Research paper

Trends in management of hip and knee osteoarthritis in general practice in Australia over an 11-year window: a nationwide cross-sectional survey

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ABSTRACT

Background: We aimed to describe trends in knee and hip OA management by general medical practitioners (GPs) in Australia.

Methods: We analysed cross-sectional survey data from the Bettering the Evaluation and Care of Health (BEACH) program (1,000 randomly-selected GPs annually recording 100 consecutive patient encounters) over two periods: Period one April 1, 2005-March 31, 2010 and period two April 1, 2010-March 31, 2016. This included data from 10,738 GPs and 1,073,800 patient encounters with 6,565 GPs and 9,196 patient encounters for hip/knee OA. Data were summarized using descriptive statistics and 95% confidence intervals around point estimates.

Findings: Rate of knee OA problems managed by GPs increased in period two (7•1 (6•9-7•4) vs 6•2 (95% CI 6•0-6•5) per 1,000 all encounters), with a similar trend for hip OA. Encounter rates rose for some subgroups but remained stable for vulnerable subgroups. Although use of Medicare chronic disease management items, referral to allied health professionals and advice/education and lifestyle management (knee OA) increased, rates remained low. Use of MRI imaging rose. Overall medication rates were stable but substantially higher than non-pharmacological treatments. Declining reliance on non-steroidal anti-inflammatory drugs and glucosamine and increased reliance on paracetamol (knee OA) and opioids were demonstrated.

Interpretation: GPs in Australia are more frequently managing knee and hip OA. While small changes in GP management actions occured, rates of recommended first-line non-pharmacological treatments remained low and imaging, medications, and surgical referral rates high. Strategies are needed to optimise lifestyle management and reduce low-value care, with attention to healthcare disparities.

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Research in context

Evidence before this study

General practitioners (GPs) frequently manage knee and hip OA problems. We previously reported on GP management in Australia from 2005-2010 and identified evidence-practice gaps, particularly under-use of key recommended lifestyle treatments of exercise and weight loss. These results aligned with findings of a systematic review of community-based observational studies of actual clinical practice treating people with OA, compared with quality indicators. In this review, the pass rates for core first-line nonpharmacologic approaches (recommendation to exercise and education) were below 40%, indicating considerable scope for improvement. However, there are no large national studies investigating whether GP care of OA has changed over time in Australia.

Added value of this study

This study utilized data from a large national GP survey and included 6565 GPs and 9196 patient encounters for hip and knee OA over an 11-year time period. We compared findings from our previously reported 5-year time period (April 1, 2005-March 31, 2010) with a subsequent 6-year time period (April 1, 2010-March 31, 2016) given that a number of initiatives had occurred with the aim being to address evidence-practice gaps. We found that the number of knee and hip OA management occasions by GPs rose 38% from 2005 to 2016. While small changes in GP management actions occurred between the two time periods, rates of recommended first line non-pharmacological treatments remained low and imaging, medications, and surgical referral rates high. We also found health care disparities with respect to vulnerable subgroups (Indigenous people and those from non-English-speaking backgrounds, residing outside major cities and those most socio-economically disadvantaged).

Implications of all the available evidence

Ongoing efforts are needed to increase GPs use of effective non-pharmacologic OA treatments, reduce use of inappropriate imaging and use medications, especially opioids, more judiciously for people with knee and hip OA. Further attention should be paid to eliminating healthcare disparities in the management of knee and hip OA in Australia.

INTRODUCTION

Osteoarthritis (OA) commonly affects the knee and hip joints and is a leading cause of pain and disability worldwide.[1] Around 2·1 million Australians (1 in 11 people) have OA, with a 58% increase expected by 2032 due to population ageing and rising obesity rates.[2] Osteoarthritis can be extremely debilitating. Afflicted individuals experience joint pain which can become persistent and more limiting over time. Osteoarthritis can also impair physical function, sleep and psychological health, impacting substantially on quality of life. The societal burden is considerable with OA costing the Australian health system more than $3·75 billion, with joint replacements for advanced disease a major contributor.[3]

Guidelines recommend use of effective non-pharmacological lifestyle interventions including education, exercise, and weight loss, if appropriate[4]. Adjunctive pharmacological management (judicious use of simple analgesia and non-steroidal anti-inflammatory drugs) is largely symptomatic, while total joint replacement surgery is reserved for advanced disease. In order to deliver timely and appropriate OA care, service models are being

re-designed to support integrated multidisciplinary care and patient self management.[5] In Australia, the main funding mechanism for primary health care is the Medicare Benefits Scheme (MBS), a publicly-funded universal health insurance scheme. It fully or partly covers treatments and services (identified via Item Numbers) provided by GPs and other health practitioners including nurses and allied health providers. GPs provide the majority of primary care and act as gatekeepers to government-subsidized health care from other medical specialists. The government actively encourages GPs to develop multidisciplinary patient chronic disease care plans (known as Chronic Disease Management Items) and to refer to allied health professionals by providing reimbursement for a limited number of these services (up to 5 visits per year) under the Medicare scheme.

Research has highlighted gaps between evidence-based guidelines and management of OA in primary care globally.[6] Our own work utilising data from the Bettering the Evaluation and Care of Health (BEACH) program, which offered detailed information about GP management activity in Australia, showed low rates of core lifestyle treatments compared with pharmacological treatments and high rates of surgical referral over the 2005-2010 period.[7]

It is important to examine if GP management has changed since then to better direct efforts to close existing evidence-practice gaps and improve outcomes for people with OA, as highlighted by Australian's National OA Strategy.[8] This study aimed to utilise data from the BEACH program to describe trends in the management of knee and hip OA by Australian GPs over two consecutive periods spanning more than a decade.

