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The unmet needs of Aboriginal Australians with musculoskeletal pain: A mixed method systematic review.

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Abstract

Objective

Musculoskeletal pain (MSP) conditions are the biggest cause of disability and internationally, Indigenous peoples experience a higher burden. There are conflicting reports about Aboriginal Australians and MSP. We conducted a systematic review to describe the prevalence, associated factors, impacts, care access, health care experiences, and factors associated with MSP among Aboriginal Australians.

Methods

A systematic search of quantitative and qualitative scientific and grey literature (PROSPERO number: CRD42016038342). Articles were appraised using the Mixed Methods Appraisal Tool. Due to study heterogeneity a narrative synthesis was conducted.

Results

Of 536 articles identified, 18 were included (14 quantitative, 4 qualitative), of high (n=11), medium (n=2) and low (n=5) quality. Prevalences of MSP in Aboriginal populations were similar to or slightly higher than the non-Aboriginal population (prevalence rate ratio 1.1 for back pain, 1.2-1.5 for osteoarthritis (OA), 1.0-2.0 for rheumatoid arthritis). Aboriginal people accessed primary care for knee or hip OA at around half the rate of non-Aboriginal people, and were less than half as likely to have knee or hip replacement surgery. Communication difficulties with health practitioners were the main reason why Aboriginal people with MSP choose not to access care. No articles reported interventions.

Conclusions

Findings provide preliminary evidence of an increased MSP burden amongst Aboriginal Australians and, particularly for OA, a mismatch between the disease burden and access to health care. To increase accessibility, health services should initially focus on improving Aboriginal patients' experiences of care, in particular by improving patient-practitioner communication. Implications for care and research are outlined.

Significance and Innovations

- This review provides preliminary evidence of an increased musculoskeletal pain burden amongst Aboriginal Australians and a mismatch between the disease burden and access to health care.
- Findings contribute to accumulating evidence of MSP disparities between Indigenous/non-Indigenous peoples; addressing these disparities should be a priority.
- Improving the patient-practitioner encounter through effective communication is a critical first step.

Internationally, conditions associated with musculoskeletal pain (MSP) are the biggest cause of disability (1). In Australia, MSP conditions are a National Health Priority area (2) and 30% of Australians have a MSP condition, most commonly low back pain (LBP - 16%) and osteoarthritis (OA - 9%) (3). They are one of the most common reasons people seek care, accounting for one in ten primary care consultations (4).

Whilst the overall burden of MSP is high within all countries, there are disparities within countries with the burden disproportionately affecting some population groups. An emerging issue of which there is increasing awareness are disparities in the burden of MSP between Indigenous and non-Indigenous populations. In Canada and the United States of America there is a higher prevalence of MSP conditions such as LBP, neck pain and arthritis among Indigenous compared to non-Indigenous populations, differences in health care access, and discrepancies in expectations between Indigenous patients and practitioners related to communication and how pain should be managed (5). A higher prevalence of MSP conditions has also been reported amongst Indigenous populations in Argentina (6) and Mexico (7).

In the Australian context disparities in the overall burden of disease between Aboriginal Australian (i.e. Aboriginal and Torres Strait Islander people, termed 'Aboriginal' or 'Indigenous' in this paper) and non-Aboriginal Australian communities is well recognised (8). However to date, MSP has received limited attention. Within the limited body of research there are conflicting reports that MSP conditions such as LBP either have little impact on Aboriginal people (9) or alternatively, have profound effects on the capacity for Aboriginal people to participate in daily life and cultural activities (10).

Conflicting reports may be problematic as MSP may not be given the attention warranted. Further, MSP could potentially contribute directly and indirectly to the disease burden in Aboriginal populations. Two thirds to three quarters of individuals with MSP have at least one other co-existing long term health condition such as cardiovascular disease or a mental health problem (3), conditions that are highly prevalent in Aboriginal populations. Indirectly, impairments resulting from MSP can potentially prevent individuals participating in secondary or tertiary care of long term health conditions. For example a person with OA and knee pain may not be able to undertake sufficient physical activity to optimise their diabetes care. Therefore the aim of this review is to examine MSP amongst Aboriginal Australians; what is known, knowledge gaps, and to explore implications for care.

Research Questions

Our systematic review included quantitative and qualitative research and was guided by six questions relating to MSP in adult Aboriginal Australians:

1. What is the prevalence?
2. What factors are associated with MSP?
3. What is the impact?
4. What access is there to health care?
5. What are the experiences of health care?
6. What management interventions have been used, and with what effect?

Materials and Methods

We undertook a segregated approach to our mixed methods systematic review (outlined below) (11). The protocol for this systematic review was developed a priori, and registered on the PROSPERO International prospective register of systematic reviews (PROSPERO registration number: CRD42016038342).

