countries. In the US, significantly higher reporting of arthritis/chronic joint symptoms was found among adults with lower education in one study (CDC 2002). In another study, family income, but not income inequality, was associated with self-reported arthritis (Sturm and Gresenz 2002). Lower education was associated with self-reported arthritis among both White and African American patients at 25 urban and rural family practice clinics in the US (Callahan et al. 2008). In Canada, both individual- and regional-level SES were associated with higher relative odds of self-reported arthritis (Cañizares et al. 2008). In Germany, 'inflammatory' arthritis (mainly RA), as determined by physician interview, was significantly more common in those with lower education and those of lower social class, and less common among most non-manual occupational categories (Schneider et al. 2006). In Denmark, lower educational level was significantly associated with recently diagnosed RA (Pedersen et al. 2006). In the EIRA study in Sweden, incident RA was associated with lower education levels and with manual employment (Bengtsson et al. 2005). In a study in the Australian state of Victoria, self-reported arthritis was significantly more common among those of lower education and those of lower income although education was no longer significant after adjusting for other factors including income (Busija et al. 2007). The inverse relationships between SES and arthritis may act through one or more of a range of plausible neuroendocrine, autonomic, metabolic, immune, and/or behavioural pathways (Brunner and Marmot 1999); some of these pathways may involve exposure to more proximal risk factors such as injury, smoking, obesity, and chronic inflammation.

The higher prevalence of arthritis among Indigenous Australians in every age group is consistent with their more adverse risk factor profile, including higher rates of obesity, smoking and injury, and greater levels of disadvantage (Australian Bureau of Statistics and Australian Institute of Health and Welfare 2008). However, the relative lack of a gradient for most measures of SES warrants further examination.

Different measures of SES may legitimately vary in how they relate to particular health outcomes, and the same measure may behave differently in different populations. However, it would be seem reasonable to expect that, within a given population and for a specific SES measure, similar relationships would be observed for diseases with similar aetiologies. Three other studies involving the same group of Indigenous Australian respondents from the 2004–2005 NATSIHS have recently been published, examining the relationship between the same set of SES measures and diabetes (Cunningham 2010a), cardiovascular disease (Cunningham 2010b), and asthma (Cunningham 2010c). Based on Katz et al. (2010) suggestion that OA and the metabolic syndrome share common pathogenic mechanisms, it might be expected that similar relationships with

**Table 3** Relative odds of self-reported current diagnosed arthritis, osteoarthritis, rheumatoid arthritis by socioeconomic status for Indigenous and non-Indigenous adults aged 18–64 living in non-remote areas of Australia, 2004–2005