METHODS

Population and setting

We analysed knee and hip OA data from the BEACH study for two consecutive periods: Period one April 1, 2005-March 31, 2010 and period two April 1, 2010-March 31, 2016 inclusively. We have previously reported some of the data from the first period.[7] The BEACH program ran from April 1998 until March 2016 and its methods have been previously described.[9] To summarise, an ever-changing random sample of GPs drawn from GP Medicare claims records by the Commonwealth Department of Health was invited to participate in each study year (April–March). Eligible GPs were those who had claimed at least 375 MBS items of service over the previous 3 months. The Department of Health randomised the full sample of GPs (excluding those who had already been approached earlier in the sample period to ensure that there was no data pairing across time periods). No stratification was utilised. Approximately 1,000 GPs (around 80% of those agreeing to participate) completed the study each year. [9]

Procedure

Each GP recorded information in free text on structured paper forms for 100 consecutive encounters with consenting patients. This provided an annual sample of 100,000 nationally representative GP-patient encounters. Information recorded included GP age, sex and practice location and patient age, sex, Indigenous status (patient self-identified), non–English-speaking background (NESB) status (primary language spoken at home was not English), and residential postcode for calculation of socioeconomic disadvantage (via the Socio-Economic Indexes for Areas Index of Relative Socio-economic Advantage and Disadvantage).[10] Encounter data included: problems managed (up to 4 in free-text descriptions), new or old (diagnosed previously) problem status, management of each problem and how the encounter was paid for, including Medicare

item numbers. The GP could record up to 4 medications and up to 2 non-pharmacological treatments linked to each problem managed. Any referrals and imaging ordered for each problem were also documented. Data from the structured paper forms were entered into a secure bespoke database by clinical coders trained in Australian general practice clinical interface terminology. The coders classified medications according to the Anatomical Therapeutic Chemical (ATC) Classification System.[11] Problems managed and non-pharmacological treatments were coded using the clinical interface terminology International Classification of Primary Care Version 2 (ICPC-2) PLUS which is automatically classified according to the ICPC-2 and used in more than 45 countries as the standard for primary care data classification.[7] Knee OA problems were defined as ICPC-2 PLUS code "L90001" and hip OA problems "L89001." Missing data in our samples were removed from all analyses.

Each year the BEACH sample was tested and shown to be representative of Australian GPs and their patient encounters.[9] Testing involved comparison of sample GP characteristics with those of all GPs in the potential sample (those who claimed $\geq$ 375 MBS service items) and comparison of patient characteristics at sample encounters where an MBS service item was claimed with those who claimed all MBS service items.

Sample size and statistical analysis

The BEACH study was a cluster design with 100 consecutive patient encounters clustered around each of 1,000 GPs annually. This sample size was based on guidelines by Meza et al[12] to enable measurement of the most common morbidities and treatments at 95 per cent confidence as estimated using ratio-estimator models for cluster sample surveys in general practice.[12] The current analysis used all available encounters from the BEACH study during the study periods.

Robust 95% confidence intervals (95% CIs) were calculated using the surveymeans procedures in SAS, version 9•4, which accounted for the study's cluster design. No covariates were included in the analyses. Differences between the two periods are regarded as significant if CIs are non-overlapping. This is far more conservative than the traditional 0•05 alpha level and reduces the risk of Type I error although at the expense of increasing the risk of Type 2 error. Data were summarized using descriptive analysis, and methods for extrapolation to total national encounters are based on previous methods.[9]

The BEACH program was approved by the Human Research Ethics Committee of the University of Sydney (reference # 2012/130).

Role of the funding source

The funders of the BEACH study had no role in the study design, data collection, data analysis, interpretation, or writing of this report.

RESULTS

Between 2005-10, 4,899 GPs collected data on 489,900 patient encounters at which knee OA was managed in 3,058 encounters and hip OA in 1,106 encounters. Between 2010-16, 5,839 GPs collected data on 583,900 patient encounters at which knee OA was managed in 4,156 encounters and hip OA in 1,492 encounters. These findings indicate that rates of GP management of knee OA problems increased from period one to two, with a similar trend for hip OA (Table 1). Nationally, GPs managed knee OA at approximately 940,000 encounters per year in period two, and hip OA at 340,000 encounters, an increase of 38% for both problems.

For patient subgroups (Table 2), knee OA management rates were higher in the second period compared with the first for both men and women, and for: non-Indigenous patients; those aged 45-64 years; those from an English-speaking background; those living in major cities; and the least socio-economically disadvantaged. Hip OA management rates for patient subgroups did not differ across the two periods, except for a higher rate in the second period for those least socio-economically disadvantaged. For GP subgroups, knee OA management rates increased in the second time period amongst female GPs and those older than 60 years while hip OA management rates did not differ across time periods in any GP subgroup.

Management strategies employed by GPs are shown in Table 3 and Figure 1. Use of Medicare chronic disease management items rose in the second period but remained low. Referral rates to other health practitioners increased, driven by more referrals to allied health professionals, particularly physiotherapists for knee OA. Referral rates to medical specialists did not differ in the second period and were more than double those to allied health professionals. Patients were commonly referred to orthopaedic surgeons, even for new problems (Period two: Knee OA 9•8 (95% CI 7•8-11•8) per 100 new OA problems; Hip OA 13•2 (9•8-16•7) per 100 new OA problems). Overall diagnostic imaging rates did not change, remaining relatively high. While x-ray was the predominant imaging modality, hip and knee MRI rates increased.

With respect to non-pharmacological treatments for knee OA, reported GP use of counselling/advice/education or use of at least one lifestyle management strategy increased, but still remained relatively infrequent. Rates for physical treatments including therapeutic exercise/ rehabilitation, acupuncture and joint injections did not differ across periods and were low. There was no change in rates of non-pharmacological treatments for hip OA.

Medication rates for management of knee and hip OA, including new problems, were substantially higher than those of non-pharmacological treatments and did not change across the two periods (Table 4, Figure 1). However, rates of specific medication types differed. Declining rates were seen for non-steroidal anti-inflammatory drugs and glucosamine for both knee and hip OA. In contrast, rates of paracetamol for knee OA and opioids for both knee and hip OA, including for new problems, increased.

DISCUSSION

We used the BEACH dataset, an 18-year national study of GP clinical activity, to describe trends in GP management of Australians with hip and knee OA over 11 years. Our analysis involved data from 6,565 GPs and 9,196 patient encounters for hip and knee OA. The results will be of interest to a range of stakeholders including researchers, clinicians, professional and consumer organisations, government and other health care funders. Findings have implications for guiding targets for implementation science research to improve evidence-based practice behaviours, decision making around resource allocation, implementation priorities, and clinician education.