Search Strategy

Searches were undertaken independently by two researchers (IL and SB) in February, 2016. First, the following scientific databases were searched: Medline, Embase, CINAHL, PsychINFO, Sociological Abstracts and the Aboriginal and Torres Strait Islander health Pubmed search tool hosted by the Lowitja Institute (see: <http://www.lowitja.org.au/>). The searches included database headings and truncated keywords related to Aboriginal health combined with keyword searches for “pain” (see Table 1: Medline search terms). This was augmented by searches of the Australian Indigenous Health Infonet bibliography (see: <http://www.healthinfonet.ecu.edu.au/>) and Google Scholar (search terms available on request).

Second we used a forwards/backwards search for citations and the reference lists of each article. Third, we searched for grey literature for epidemiological reports in the Australian Institute of Health and Welfare (see: <http://www.aihw.gov.au/>), an Australian Government agency for statistical health information, for relevant publications (January 2011-February 2016). Finally our list of articles was reviewed for comprehensiveness by a pain medicine specialist with expertise in Aboriginal pain management. From the identified articles we selected those pertinent to our research questions. The inclusion/exclusion criteria are outlined in Table 2. Articles were selected via consensus between researchers.

Data Recording and Assessment of Methodological Quality

Data were extracted by two reviewers including study aims, design, setting, population, data sources and main findings (form available on request). Pairs of reviewers independently assessed methodological quality (quantitative: DBM and IL, qualitative: SB and CG) using the Mixed Methods Appraisal Tool (MMAT) (12). The MMAT allows reviewers to assess the methodological quality of studies with diverse designs (e.g. qualitative, descriptive) and is

reported to have content validity and moderate to perfect inter-rater reliability (13). Reviewers scored articles as high (75 or 100%), moderate (50%) or low quality (0 or 25%) according to the number of positive responses to the appropriate four MMAT criteria. Any discrepancies in reviewer scores were discussed and a consensus score determined. If irreconcilable score differences were to occur a third reviewer would mediate (although this was not required). Articles with low MMAT scores were not considered in our synthesis.

Information Synthesis

Segregated methods were used to synthesise information. This approach assumes that although both quantitative and qualitative studies can answer similar questions they answer them differently (11). Due to heterogeneity in study methodology, participants, outcomes of interest and setting a meta-analysis was not possible. Therefore we undertook a narrative synthesis. Quantitative and qualitative data were initially analysed separately, and then combined narratively in order to answer our research questions. Final conclusions were determined following multiple rounds of review within the inter-professional author group.

Results

Academic database searches identified 530 discrete articles; two articles identified by an expert reviewer and four government epidemiological reports were added (n = 536).

Following the selection process, 18 articles (14 quantitative, four qualitative) were reviewed (PRISMA flowchart – Figure 1).

Study Characteristics

All 14 quantitative studies were observational or descriptive in design (Table 3); there were no intervention studies. Quantitative articles most commonly reported on musculoskeletal or rheumatic disorders (8, 14-16), LBP (9, 14, 16, 17), OA (16, 18, 19), 'arthritis' (8, 20, 21), rheumatoid arthritis (18, 22), 'back pain' (15, 20), total knee and hip replacement (23), 'bone and joint problems' (24) and 'muscle pain' (25). Four government reports (8, 18, 20, 22) and two articles (21, 23) utilised national health data sets (e.g. Australian National Health Survey).

Qualitative articles examined the experiences and perceptions about health care of Aboriginal people with chronic LBP (three articles from one study) (10, 26, 27), and pain associated with arthritis, orthopaedic injuries, back pain and coronary artery disease (28). All qualitative articles only included Aboriginal participants.

Of the quantitative articles seven focussed on Aboriginal participants (8, 9, 14-17, 25) and seven on Aboriginal and non-Aboriginal participants (18-24). Seven compared Aboriginal and non-Aboriginal populations.

Eight quantitative studies were rated as high, one as medium and five as low quality (Table 4). Quantitative studies that scored most highly (100% on MMAT) used Australian national datasets e.g. Australian National Health Survey. Articles of low quality that scored 0% (14, 16, 17, 25) or 25% (24) did not adequately define their included cases, had questionable instrument validity, did not define/control for possible confounders, and/or had poorly-defined or potentially-biased sampling methods and/or study samples (Table 4).

Three qualitative articles from the same study were rated as high quality (100%) on the MMAT (10, 26, 27). The other qualitative study was rated medium (50%) and did not report detailed information about the research settings or the relationship between the researchers and the participants (28).

1. The Prevalence of Musculoskeletal Pain

Six studies reported the prevalence of MSP or conditions associated with MSP. The prevalence of 7-day MSP was 20% nationally (8) to 33% in a Queensland semi-rural community (15). Nationally the prevalence of long term musculoskeletal diseases was marginally (1.1 times) higher in Aboriginal populations (8).