| | Any arthritis[a] | | Osteoarthritis | | Rheumatoid arthritis | |
|---|---|---|---|---|---|---|
| | Indigenous adjusted OR (95% CI)[b] | Non-indigenous adjusted OR (95% CI)[b] | Indigenous adjusted OR (95% CI)[b] | Non-indigenous adjusted OR (95% CI)[b] | Indigenous adjusted OR (95% CI)[b] | Non-indigenous adjusted OR (95% CI)[b] |
| Highest year of school completed | | | | | | |
| Year 12 or more | 1.0 (0.6–1.5) | **0.6 (0.5–0.7)** | 1.0 (0.5–2.1) | **0.7 (0.6–0.9)** | 1.6 (0.8–3.3) | **0.6 (0.5–0.9)** |
| <Year 12[c] | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Highest qualification | | | | | | |
| University degree | 1.0 (0.4–2.3) | **0.5 (0.4–0.7)** | 1.4 (0.4–4.9) | **0.7 (0.5–0.9)** | 0.4 (0.1–1.6) | **0.5 (0.3–0.8)** |
| Diploma | 1.6 (0.6–3.9) | **0.7 (0.5–0.8)** | 2.8 (0.9–9.4) | 0.8 (0.6–1.0) | 0.6 (0.1–3.7) | 1.2 (0.8–1.6) |
| Certificate | 1.3 (0.9–2.0) | 0.9 (0.8–1.1) | 1.6 (0.9–2.9) | 1.0 (0.8–1.2) | 1.0 (0.4–2.6) | 1.0 (0.7–1.4) |
| No | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Employment status | | | | | | |
| Employed | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Unemployed | 1.2 (0.6–2.7) | **1.6 (1.1–2.3)** | 0.9 (0.3–2.2) | 1.3 (0.8–2.2) | 3.1 (0.3–29.6) | 2.1 (0.7–5.8) |
| Not in labour force | **1.7 (1.2–2.4)** | **1.9 (1.6–2.2)** | 1.4 (0.9–2.5) | **1.8 (1.5–2.2)** | 2.1 (1.0–4.4) | **1.7 (1.2–2.4)** |
| Housing tenure | | | | | | |
| Owner/purchaser | 0.9 (0.7–1.3) | – | 1.3 (0.8–2.1) | – | 0.6 (0.3–1.1) | – |
| Renter/other tenure | 1.0 | – | 1.0 | – | 1.0 | – |
| Equivalised household income quintile[d] | | | | | | |
| 1 (lowest) | **1.6 (1.1–2.4)** | **2.1 (1.7–2.5)** | 1.8 (0.9–3.6) | **1.9 (1.5–2.3)** | 1.9 (0.9–4.2) | **2.4 (1.7–3.5)** |
| 2 | 1.0 (0.6–1.7) | **1.6 (1.3–1.9)** | 1.3 (0.6–3.0) | **1.5 (1.1–1.9)** | 0.8 (0.2–2.5) | **1.9 (1.3–2.8)** |
| 3–5 (highest) | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Not known/not stated | 0.8 (0.5–1.4) | 1.0 (0.9–1.2) | 1.3 (0.6–2.7) | 0.8 (0.7–1.1) | 0.5 (0.1–1.9) | 1.3 (0.8–2.1) |
| SEIFA quintile[e] | | | | | | |
| 1 (most disadvantaged) | 2.3 (0.6–8.7) | **1.7 (1.4–2.1)** | 1.8 (0.6–5.7) | **1.3 (1.0–1.7)** | 1.0 (0.0–77.3) | 1.7 (1.0–2.8) |
| 2 | 2.6 (0.7–10.1) | **1.5 (1.2–1.9)** | **3.4 (1.0–11.4)** | 1.3 (1.0–1.8) | 0.6 (0.0–56.5) | 1.4 (0.9–2.2) |
| 3 | 1.8 (0.5–7.2) | **1.3 (1.1–1.7)** | 2.1 (0.6–7.7) | 1.0 (0.8–1.4) | 0.8 (0.0–66.5) | 1.4 (0.8–2.3) |
| 4 | 3.5 (0.9–13.0) | 1.2 (1.0–1.4) | 3.5 (0.7–17.2) | 0.9 (0.7–1.2) | 1.2 (0.1–20.5) | 1.2 (0.7–1.9) |
| 5 (least disadvantaged) | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Area of residence | | | | | | |
| Major cities | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Inner regional | 1.4 (0.9–2.1) | **1.5 (1.3–1.7)** | 1.3 (0.7–2.2) | **1.4 (1.1–1.8)** | **2.9 (1.4–5.8)** | **1.6 (1.2–2.3)** |

**Table 3** continued

| | Any arthritis[a] | | Osteoarthritis | | Rheumatoid arthritis | |
|---|---|---|---|---|---|---|
| | Indigenous adjusted OR (95% CI)[b] | Non-indigenous adjusted OR (95% CI)[b] | Indigenous adjusted OR (95% CI)[b] | Non-indigenous adjusted OR (95% CI)[b] | Indigenous adjusted OR (95% CI)[b] | Non-indigenous adjusted OR (95% CI)[b] |
| Outer regional | 0.9 (0.6–1.4) | **1.3 (1.0–1.6)** | 0.7 (0.3–1.4) | 0.9 (0.7–1.2) | 2.0 (0.9–4.6) | 1.0 (0.7–1.7) |

Source: Weighted data from the National Aboriginal and Torres Strait Islander Health Survey 2004–2005 confidentialised unit record file (CURF) (Australian Bureau of Statistics 2006b), based on 3,220 Indigenous and 15,120 non-Indigenous respondents

Excludes participants who reported the condition of interest as being current but did not indicate that it had been diagnosed by a doctor or nurse. The number of participants excluded is as follows: any arthritis: 118 Indigenous, 576 non-Indigenous; osteoarthritis: 31 Indigenous, 198 non-Indigenous; rheumatoid arthritis: 24 Indigenous, 91 non-Indigenous

Values in bold are statistically significant at $p < 0.05$

*OR* odds ratio, *CI* confidence interval, *SEIFA* socioeconomic index for areas, index of relative disadvantage

[a] Includes osteoarthritis, rheumatoid arthritis, and arthritis of unknown or unspecified type

[b] All odds ratios are from logistic regression models adjusted for age group, sex, and the individual variable (or set of indicator variables) listed

[c] Includes those who never went to school

[d] Gross weekly equivalised cash income of household, using the OECD scale (Australian Bureau of Statistics 2006c). Quintiles are based on national figures