Our findings show that the rate at which knee OA problems was managed by GPs significantly increased in 2010-2016 relative to 2005-2010, with a similar trend observed for hip OA. These findings are consistent with national joint replacement registry data showing a 130% and 82% rise respectively in rates of primary total knee and hip replacements from 2003 to 2015.[13] The results highlight that OA is a problem commonly managed by GPs in Australia, particularly knee OA where encounter rates were treble those for hip OA.

We also demonstrated that rates of management for vulnerable patient subgroups (Indigenous people, those from non-English-speaking backgrounds, those residing outside major cities

Table 1

Management rates of knee and hip OA by general practitioners in Australia from 2005 to 2016.

Rates	Knee OA	Hip OA
2005-10		
N of GP participants	4,899	4,899
N of GPs who had an OA encounter	1,954	1,149
N of patient encounters where OA is managed	3,058	1,106
N of total GP-patient encounters	489,900	489,900
Management rate per 1000 all encounters (95% CI)	6•2 (6•0-6•5)	2•3 (2•1-2•4)
Estimated occasions problems managed nationally †	679,000	245,000
2010-16		
N of GP participants	5,839	5,839
N of GPs who had an OA encounter	2,586	876
N of patient encounters where OA is managed	4,156	1,492
N of total GP-patient encounters	583,900	583,900
Management rate per 1000 all encounters (95% CI)	7•1 (6•9-7•4) *	2•6 (2•4-2•7)
Estimated occasions problems managed nationally †	938,000	337,000

† Annual estimated number of occasions problem managed by GPs nationally (rounded to nearest '000). The extrapolation base for 2005-10 is 108•7 million (average of financial years of non-referred MBS GP attendances 2005-06 to 2009-10 inclusive). For 2010-16 the extrapolation base is 131•8 million (average of financial years of non-referred MBS GP attendances 2010-11 to 2015-16 inclusive).

* significant difference compared with 2005-2010 time period.

OA=osteoarthritis; BEACH = Bettering the Evaluation and Care of Health Program; CI=confidence interval.
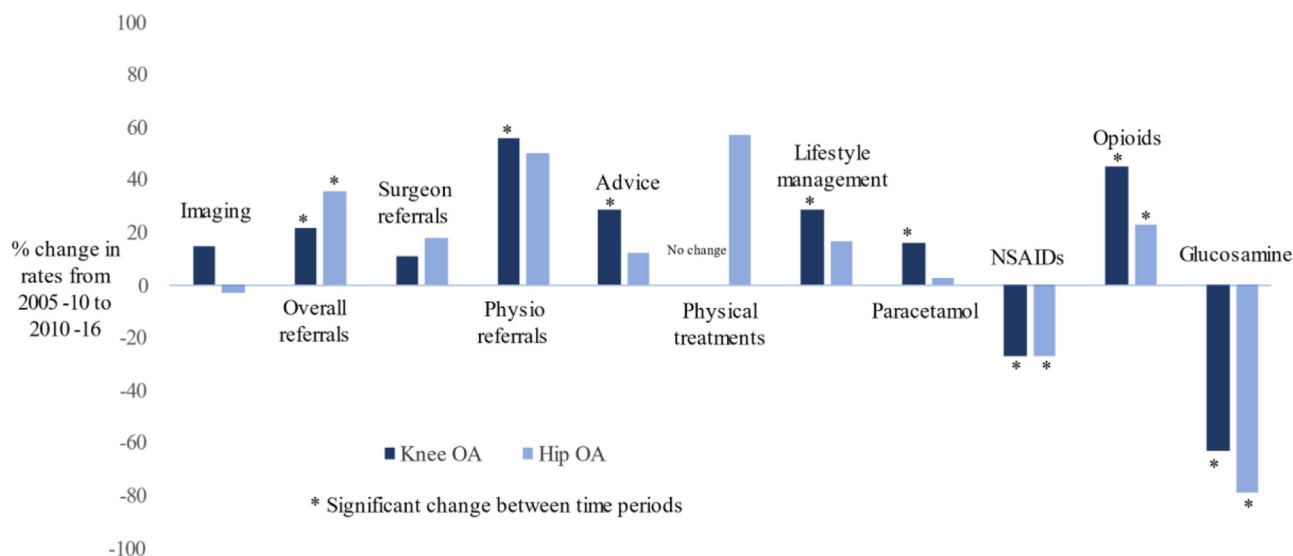

Figure 1. Percentage change in rates for management strategies between period one and period two for knee and hip OA.

and those most socio-economically disadvantaged) remained unchanged. This is concerning given that the prevalence of OA in Australia is higher in inner regional and outer regional/remote areas (25% and 23%, respectively) than in major cities (19%), and higher for people living in the lowest socioeconomic areas (25%) than in the highest socioeconomic areas (16%).[14] A mismatch between OA disease burden and access to health care is also well-established among Indigenous Australians, where OA is 1•5 times more prevalent than among non-Indigenous Australians, yet Indigenous Australians are approximately half as likely to undergo joint replacement.[15] Reasons for observed healthcare disparities across patient subgroups in our study are likely to be multi-factorial and may be related to negative experiences with healthcare, perceived or experienced racism, geographical isolation and/or financial limitations.[15]

Australia's first national OA clinical guidelines were published by the Royal Australian College of General Practitioners (RACGP) in July 2009,[16] just before data collection for period one ended in March, 2010. The guidelines at this time recommended exercise, weight reduction (if appropriate) and paracetamol as first-line drug

therapy, NSAIDs when simple analgesia and non-pharmacological approaches were ineffective, glucocorticoid injections for short-term treatment and opioids in some circumstances. Our study shows small changes in GP management of OA, particularly knee OA, that were somewhat in the direction of these guideline recommendations. For example, positive changes included increased use of Medicare chronic disease management items, referrals to allied health professionals (predominantly physiotherapists), advice/education and lifestyle management. Although rates for these, as well as for exercise/rehabilitation, remained low across both periods, these results do indicate some improvement in non-pharmacological non-surgical management of OA across time.