The prevalence of back pain was 10 and 12.5 % nationally and in a Queensland semi-rural community respectively (8, 15). In another study 41% of residents in a remote central Australian community reported current LBP (9). The crude prevalence of arthritis was 10% in Aboriginal populations nationally (8). Knee pain and shoulder pain were present in 11.2% and 8.9%, respectively, of residents in a semi-rural Queensland community (15).

Nationally the prevalence of MSP was equal or higher than in non-Aboriginal populations. The prevalence rate of OA was 1.2 to 1.5 times higher in Aboriginal compared to non-Aboriginal populations (20) with an age adjusted prevalence of 17% compared to 14% (21). Aboriginal people were 1.1 times more likely to report current back pain (20). Rheumatoid arthritis was up to twice as prevalent in Aboriginal compared to non-Aboriginal populations (18, 22).

2. Factors Associated with Musculoskeletal Pain

One quantitative and two qualitative studies reported factors associated with MSP. Amongst non-remote living Aboriginal Australians there were inverse associations between arthritis and employment status and household income. Aboriginal people not in the labour force were 1.7 times (95% CI: 1.2-2.4) more likely to report arthritis than those employed (21). Aboriginal people in the lowest household income quintile were 1.6 times (95% CI: 1.1-2.4) more likely to self-report arthritis than those in the upper two quintiles (21). Results differed from non-Aboriginal Australians who, in addition to the above factors, also had significant inverse associations between self-reported arthritis and level of education and socio-economic status.

One qualitative study found that negative beliefs were associated with disabling LBP. Participants who were more disabled, had pessimistic beliefs about their ability to function in the future, a passive reliance on clinicians for pain relief, and reported having been informed by a health care professional their pain was caused by structural/anatomical problems identified by radiological imaging(27). Another qualitative study examined the nature of Aboriginal people's experiences communicating about diverse pain conditions. The authors differentiated "physical pains" and "emotional pains". Whilst not diminishing physical pain, emotional pains often took precedence and were associated with the historical and contemporary context of Aboriginal peoples' lives including intergenerational trauma, dispossession, community violence and loss (28).

3. Impact of non-cancer pain and pain-related conditions

Two quantitative and two qualitative studies reported the impact of MSP. Quantitative studies were in two discrete communities. A survey in a rural North Queensland community

reported that 7.7% of community members were limited in their daily activity due to current rheumatic symptoms (15). Another study in a remote Central Australian community reported that there was limited impact of LBP based on researcher observations, including that no community members attended the clinic for LBP treatment during the study period (9).

In contrast two qualitative studies suggested that MSP has significant impacts. Aboriginal community members with chronic LBP living in three rural and remote towns reported functional, cultural and emotional impacts of the condition (10). The authors described chronic LBP as “profoundly disabling” for some participants, for example one man who was unable to travel to attend to cultural business, “...the old people wouldn’t let me go because of my spinal injury”, and “they know my back is no good. They all know. That’s why they told me I can’t come” p 1337 (10). Another study noted that Aboriginal people are “quiet about pain”, not due to a lack of impact, but because Aboriginal people “put on a brave face”, a lack of trust of health care, or a reluctance to expose vulnerability to non-Aboriginal people (28).

4. Access to Health Care

Five quantitative studies described the level of access to care for various MSP conditions.

The Bettering the Evaluation and Care of Health (BEACH) study, a national study of Australian General Practice, reported that Aboriginal populations had lower rates of primary care access compared to non-Aboriginal Australians for knee OA (3.2 vs 6.5 per 1000 encounters), and hip OA (1.2 vs 2.3 per 1000 encounters) (19). Nationally, Aboriginal people had significantly lower rates of total knee replacements (TKR) (RR=0.49 for men, RR=0.44 for women) and total hip replacements (THR) for OA (RR=0.37 for men, RR=.02 for women) (23). In contrast, self-reported pharmaceutical use for OA or rheumatoid arthritis was not different between Aboriginal and non-Aboriginal people in non-remote areas (18).

Based on age standardised rates Aboriginal people were admitted to hospital for MSP at 0.8 times the rate of non-Aboriginal Australians (8). In one semi-rural Aboriginal community, 38% of residents with rheumatic symptoms had not previously sought treatment (15), and in

a remote central Australian community, no residents had sought treatment in the one month study period despite 41% of residents acknowledging LBP (9).

5. *Experiences of Care*

Qualitative health care experiences for MSP, discussed in three studies, were predominantly negative and reasons why Aboriginal participants chose not to access health care.