[e] Quintiles are based on national figures

specific SES measures would be observed for diabetes, cardiovascular disease, and arthritis, but this was not the case. Self-reported diabetes was significantly associated with every SES measure examined, and cardiovascular disease was associated with most measures; in both cases, the odds ratios for a given SES measure were generally similar in the Indigenous and non-Indigenous populations (Cunningham 2010a, b). In contrast, asthma was not significantly associated with any traditional SES measure (Cunningham 2010c). The results for arthritis thus lie between those for diabetes/cardiovascular disease and asthma. The contrasting results for these four chronic diseases in the Indigenous population may be due to a range of factors, such as differences in the nature and aetiology of the conditions, or in the likelihood and process of obtaining a diagnosis and/or the accuracy of self-reporting, both of which may plausibly vary by SES. Critically, for each of the four disease groups examined so far, the relative disadvantage of the Indigenous population has failed to explain completely their higher disease prevalence relative to non-Indigenous Australians, i.e., with very few exceptions, the prevalence of disease was higher for Indigenous than non-Indigenous people of the same age group and SES category for all measures of SES. This suggests that other factors are likely to be salient for Indigenous people across the socioeconomic spectrum, including racism and discrimination (Paradies 2006), stress (Walker et al. 1999; Fitzgerald 2009), childhood adversity (Von Korff et al. 2009), and a legacy of loss, grief, and dispossession (Human Rights and Equal Opportunity Commission 1997). Addressing such factors may help to reduce Indigenous Australians' excess burden of a wide range of diseases, including arthritis.

The main strengths of this study are that it uses nationally representative data and uses identical measures of SES to make comparisons between Indigenous and non-Indigenous Australians. The main limitations of the study relate to its cross-sectional nature, the potential misclassification of both arthritis (and its subtypes) and SES, the heterogeneity of conditions included under arthritis, and the exclusion of those most affected by arthritis.

Because information on SES and arthritis were collected at the same time, the temporal relationship between SES indicators and arthritis is not always certain. For example, employment status may change as a result of having a debilitating chronic disease such as arthritis, and this may explain the observed relationship between being out of the labour force and being more likely to report arthritis.

Although the outcomes in this study only included those reported as being diagnosed by a doctor or nurse, it is possible that some people who reported arthritis did not actually have it, while others who did have arthritis did not report it. The accuracy of self-reporting of arthritis (and

RA and OA) in the Indigenous population is not known. In other populations, the accuracy of self-reported diagnosed arthritis has been reasonably good (Bombard et al. 2005; Sacks et al. 2005) although self-reporting of specific subtypes is less accurate with OA apparently better than RA (March et al. 1998; Kvien et al. 1996; Walitt et al. 2008). Many people report that they do not know what type of arthritis they have (Gill et al. 2010); this is consistent with data from the present study, in which about a third of respondents did not report arthritis type.

The main outcome of interest (any diagnosed arthritis) included a range of conditions, including osteoarthritis and rheumatoid arthritis, which have different aetiologies and risk factors. Although arthritis sub-types were examined separately, the relatively low prevalence of individual subtypes resulted in less precise estimates, as evidenced by relatively wide confidence intervals.

Information used to determine SES may have been incorrectly reported by some participants, and only limited detail was available on the SES indicators examined here. Despite the use of comparable scales, the equivalence of a given level of SES may not be guaranteed across individuals or population groups. For example, the meaning of a certain level of education may vary over time and place, and years of education do not necessarily reflect the quality of education received or its socioeconomic value (Krieger et al. 1997; Lynch and Kaplan 2000). Similarly, the use of SEIFA quintiles based on the whole population may not adequately capture the socioeconomic position of population subgroups such as Indigenous Australians (Kennedy and Firman 2004). No information was available about other potentially important SES measures, such as total household assets or SES in childhood. Although an area-based measure of disadvantage was included, no other information was available about neighbourhood/area characteristics. Equivalised household income is intended to adjust for household size and economies of scale, but the dynamic nature of Indigenous households (Daly and Smith 1999) can make it difficult to assess both Indigenous household income and household size, both of which are required to calculate equivalised income.

Because the NATSIHS and NHS exclude people living in institutions such as hospitals and residential aged care services, those most affected by arthritis would not have been included. In addition, the current analysis was limited to those less than 65 years old, thus excluding the age group with the greatest arthritis prevalence (age 65 and over) (Australian Institute of Health and Welfare 2009).

Arthritis is one of a large number of health conditions that are more commonly reported among Indigenous than non-Indigenous Australians. Perhaps, because of the high burden of early mortality due to conditions such as diabetes, heart disease, respiratory disease, cancer, and injury (Australian Bureau of Statistics and Australian Institute of Health and Welfare 2008), arthritis is not usually considered a priority for Indigenous health. However, as progress is made in reducing the burden of these other chronic diseases, it is highly likely that arthritis and other debilitating/disabling conditions will become the focus of greater attention. It is therefore critical to understand the factors that contribute to arthritis risk in order to develop suitable education, prevention, and treatment strategies for this vulnerable and disadvantaged population group.

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