Pharmacological management continued to be the most frequent treatment approach used by GPs over both periods, with overall medication rates unchanged in 2010-2016. Reductions in NSAID and glucosamine use over time were offset by increased use of paracetamol and opioids. In period two, 14•9% and 25•6% of knee and hip OA problems respectively were managed with opioids. While this could reflect awareness of the original 2009 RACGP OA guideline recommendation,[16] the Medical Journal of Australia

Table 2

Patient- and GP-characteristic specific rates of knee and hip OA management per 1,000 encounters (95% confidence interval) in BEACH dataset, April 2005-March 2016.

	Encounters in sample (n)		Knee OA per 1,000 encounters		Hip OA per 1,000 encounters	
	2005-10	2010-16	2005-10 (n=489,900) †	2010-16 (n=583,900) †	2005-10 (n=489,900) †	2010-16 (n=583,900) †
Patient characteristics						
Sex *(Missing)*	*(4,159)*	*(5,154)*				
Male	197,779	234,686	6·1 (5·8-6·5)	7·0 (6·6-7·4) *	2·1 (1·9-2·4)	2·5 (2·3-2·7)
Female	287,962	344,060	6·3 (6·0-6·7)	7·2 (6·9-7·6) *	2·4 (2·2-2·5)	2·6 (2·4-2·8)
Age *(Missing)*	*(3,775)*	*(4,913)*				
<25	100,260	113,346	0·1 (0·1-0·2)	0·1 (0·1-0·2)	0·1 (0·0-0·1)	0·0 (0·0-0·0)
25-44	112,509	129,154	1·3 (1·1-1·5)	1·4 (1·2-1·6)	0·4 (0·3-0·6)	0·4 (0·3-0·6)
45-64	136,657	158,384	8·3 (7·8-8·9)	9·5 (9·0-10·0) *	2·6 (2·3-2·9)	3·2 (2·9-3·5)
65-74	60,888	81,498	13·7 (12·7-14·7)	14·9 (14·0-15·8)	5·2 (4·6-5·8)	5·0 (4·4-5·5)
75+	75,811	96,605	12·0 (11·2-12·9)	12·5 (11·7-13·3)	4·8 (4·3-5·3)	5·4 (4·9-5·9)
Indigenous status *(Missing)*	*(47,373)*	*(57,477)*				
Indigenous	5,695	10,219	3·2 (1·5-4·8)	5·9 (4·3-7·4)	1·2 (0·2-2·2)	1·3 (0·6-2·0)
Non-Indigenous	436,832	516,204	6·5 (6·2-6·8)	7·3 (7·0-7·6) *	2·3 (2·2-2·5)	2·6 (2·5-2·8)
Language *(Missing)*	*(47,953)*	*(57,495)*				
English	36,709	46,478	6·2 (6·0-6·5)	7·1 (6·8-7·3)	2·4 (2·2-2·6)	2·7 (2·5-2·9)
NESB	405,598	479,927	8·5 (7·4-9·6)	9·6 (8·6-10·7)	1·5 (1·1-2·0)	1·7 (1·3-2·1)
Socio-economic disadvantage *(Missing)*	*(12,059)*	*(13,230)*				
Least disadvantaged	291,722	343,718	5·9 (5·5-6·2)	6·7 (6·4-7·1) *	2·0 (1·8-2·1)	2·4 (2·2-2·6) *
Most disadvantaged	186,119	226,952	6·9 (6·5-7·4)	7·8 (7·4-8·2)	2·7 (2·4-2·9)	2·8 (2·5-3·0)
GP characteristics						
Sex *(Missing)*	*(0)*	*(0)*				
Male	309,300	337,800	7·1 (6·7-7·5)	7·9 (7·5-8·2)	2·4 (2·2-2·6)	2·8 (2·6-3·0)
Female	180,600	246,100	4·8 (4·4-5·2)	6·1 (5·7-6·4) *	2·0 (1·8-2·2)	2·2 (2·0-2·5)
Age, years *(Missing)*	*(4,700)*	*(3,500)*				
<40	68,700	91,400	4·6 (4·0-5·2)	4·7 (4·2-5·2)	1·7 (1·3-2·0)	1·9 (1·6-2·2)
40-49	145,500	138,100	5·5 (5·1-6·0)	6·4 (5·9-6·9)	2·3 (2·0-2·5)	2·4 (2·1-2·7)
50-59	166,200	191,500	6·9 (6·4-7·4)	7·5 (7·0-7·9)	2·5 (2·2-2·8)	2·8 (2·5-3·1)
60+	104,800	159,400	7·3 (6·7-8·0)	8·8 (8·2-9·3) *	2·3 (2·0-2·6)	2·8 (2·5-3·1)
Practice location ^ *(Missing)*	*(10,913)*	*(12,364)*				
Major City	353,300	409,900	6·0 (5·7-6·3)	6·9 (6·6-7·3) *	2·0 (1·9-2·2)	2·3 (2·1-2·5)
Inner regional area	89,800	115,200	6·9 (6·3-7·6)	7·7 (7·1-8·3)	2·9 (2·5-3·2)	3·5 (3·1-3·9)
Outer regional/ remote area	46,700	57,500	6·5 (5·6-7·3)	7·3 (6·4-8·2)	2·9 (2·3-3·4)	2·5 (2·0-3·0)

OA=osteoarthritis; BEACH = Bettering the Evaluation and Care of Health Program; NESB=Non-English-speaking background.

† total number of GP encounters for all problems recorded by 4899 GPs in 2005-10 and 5,839 in 2010-16.

^ Postcode mapped to the Australian Statistical Geography Standard classification * significant difference compared with 2005-2010 time period.

was already publicising concern over rising opioid prescription rates for non-cancer pain from around 2011.[17] Aligned with this concern, the revised 2018 RACGP guidelines now strongly recommend against the use of opioids for the management of knee and hip OA.[4] Reasons for the substantial drop in use of glucosamine are not known but likely reflect the lack of efficacy of the agent as well as changes in guideline recommendations.