Ineffective communication with health practitioners was the most prominent reason why Aboriginal people with MSP “gave up” on the health system (26, 28). This included when communication content was not congruent with evidence or Aboriginal peoples’ experiences, an absence of communication, or the use of medical jargon (26), e.g. “they spoke in their language which left me far behind” p3 (28). Conversely, practitioners were viewed more positively if they were known to the community, perceived as being honest and attentive listeners, and ‘yarned’ with their patients, showing a wider interest in their lives; “they’ll have a yarn with you. They ask how ya going and what ya doing, how the people where you, you know been and that” p 323 (26).

Other negative care experiences included feeling stigmatised by health staff, lack of empowerment in treatment decision making, and the perception that clinicians lacked the cultural knowledge, interest and experience to understand their pain (26, 28). These factors led to a lack of trust of health care and practitioners. In the case of LBP, Lin et al (2013) suggested that Aboriginal peoples’ experiences of health care were potentially iatrogenic because practitioners provided information about LBP that reinforced disability behaviours (27), discussed further below.

6. *Management interventions and their effects*

No articles pertinent to the sixth question were identified.

Discussion

We identified 13 articles of medium to high quality related to MSP in Aboriginal populations. Articles were diverse in focus and methodology and we were only able to address some of our research questions in selected MSP conditions. Findings suggest that there is a health

gap in both the prevalence of and access to, care between Aboriginal and non-Aboriginal Australians.

In all conditions reported ('musculoskeletal pain', OA, back pain and rheumatoid arthritis) the prevalence was similar to or slightly higher in Aboriginal populations compared to non-Aboriginal. Prevalence rate ratios of MSP conditions were similar or higher than other health conditions that have a higher prevalence in Aboriginal communities including; respiratory conditions (1.2 times), all-age cardiovascular disease (1.2 times), and asthma (2 times), and lower than that of diabetes (3.3 times) and psychological distress (2.7 times) (8). Results were similar to disparities in the USA and Canada where the prevalence of back pain (29), neck pain (5) and OA (30) are between 1.3 to 2.0 times higher amongst Indigenous populations.

Aboriginal Australians are around one half times less likely to access primary care or undergo TKR or THR for OA, and 0.8 times as likely to be hospitalised for MSP as non-Aboriginal Australians. This contrasts to North America where Indigenous peoples are two times as likely to seek primary care for arthritis as Non-Indigenous North Americans (5). However lower rates of joint replacement surgery for OA is similar to that of Canadian First Nations people in Alberta (30). There is a lack of research comparing access to care between Aboriginal/non-Aboriginal people with other MSP conditions however two observational studies suggested that there may also be low levels of care for LBP (9) and rheumatic disorders (15).

Lower access to care may be in part explained by qualitative experiences of care. Aboriginal people's care experiences for MSP were predominantly negative. The most important factor associated with reduced access was poor communication, resulting in Aboriginal people "giving up" on care (26, 28). Communication has been described as "the most important factor influencing health care utilisation" (31) for Aboriginal people. Poor communication and a lack of trust of practitioners are underpinned by a lack of practitioner cultural awareness (31, 32). This is similar to North American research where poor communication, the perception that practitioners are disinterested in their pain, and a lack of faith in their ability to treat it are barriers for Indigenous peoples seeking pain care (5). Multiple factors

including geography, systemic racism and a lack of culturally safe care have been postulated to result in lower access by First Nations Canadians with OA to specialist care (30).

Although one study of moderate quality suggested that there was limited impact of LBP because socioculturally, LBP was not viewed as a health issue (9), most studies support the finding that MSP has a substantial impact on the lives of Aboriginal people. Impacts included functional limitations as well as emotional and cultural well-being (10, 15, 28). Whilst guidelines recommend assessing the emotional impacts of MSP (33, 34), cultural impacts, such as participation in cultural activities, expectations of care and the manner in which MSP is expressed, may be less well recognised by practitioners and should be considered during MSP care.

One study reported socioeconomic associations (employment and income) with OA, noting that unexplained disparities in OA prevalence between Aboriginal/non-Aboriginal populations may be due to experiences of racism, stress, childhood adversity, grief, loss and dispossession (21). This assertion is supported by a body of research reporting associations between MSP and stressful life events and psychological distress e.g. (35), and the negative impact of racism on mental and physical health (36). However a direct examination of the relationship between health determinants such as those described above and MSP is lacking. Likewise a relationship between socioeconomic health determinants and MSP conditions other than OA is also lacking.

No studies reported interventions for MSP. Self-management programs for chronic conditions, such as the Flinders Chronic Condition Self-Management program, have been implemented amongst rural Aboriginal populations (37). Although arthritis is a target condition, outcomes for Aboriginal people with arthritis have not been reported. Robust research reporting MSP interventions for Aboriginal populations is needed.

One article reviewed highlighted the potential for health care practices to be an iatrogenic contributor to LBP disability in Aboriginal people (27), suggesting a low quality of care. No studies directly compared the quality of care between Aboriginal and non-Aboriginal patients with MSP. Holiday et al (2015) reported that Aboriginal patients were more than twice as likely to be prescribed opioids in primary care (OR: 2.2 CI: 1.6-2.9) despite increasing concerns regarding efficacy, addiction and overdose (38). Disparities in

pharmacological pain management have also been reported for Aboriginal women during labour (increased likelihood of opioid prescription) (39) and post-operatively (less likelihood of receiving more complicated analgesia techniques such as epidural analgesia) (40). This contrasts to the USA where prescriptions for opioids or other analgesia are similar between Indigenous and White Americans, with Black Americans less likely to receive analgesic prescription than White Americans (41). In Australia higher opioid use is associated with poorer overall health, other lifestyle risk factors such as smoking, and socio-economic status (42). Examining the quality of health care for Aboriginal people with MSP and, if present, the determinants of care disparities is needed.

Implications for Care

An important priority is to increase access by Aboriginal people to health care for OA, and potentially other MSP conditions such as LBP. To enhance care clinicians should focus on improving relationships with patients by attending to fundamental interpersonal skills; successful communication, building trust by demonstrating care and respect, and showing an interest in the patient (26, 28, 43). Evidence also supports increasing practitioner cultural awareness (32), ensuring Aboriginal Health Practitioners are employed and involved in care, providing consistent services, and delivering services in a culturally safe space (44). This may be further enhanced by developing health service-community partnerships and a positive workplace culture (44). Health care organisations such as Aboriginal Community Controlled Health Care Services (45), by their design, inherently address a number of these factors and should be considered as settings for MSP care.

Implications for Research

MSP research in Aboriginal populations is in its infancy and there are numerous priorities. One is investigation of the quality of MSP health care, such as the quality of communication, and practices with the potential to cause iatrogenic harm such as; opioid prescribing, the provision of non-evidence based and potentially harmful health information, and unwarranted radiological imaging. Implementation-oriented research aiming to identify disparities in health care practice behaviours and their determinants, could then link to health service interventions to reduce evidence-to-practice gaps (46, 47).

While several articles report Aboriginal peoples' experiences of LBP, more qualitative research investigating the lived and health care experiences of other MSP conditions, especially OA, would be useful in further understanding disparities in access to care and informing health care delivery.

Interventional research for MSP is lacking. MSP conditions share common determinants with other health conditions that contribute to a high burden of disease in Aboriginal populations (e.g. physical activity participation and obesity). Investigation of culturally appropriate interventions that address MSP specifically, or target risk factors common to MSP and other long term health conditions, at clinical or population health levels is needed.

Epidemiological research could examine MSP conditions and their relationship to a wide range of determinants that includes lifestyle and psychological factors (e.g. racism, sense of injustice, anger, distress) and socioeconomic factors, in diverse Aboriginal populations e.g. urban/rural/regional/remote. Initially this could extend analyses of existing datasets such as the National Aboriginal and Torres Strait Islander Health Survey. Comparing access to care for Aboriginal people with MSP conditions other than OA is also warranted (e.g. utilising data from the BEACH study)..

Limitations and Strengths

Four authors of this study (IL, PO, JC, DBM) co-authored articles included within this review raising the issue of bias in the appraisal. We addressed this by ensuring two uninvolved authors (SB, CG) undertook the appraisal and synthesis of these articles. We are confident in the comprehensiveness of our search strategy within scientific databases; however we did not consider all sources of grey literature. There is the potential for publication bias, especially for qualitative studies preferentially reporting negative health care experiences. With the exception of rheumatoid arthritis we did not examine inflammatory arthritis. The prevalence of gout in particular is higher in Indigenous populations (48) and could be included in future reviews. A strength was the interprofessional and inter-cultural author group enabling diverse insights into the topic.

In conclusion, our review provides preliminary evidence of increased MSP burden in Aboriginal Australian communities with disparities in the prevalence and access to care,

notably for OA. Further investigation of MSP conditions amongst Aboriginal Australians, and delivery of high quality MSP pain care should be priorities.