Although the 2009 RACGP OA guidelines[16] did not address the use of imaging in OA management, recommendations against routine imaging for making an OA diagnosis in patients with hip or knee pain emerged from as early as 2008[18] and are consistent with current guidelines.[4] Despite this, use of imaging did not change and it is notable that around half of all new knee and hip OA problems were still referred for imaging. X-ray was the predominant imaging modality accounting for 88% and 86% of modalities for knee and hip OA, respectively. MRI use rose 5-fold for knee OA and 10-fold for hip OA in the second period, making up 4% of imaging modalities for knee OA and 2·3% for hip OA. This increase aligns with findings using Medicare Benefits Scheme claims data in Australians aged over 55 years.[19] Thus GP education should emphasise that imaging in OA should be reserved for cases where a differential diagnosis needs to be excluded or if joint replacement surgery is being considered.

The rate of GP referral to orthopaedic surgeons for knee and hip OA did not change over time and was a common practice, even for new problems. Temporal trends reported in a retrospective study using Australian Medicare Benefits Scheme claims data from 2003 to 2017 showed that knee arthroscopy rates increased from 2003 before declining modestly from 2011, likely due to accumulating evidence that did not support its ongoing use,[20] while joint replacement rates have continued to increase.[19] GP referrals to orthopaedic surgeons remained more than double those to allied health professionals.

Overall, despite publication of numerous Australian[16] and international clinical practice guidelines over this time frame,[21, 22] our study highlights that GPs in Australia continued to predominantly used medications to manage OA and under-utilised recommended non-pharmacological approaches. These findings have implications not only at an individual patient level, but also at a societal level. Whilst several diagnostic and treatment items showed no change, at a national level this still implies increased healthcare costs given the rise in absolute number of OA-related encounters. Data were only available until March 2016 when the BEACH study ceased. Revised Australian OA clinical guidelines were published by the RACGP in 2018[4] and although most recommendations remained consistent, key changes included a strong recommendation against opioids and softening of advice regarding paracetamol where no clear recommendation could be made. Future research should investigate whether, and how, trends in GP management change following the release of these revised Australian guidelines and other initiatives such as withdrawal of GPs' ability to request government-subsidised knee MRIs for patients aged 50 years and over.

Our findings are consistent with a small survey of GPs in Australia in 2013[23] and a systematic review evaluating the quality of community-based OA care in ten developed countries.[24] In that re-

Table 3

Comparison of general practitioner imaging and referral patterns and non-pharmacological management of knee and hip OA in period one and period two.

	Knee OA Rate per 100 knee OA problems managed (95% CI)				Hip OA Rate per 100 hip OA problems managed (95% CIs)			
	2005-10		2010-16		2005-10		2010-16	
	N	n=3,058	N	n=4,156	N	n=1,106	N	n=1,492
Medicare chronic disease management items ^	53	1·7 (1·1-2·3)	137	3·3 (2·6-4·0)	21	1·9 (0·9-2·9)	93	6·2 (4·5-7·9)
Referrals								
All	533	17·4 (16·0-18·9)	879	21·2 (19·8-22·5) *	196	17·7 (15·4-20·0)	358	24·0 (21·7-26·3) *
New	*100*	*14·9 (12·1-17·7)*	*181*	*18·9 (16·1-21·6)*	*39*	*13·7 (9·6-17·8)*	*73*	*19·7 (15·4-24·0)*
Specialist referrals	393	12·9 (11·6-14·1)	586	14·1(13·0-15·2)	151	13·7(11·6-15·7)	249	16·7(14·8-18·6)
Orthopaedic surgeon	363	11·9 (10·7-13·1)	548	13·2 (12·1-14·3)	147	13·3 (11·3-15·3)	234	15·7 (13·8-17·6)
Rheumatologist	19	0·6 (0·3-0·9)	15	0·4 (0·2-0·5)	0	0·0 (N/A)	5	0·3 (0·0-0·6)
Allied health professionals	118	3·9 (3·1-4·6)	262	6·3 (5·5-7·1) *	40	3·6 (2·5-4·7)	96	6·4 (5·1-7·7) *
Physiotherapist	97	3·2 (2·5-3·8)	209	5·0 (4·3-5·7) *	33	3·0 (2·0-4·0)	67	4·5 (3·4-5·6)
Podiatrist/chiropodist	5	0·2 (0·0-0·3)	5	0·1 (0·0-0·2)	2	0·2 (0·0-0·4)	5	0·3 (0·0-0·6)
Exercise physiologist	0	0·0 (N/A)	8	0·2 (0·1-0·3)	1	0·1 (0·0-0·3)	6	0·4 (0·1-0·7)
Dietitian/nutritionist	1	0·0 (0·0-0·1)	7	0·2 (0·0-0·3)	0	0·0 (N/A)	2	0·1 (0·0-0·3)
Imaging								
All	668	21·8 (20·2-23·5)	1,037	25·0 (23·5-26·4)	356	32·2 (28·9-35·5)	464	31·1 (28·1-34·1)
New	*301*	*44·8 (40·7-48·9)*	*444*	*46·3 (42·7-49·8)*	*167*	*58·8 (51·1-66·5)*	*209*	*56·3 (49·4-63·3)*
Diagnostic radiology ₵	632	20·7 (19·1-22·2)	913	22·0 (20·6-23·3)	332	30·0 (26·8-33·2)	400	26·8 (24·1-29·5)
Ultrasound	26	0·9 (0·5-1·2)	66	1·6 (1·2-2·0)	16	1·4 (0·6-2·3)	36	2·4 (1·6-3·2)
MRI	5	0·2 (0·0-0·3)	43	1·0 (0·7-1·4) *	1	0·1 (0·0-0·3)	10	0·7 (0·2-1·1) *
Counselling/advice/ education								
All	472	15·4 (14·0-16·9)	821	19·8 (18·3-21·2) *	175	15·8 (13·3-18·4)	268	18·0 (15·7-20·2)
New	*106*	*15·8 (12·7-18·8)*	*195*	*20·3 (17·2-23·4)*	*39*	*13·7 (9·0-18·4)*	*65*	*17·5 (13·2-21·8)*
Physical Treatments								
All	345	11·3 (9·9-12·7)	470	11·3 (9·9-12·7)	39	3·5 (2·3-4·8)	82	5·5 (3·9-7·1)
New	*65*	*9·7 (7·1-12·2)*	*105*	*10·9 (8·8-13·1)*	*5*	*1·8 (0·0-3·6)*	*18*	*4·9 (2·5-7·2)*
Exercise/rehabilitation	114	3·7 (2·9-4·6)	213	5·1 (4·3-6·0)	23	2·1 (1·1-3·1)	50	3·4 (1·9-4·8)
Acupuncture	56	1·8 (1·2-2·5)	50	1·2 (0·7-1·7)	2	0·2 (0·0-0·4)	9	0·6 (0·2-1·0)
Joint injection #	134	4·4 (3·5-5·3)	132	3·2 (2·5-3·9)	6	0·5 (0·1-1·0)	10	0·7 (0·3-1·1)
At least one lifestyle management †								
All	546	17·9 (16·4-19·3)	954	23·0 (21·5-24·4) *	186	16·8 (14·5-19·1)	292	19·6 (17·3-21·8)
New	*139*	*20·7 (17·5-23·9)*	*257*	*26·8 (23·8-29·7)*	*42*	*14·8 (10·4-19·1)*	*77*	*20·8 (16·4-25·1)*