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Table and Figure Legends

Table 1: Medline search terms

Table 2: Inclusion/Exclusion Criteria

Figure 1: PRISMA Flow Diagram

Table 3: Article description

Table 4: Article findings and MMAT score

Table 1: Medline Search Strategy

1.	pain.mp.
2.	Pain/
3.	1 OR 2
4.	indigenous.mp.
5.	Oceanic Ancestry Group/
6.	Health Services, Indigenous/
7.	aborigin*
8.	"torres strait island*"
9.	4 OR 5 OR 6 OR 7 OR 8
10.	3 AND 9
Date range: 1946 to January week 4 2016	
Limitations: English language	

Table 2: Inclusion/Exclusion Criteria

<i>Inclusion Criteria:</i> • In English language • Relevant to research questions • From date limits of database (excluding government statistical reports) until February 2016 • Primary research
<i>Exclusion Criteria:</i> • Ethnopharmacological studies e.g. reporting properties of traditional bush medicines • Only reporting children/adolescents (less than 18 years of age) • Secondary analyses of data (e.g. reviews) or discussion papers • Inflammatory arthritis with the exception of rheumatoid arthritis

Table 3: Article description

Quantitative Articles	Relevant study aim(s)	Design	Participants/ sample size	Setting	Dates	Data source
AIHW, 2011	Examine population group differences in health-care use for OA, RA and OP.	Population level cross-sectional prevalence survey.	National representative sample. 36,345 participants.	National	August 2004 - June 2005	2004-05 NHS and NATSIHS.
AIHW, 2013	Summarise Australian national statistics on RA.	Population level cross-sectional prevalence survey.	National representative sample. 30,832 participants.	National	August 2007-July 2008 and August 2004 - June 2005	2007-08 NHS and 2004-05 NATSIHS.
AIHW, 2014	Summarise Australian health statistics.	Population level cross-sectional prevalence survey.	National representative sample. 30,832 participants.	National	2012-13 and 2011-12.	2012-13 AATSIHS and 2011-12 NHS.
AIHW, 2015	Summarise Australian ATSI health statistics.	Population level cross-sectional prevalence survey.	National representative sample ATSI peoples. Approx 13,000 participants.	National	2012-13	2012-13 AATSIHS
Benson et al, 2006	To determine if muscle pain was associated with low vitamin D levels.	Case control study.	16 participants; 8 patients with 'muscle pain', 8 control.	Adelaide.	October-November 2005.	Laboratory results - serum level vitamin D.
Brand et al, 2014	To describe OA management in Australian general practice.	Cross-sectional prevalence survey.	GP patient encounters for hip and knee OA. 12,915 encounters.	National	April 2005 - March 2010	BEACH study – longitudinal study of Australian GP encounters.
Cunningham et al, 2011	To examine disparities within and between ATSI/non-ATSI adults with arthritis	Population level cross-sectional prevalence survey.	National representative sample. 18,430 participants.	National	August 2004 to June 2005	2004-05 NHS. 2004-05 NATSIHS.

Dixon et al, 2011	To investigate differences in rates of THR and TKR between Aboriginal/non-Aboriginal patients.	Cross sectional study.	Australian hospital separations for THR or TKR for arthritis. 18,345 THR and 27,872 TKR encounters.	Australian public and private hospitals.	2005-07 financial years for ATSI separations. 2006-07 financial year for other data.	National Hospital Morbidity Database.
Douglas, 2004	To determine the prevalence of rheumatic disorders in two Aboriginal communities.	Prevalence survey.	ATSI adults of "pure ancestry". 288 participants.	Two Cape York Communities – Aurukun and Weipa.	October 1965	Examination, hand x-ray and blood tests.
Honeyman et al, 1996	To describe the occurrence of LBP and associated behaviours and disabilities in one remote community.	Prevalence study.	55 adults.	One remote central Australian community.	1988	Interviews and physical examination.
Minaur et al, 2004	To estimate prevalence's of rheumatic diseases in Aboriginal Australians.	Cross sectional prevalence study.	847 ATSI people aged 15 years and over.	Yarrabah, North Queensland.	January 2002.	Health survey questionnaire and physical examination.
Pham et al, 2013	To describe the burden of BJP in a regional population, and to identify characteristics and service-usage patterns	Cross sectional study.	3350 people aged 15 years and over.	Port Lincoln, South Australia.	2010	Cross sectional health survey all residents. Follow-up survey of people with BJP.
Vindigni et al, 2004	To identify the prevalence of musculoskeletal conditions, associated levels of pain, treatments sought and barriers to management	Cross sectional prevalence study.	189 Aboriginal Australians aged 15 and over.	Kempsey district, New South Wales	January 2001 to July 2002.	Musculoskeletal pain survey questionnaire and clinical examination.