^ Medicare service item numbers (up to 3) could be recorded for each encounter. Chronic disease management items including case conferences: Identified by any of the following item numbers: 720, 721, 722, 723, 724, 725, 726, 727, 729, 730, 731, 732.

†At least one of the following being used in the management of OA: referral to a dietician/nutritionist or physiotherapist; advice/education/counselling; physical medicine/rehabilitation.

performed by the GP and includes platelet rich plasma, hyaluronic acid, corticosteroid.

₵ including x-ray but excluding MRI and US.

* significant difference compared with 2005-2010 time period.

N/A=not applicable; CI=confidence interval.

Table 4

Comparison of general practitioner pharmacological management in period one and period two for knee and hip OA.

	Knee OA Rate per 100 knee OA problems managed (95% CI)				Hip OA Rate per 100 hip OA problems managed (95% CI)			
	2005-10		2010-16		2005-10		2010-16	
	N	n=3,058	N	n=4,156	N	n=1,106	N	n=1,492
All medication								
All	2,365	77·3 (74·5-80·2)	3,086	74·3 (71·7-76·8)	836	75·6 (71·4-80·0)	1,120	75·1 (70·8-79·4)
New	*529*	*78·7 (73·2-84·2)*	*722*	*75·2 (70·5-80·0)*	*208*	*73·2 (64·7-81·8)*	*258*	*69·5 (62·2-76·9)*
Prescribed	1,818	59·5 (56·9-62·0)	2,444	58·8 (56·5-61·1)	717	64·8 (60·5-69·2)	992	66·5 (62·3-70·6)
Advised over counter	344	11·3 (9·8-12·7)	443	10·7 (9·5-11·9)	96	8·7 (6·8-10·6)	100	6·7 (5·3-8·1)
Supplied	203	6·6 (5·3-8·0)	199	4·8 (3·9-5·7)	23	2·1 (1·1-3·1)	28	1·9 (1·0-2·7)
NSAIDs								
All	862	28·2 (26·4-29·9)	853	20·5 (19·2-21·9) *	266	24·1 (21·4-26·7)	261	17·5 (15·5-19·5) *
New	*215*	*32·0 (28·4-35·6)*	*218*	*22·7 (20·0-25·4)* *	*70*	*24·6 (19·5-29·8)*	*66*	*17·8 (13·7-21·8)*
Paracetamol								
All	693	22·7 (21·0-24·3)	1,096	26·4 (24·9-27·9) *	258	23·3 (20·7-25·9)	357	23·9 (21·5-26·4)
New	*156*	*25·7 (22·3-29·1)*	*232*	*24·2 (21·4-26·9)*	*79*	*27·8 (22·5-33·1)*	*101*	*27·2 (22·5-32·0)*
Opioids								
All	316	10·3 (9·2-11·5)	621	14·9 (13·7-16·2) *	218	19·7 (17·0-22·5)	382	25·6 (22·8-28·4) *
New	*21*	*3·1 (1·8-4·5)*	*65*	*6·8 (5·1-8·5)* *	*27*	*9·5 (5·6-13·4)*	*36*	*9·7 (6·5-13·0)*
Glucosamine								
All	148	4·8 (4·0-5·6)	74	1·8 (1·4-2·2) *	36	3·3 (2·2-4·3)	10	0·7 (0·3-1·1) *
New	*54*	*8·0 (6·0-10·1)*	*26*	*2·7 (1·6-3·8)* *	*19*	*6·7 (3·8-9·6)*	*3*	*0·8 (0·0-1·7)* *

* significant difference compared with 2005-2010 time period.

NSAIDS=non steroidal anti-inflammatory drugs.

view, which included 15 studies and 16,103 patients, the median overall pass rate for OA care quality indicators across studies was 41% (range 22–65%). In particular, pass rates for core recommended first line non-pharmacological approaches (recommendations for exercise and education which are consistent across OA clinical guidelines globally) were all below 40%, indicating considerable scope for improvement. Difficulties in implementing guideline recommendations into clinical practice are well known[6, 25] and barriers include concerns by GPs themselves[26] about their capability to manage OA, system-related factors (including time limitations during consultations), patient expectations of care and their perceived role in OA management. GPs in Australia have also voiced pessimism and a sense of despair about OA management,[27] which may partially be explained by recent research showing that GP registrars and GPs in Australia and New Zealand report only moderate levels of confidence in their OA knowledge and clinical skills,[28] possibly associated with a biomedical orientation to joint pain.