	amongst Aboriginal Australians.					
Vindigni et al, 2005	To examine the association between LBP and modifiable risk factors in a large rural Indigenous community.	Cross sectional study	189 Aboriginal Australians aged 15 and over.	Kempsey district, New South Wales	January 2001 to July 2002.	Musculoskeletal pain survey questionnaire and clinical examination.
Qualitative Articles	Relevant study aim(s)	Design	Participants/ sample size	Setting	Dates	Data source
Lin et al. 2012	To understand the chronic LBP experience from the perspective of Aboriginal people with LBP.	A qualitative interpretive perspective, clinical ethnography	21 Aboriginal men, 11 Aboriginal women with chronic LBP	One regional and two remote Western Australian towns	2007-2010	Semi-structured interviews using 'yarning'. Interviews conducted by PI and Aboriginal co-investigator. Follow-up interviews (n=19).
Lin et al. 2013	Explore the back pain beliefs in Aboriginal people with CLBP and their relationship to disability	As above	As above	As above	As above	As above
Lin et al. 2015	To examine communicative barriers between Aboriginal people with chronic LBP and clinicians	As above	As above	As above	As above	As above
Strong et al. 2015	Explore the ways Aboriginal people communicate about their pain to clinicians and barriers to	Qualitative	20 men and 20 women with a health condition for which they had sought pain relief – including arthritis,	One regional town and one rural Aboriginal community in South East Queensland	Unknown	Separate female and male focus groups, conducted by female/male researchers. Open and

communication and pain management.	orthopaedic injuries, back pain and coronary artery disease.	culturally sensitive enquiry and analysis.
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AIHW – Australian Institute of Health and Welfare, OA - osteoarthritis, RA - rheumatoid arthritis, OP – osteoporosis, NHS – National Health Survey, NATSIHS – National Aboriginal and Torres Strait Islander Health Survey, AATSIH – Australian Aboriginal and Torres Strait Islander Health Survey, ATSI – Aboriginal and Torres Strait Islander, MSD – musculoskeletal disease, GP – general practitioner, BEACH - Bettering the Evaluation and Care of Health, THR – total hip replacement, TKR – total knee replacement, GA - general anaesthesia, MIH – maternal infant health, BJP - bone and joint problems, AMS – Aboriginal Medical Service, PI – primary investigator

Table 4: Article findings and MMAT score

Quantitative Article	Main relevant findings	MMAT score	Comments (MMAT criteria where relevant)
AIHW, 2011	OA and RA 1.5 and 2.0 times more prevalent in ATSI than non-ATSI population. No difference in OP prevalence	100	Large population level survey. Response rate >80%. Very remote areas not sampled.
AIHW, 2013	Prevalence RA 2.5% in ATSI population. No difference between ATSI/non-ATSI populations.	100	As above. Used direct age standardisation method.
AIHW, 2014	Arthritis 1.2 times (16.9% vs 13.6%) greater in ATSI population. Current back pain 1.1 times greater. Back pain/arthritis is the third most common long term condition in ATSI.	100	Large population level survey. Response rate > 74%.
AIHW, 2015	MSD 1.1 times higher in ATSI population. Prevalence in ATSI: MSD - 20%, back pain - 10%, arthritis - 10%, OP - 2%. MSD 2nd most common long term health condition >45 years and 3rd most common aged 15-44. Hospitalizations due to MSD less common in ATSI vs non-ATSI (0.8 times). Having arthritis reduced the likelihood of being in full time employment.	100	As above.
Benson et al, 2006	Vitamin D levels lower in patients with muscle pain (40.88 nmol/L vs 58.25 nmol/L).	0	3.1 Recruitment not described. 3.2 Suitability of measurements unknown as there was no definition of 'muscle pain'. 3.3 Groups only matched for age and sex. No data supplied for other factors. 3.4 Cannot interpret based on sampling strategy.
Brand et al, 2014	Primary care access for knee OA (3.2 vs 6.5 per 1000 encounters) and hip OA (1.2 vs 2.3 per 1000 encounters) is lower for ATSI patients. Hip OA difference is not significant. Authors suggest differences in knee OA could be due to younger age, lack of access to GP management, or other health issues that were of higher priority.	100	Random sampling 1000 GPs. Response rate >80%.
Cunningham et al, 2011	Arthritis prevalence 17% in ATSI vs 14% in non-ATSI. Arthritis associated with house income and employment status amongst ATSI people. Higher prevalence may be due to racism and discrimination, stress, childhood adversity, and a legacy of loss, grief, and dispossession.	100	Large population level survey. Response rate >80%. Only non- remote areas sampled.
Dixon et al, 2011	ATSI men had 1/3 rd number of THR and ½ number of TKR, ATSI women 1/5 and ½.	100	Large national dataset.