Strategies are therefore needed to address barriers that impede alignment of GP practice with OA guideline recommendations. Australia's National OA Strategy[8] has outlined an implementation plan to increase uptake of high-value care by Australians with OA and to support primary care practitioners to deliver high-value care. Valuable evidence-based clinician and patient resources exist including the 2018 update of the RACGP knee and hip OA clinical guidelines,[4] the Osteoarthritis of the Knee Clinical Care Standards from the Australian Commission for Quality and Safety in Health Care,[29] the RACGP Handbook of Non-Drug Interventions (HANDI) (https://www.racgp.org.au/clinical-resources/clinical-guidelines/handi), Arthritis Australia's MyJointPain website (www.myjointpain.org.au), Western Australia's Department of Health painHealth website (https://painhealth.csse.uwa.edu.au), painTRAINER (8 week online pain coping skills training program; www.paintrainer.org), and the My Knee Exercise online program (www.mykneeexercise.org.au) to name a few.

While clinical guidelines and resources may be available, it is apparent that passive dissemination needs to be supplemented with other implementation strategies. There is some evidence to support the use of local opinion leaders,[30] interactive educational meetings and workshops,[31] and audit of professional behaviour with feedback of results[32] to increase clinician adherence to guidelines in general. The effectiveness and utility of electronic decision support tools/systems are still unclear.[33, 34] At a system level, there is interest in alternative models of health care delivery to optimise quality and outcomes of care while improving the allocation of finite healthcare resources,[35,36] although there is limited research in OA specifically. Clinical trials investigating a GP OA model consultation that included an electronic template in the UK[37] and a structured primary care OA model integrating GP care with group-based physiotherapist-led education and exercise and optional healthy eating program in Norway[38] have shown increased uptake of core treatment recommendations by GPs. Further research is needed to determine the most clinical- and cost-effective models of OA management in the GP primary care setting.

Our study has several limitations.[4] The design was cross-sectional and while we analysed data spanning an 11-year period, this was not patient-level longitudinal data. This limits an assessment of the appropriateness of service provision as we may be missing information about treatments given in previous patient encounters. There was also considerable missing data for some patient characteristics, particularly Indigenous status and language (although still <10%) which may have affected OA encounter rates for patient subgroups. Some treatments such as education and advice may not have been recorded by GPs thereby underestimating their rates. Furthermore, we may have missed some significant differences due to our highly conservative approach to statistical significance which we adopted to reduce the effects of multiplic-

ity. With any survey design, there is potential for sampling (non-responder) bias. However, we consider this to have been minimal given the random sampling of GPs with collection of consecutive patient encounters and that annual testing demonstrated the GP and patient encounter samples to be representative of Australian GPs and their patient encounters.[9] We cannot exclude bias from a possible Hawthorne effect whereby GPs may have changed their management behaviours because they were being surveyed. Our study aimed to describe changes in management rates and future research could explore whether specific GP-, patient- or system-level characteristics confounded/explained changes in these rates. Finally, we cannot generalise our results to other countries where healthcare systems and contexts differ, although evidence-practice gaps highlighted in our study have been consistently found in other countries, showing that Australia is not unique with respect to issues with implementing best practice OA care.[24]

In summary, this study shows that in Australia, GPs frequently manage hip and knee OA problems, the number of management occasions rising over time. Findings highlight the importance of ongoing efforts in primary care, focussing on increasing use of effective non-pharmacologic OA management strategies, reducing use of inappropriate diagnostic imaging, using medications more judiciously especially opioids given potential harms, and eliminating healthcare disparities.

CONTRIBUTORS

Bennell, Brand, and Hinman conceived the study questions; Harrison and Bayram contributed to the conduct of the BEACH study, accessed the BEACH data, performed the statistical analyses and can verify the data; All authors contributed to the data interpretation; Bennell, Hinman, Harrison and Bayram drafted the manuscript; All authors contributed to manuscript review and approval of final version.

Data Sharing Statement

Analyses of the BEACH data can be requested by researchers whose requests are within the ethical guidelines the data sits under. Access to the raw data is not permitted under these guidelines. The BEACH study protocol, statistics used in analysis, patient information card and upper-level statistics have all been published annually since 2000. The most recent version is "General practice activity in Australia 2015-16, Britt H et al. General Practice Series Number 40. Sydney University Press". Requests for analyses can be made now and can be made via the contact details on the BEACH webpage (https://www.sydney.edu.au/medicine-health/our-research/research-centres/bettering-the-evaluation-and-care-of-health.html). Analysis requests must be approved by the data custodian to ensure the research question is appropriate and fits within the ethical guidelines around the use of data. If appropriate, a services agreement will be signed by both parties which stipulates how the results can be used. Any publication of the results also has to be checked by the University of Sydney to ensure accuracy and correct interpretation.

Declaration of Competing Interest

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.lanwpc.2021.100187.

References

[1] Safiri S, Kolahi AA, Smith E, et al. Global, regional and national burden of osteoarthritis 1990-2017: a systematic analysis of the Global Burden of Disease Study 2017. Ann Rheum Dis 2020;79(6):819–28.

[2] Arthritis Australia. A problem worth solving - rising cost of musculoskeletal conditions in Australia. 2013.

[3] Arthritis Australia. Counting the cost: The current burden and future burden of arthritis 2016.

[4] Royal Australian College of General Practitioners. Guideline for the non-surgical management of hip and knee osteoarthritis. Melbourne: RACGP; 2018.

[5] Speerin R, Slater H, Li L, et al. Moving from evidence to practice: Models of care for the prevention and management of musculoskeletal conditions. Best Pract Res Clin Rheumatol 2014;28(3):479–515.

[6] Allen KD, Golightly YM, White DK. Gaps in appropriate use of treatment strategies in osteoarthritis. Best Pract Res Clin Rheumatol 2017;31(5):746–59.

[7] Brand CA, Harrison C, Tropea J, Hinman RS, Britt H, Bennell K. Management of osteoarthritis in general practice in australia. Arthritis Care Res 2014;66:551–8.

[8] Eyles JP, Hunter DJ, Briggs AM, et al. National Osteoarthritis Strategy brief report: Living well with osteoarthritis. Aust J Gen Pract 2020;49(7):438–42.

[9] Britt H, Miller GC, Bayram C, et al. A decade of Australian general practice activity 2006–07 to 2015–16. Sydney; 2016.