	May be due to lower access to health care, lower acceptance, increased surgery risk, or MSD are a lower priority due to other health issues.		
Douglas, 2004	Prevalence of LBP - 7% in Aurukun, 26% at Weipa. Knee OA 4.6% at Aurukun, 14% at Weipa.	0	4.1 Inclusion criteria not reported other than "pure ancestry" which is not defined. 4.2 As above and overall population not reported. 4.3 Interview questions not described in detail. 4.4 See 4.2
Honeyman et al, 1996	8/31 men and 15/25 women had current long term LBP. Little evidence of pain behaviours. Authors concluded: back pain is not regarded as a health issue due to cultural views.	50	4.1 Sampling is via convenience method 4.3 Modification to the Nordic Pain Questionnaire not described. Physical examination details not reported.
Minaur et al, 2004	33% reported rheumatic symptoms within previous 7 days, 22% past symptoms. Most common 7-day sites were back pain (12.5%), knee pain (11.2%), and shoulder pain (8.9%). 3.8% were diagnosed with gout. 7.7% participants said they were limited due to current rheumatic symptoms. 38% had not sought treatment, 6% had self-treated with medicines, and 38% had visited the GP.	75	3.2 Validity of questionnaire in study population not reported.
Pham et al, 2013	ATSI less likely to report BJP than non-ATSI (OR=0.49; 0.25-0.97). ATSI participants with BJP; more likely to use an AMS, have trouble washing/dressing, less likely to access mental health services, have asthma and report drug and alcohol issues.	25	3.2 Validity of survey tool for ATSI unknown. 3.3 Suitability of multivariate regression analysis unknown for n=17 3.4 Low number of ATSI participants.
Vindigni et al, 2004	95% participants reported pain in previous 7 days, most commonly LBP 39%. 87% reported multiple MSD in past 7 days. 64% had MSD greater than 7 weeks. 68% rated high levels of pain, 38% rated themselves significantly limited. 48% of people with pain had not received care because; 'learned to live with it' (33%), 'unaware of what might help' (17%) and therapies too expensive (13.2%).	0	4.1 Pooled random and convenience sample data for analysis. 4.2 Sample characteristics were not compared to community characteristics. 4.3 Validity of measurement not substantiated by cited reference. Definitions of risk factors not reported. 4.4 There was a 40% random sample response rate.
Vindigni et al, 2005	7-day LBP prevalence was 72%. Recorded risk factors were common amongst those with LBP (smoking – 46%, physical inactivity – 16% no exercise and 35.9% less than 30 mins/week, history of physical trauma – 66.1%) however no statistical	0	3.1 Mixed random/convenience sample. 3.2 Validity of measurement not substantiated by cited reference. 3.3 No controlling for differences

	association.		between those with/without LBP 3.4 Response rate 40% for random sample
Qualitative Article	Main relevant findings	MMAT score	Comments
Lin et al. 2012	Gendered impact of chronic LBP e.g. housework for women; employment and sport for men. Financial loss, social and identity loss associated with inability to work/play sport. Racism in workplace when continued to work in pain Chronic LBP impacted on spiritual and cultural expression and obligations e.g. going bush, cultural meetings. Pain impacted ability to travel by car for medical care Emotional consequences: anger, frustration and depression.	100	All MMAT criteria addressed
Lin et al. 2013	Beliefs associated with LBP and disability identified: Beliefs that LBP due to structural/anatomical problems common, originating from clinicians advice and imaging. Structural beliefs and negative beliefs about future closely tied. These were reinforced by clinician and experiences of family members. Structural beliefs linked to passive reliance on clinicians. Those with positive outlook, because of self-held belief and self-efficacy, not interaction with clinicians. Authors concluded: disabling LBP may be partly iatrogenic.	100	As above
Lin et al. 2015	Poor communication identified: conflicting information, medical jargon not understood and absence of communication (usually when travelling to specialists) Poor communication could lead to disengagement with healthcare system – ‘giving up’ Participant would disclose more to clinicians that took time and listened. ‘Yarning’ identified as positive communication.	100	As above
Strong et al. 2015	Physical pains could be secondary to emotional pains. Reluctance to report pain. Cultural preference for bravery. Some concerned about exposing vulnerabilities to Whitefellas. Lack of trust. Perceptions that; clinicians don't listen, lack interest so participants didn't seek help unless desperate, and patients were allocated inexperienced doctors.	50	1.3 Little contextual detail about settings e.g. size of towns/community, available health services. 1.4 The relationship between researchers and participants and the role of the researchers in the community unknown

Stigma a barrier to care e.g. 'drunk Aboriginal'.
Communication difficulties making self-understood
and understanding what told.

AIHW – Australian Institute of Health and Welfare, OA - osteoarthritis, RA - rheumatoid arthritis, OP – osteoporosis, ATSI – Aboriginal and Torres Strait Islander, MSD – musculoskeletal disease, GP – general practitioner, THR – total hip replacement, TKR – total knee replacement, BJP - bone and joint problems, AMS – Aboriginal Medical Service, MMAT - Mixed Methods Appraisal Tool.

Figure 1: PRISMA Flow Diagram