[10] Australian Bureau of Statistics. Socio-Economic Indexes for Areas The Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD) 2011 [Available from: https://www.abs.gov.au/websitedbs/censushome.nsf/home/seifa].

[11] World Health Organization Collaborating Centre for Drug Statistics Methodology Anatomical therapeutic chemical classification index with defined daily doses. Oslo; 2009.

[12] Meza RA, Angelis M, Britt H, Miles DA, Seneta E, Bridges-Webb C. Development of sample size models for national general practice surveys. Aust J Public Health 1995;19(1):34–40.

[13] Australian Orthopaedic Association. National Joint Replacement Registry. Hip, Knee & Shoulder Arhroplasty. Annual Report 2016.; 2016.

[14] Australian Institute of Health and Welfare. Osteoarthritis Canberra: AIHW; 2020 [Available from: https://www.aihw.gov.au/reports/chronic-musculoskeletal-conditions/osteoarthritis].

[15] Lin I, Bunzli S, Mak D, et al. Unmet needs of Aboriginal Australians with musculoskeletal pain: A mixed-method systematic review. Arthritis Care Res 2018;70:1335–47.

[16] Royal Australian College of General Practitioners Guideline for the non-surgical management of hip and knee osteoarthritis. Melbourne: RACGP; 2009.

[17] Roxburgh A, Bruno R, Larance B, Burns L. Prescription of opioid analgesics and related harms in Australia. Med J Aust 2011;195(5):280–4.

[18] Zhang W, Doherty M, Peat G, et al. EULAR evidence-based recommendations for the diagnosis of knee osteoarthritis. Ann Rheum Dis 2010;69(3):483–9.

[19] Smith L, Barratt A, Buchbinder R, Harris IA, Doust J, Bell K. Trends in knee magnetic resonance imaging, arthroscopies and joint replacements in older Australians: still too much low-value care? ANZ J Surg 2020;90(5):833–9.

[20] Zhang W, Nuki G, Moskowitz RW, et al. OARSI recommendations for the management of hip and knee osteoarthritis: Part III: Changes in evidence following systematic cumulative update of research published through January 2009. Osteoarthritis Cartilage 2010;18(4):476–99.

[21] National Institute for Health and Care Excellence Osteoarthritis. Care and management in adults. Clinical guideline CG177. Methods. London: evidence and recommendations; 2014.

[22] Hochberg MC, Altman RD, April KT, et al. American College of Rheumatology 2012 recommendations for the use of nonpharmacologic and pharmacologic therapies in osteoarthritis of the hand, hip, and knee. Arthritis Care Res 2012;64(4):465–74.

[23] Basedow M, Williams H, Shanahan EM, Runciman WB, Esterman A. Australian GP management of osteoarthritis following the release of the RACGP guideline for the non-surgical management of hip and knee osteoarthritis. BMC Res Notes 2015;8:536.

[24] Hagen KB, Smedslund G, Østerås N, Jamtvedt G. Quality of community-based osteoarthritis care: A systematic review and meta-analysis. Arthritis Care Res 2016;68(10):1443–52.

[25] Egerton T, Diamond L, Buchbinder R, Bennell K, Slade SC. Barriers and enablers in primary care clinicians' management of osteoarthritis: protocol for a systematic review and qualitative evidence synthesis. BMJ Open 2016;6(5):e011618.

[26] Egerton T, Nelligan RK, Setchell J, Atkins L, Bennell KL. General practitioners' views on managing knee osteoarthritis: a thematic analysis of factors influencing clinical practice guideline implementation in primary care. BMC Rheumatol 2018;2:30.

[27] Australia Arthritis. Whose problem is it anyway? The voice of GPs on arthritis; 2012.

[28] Briggs AM, Hinman RS, Darlow B, et al. Confidence and Attitudes Toward Osteoarthritis Care Among the Current and Emerging Health Workforce: A Multinational Interprofessional Study. ACR Open Rheumatol 2019;1(4):219–35.

[29] Australian Commission of Safety and Quality in Health Care Osteoarthritis of the Knee Clinical Care Standard. Sydney; 2017.

[30] Flodgren G, O'Brien MA, Parmelli E, Grimshaw JM. Local opinion leaders: effects on professional practice and healthcare outcomes. Cochrane Database Syst Rev 2019;6 CD000125.

[31] Gagliardi AR, Alhabib S. members of Guidelines International Network Implementation Working G. Trends in guideline implementation: a scoping systematic review. Implement Sci 2015;10:54.

[32] Ivers N, Jamtvedt G, Flottorp S, et al. Audit and feedback: effects on professional practice and healthcare outcomes. Cochrane Database Syst Rev 2012;6 CD000259.

[33] Ostropolets A, Zhang L, Hripcsak G. A scoping review of clinical decision support tools that generate new knowledge to support decision making in real time. J Am Med Inform Assoc 2020;27(12):1968–76.

[34] Souza-Pereira L, Pombo N, Ouhbi S, Felizardo V, Garcia N. Clinical decision support systems for chronic diseases: A Systematic literature review. Comput Methods Programs Biomed 2020;195:105565.

[35] Jessup R, Putrik P, Buchbinder R, et al. Identifying alternative models of healthcare service delivery to inform health system improvement: scoping review of systematic reviews. BMJ Open 2020;10(3):e036112.

[36] Briggs AM, Page CJ, Shaw BR, et al. A Model of Care for Osteoarthritis of the Hip and Knee: Development of a System-Wide Plan for the Health Sector. Healthc Policy 2018;14(2):47–58.

[37] Jordan KP, Edwards JJ, Porcheret M, et al. Effect of a model consultation informed by guidelines on recorded quality of care of osteoarthritis (MOSAICS): a cluster randomised controlled trial in primary care. Osteoarthritis Cartilage 2017;25(10):1588–97.

[38] Osteras N, Moseng T, van Bodegom-Vos L, et al. Implementing a structured model for osteoarthritis care in primary healthcare: A stepped-wedge cluster-randomised trial. PLoS Med 2019;16(10):e1002949.