



Australian Healthcare and Hospitals Association

Cost benefit analysis

Rheumatology nurses: Adding value to arthritis care

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Table of Contents

Background	1
Introduction	1
Overview	1
Purpose of the cost benefit analysis	1
Roles and scope of activities for rheumatology nurses in Australia	2
Initiation of pharmacological therapy	4
Pharmacological management.....	4
Delays in initiating treatment	4
Avoiding delay	5
Economic analysis	6
Assumptions	8
Patient treatment pathways.....	8
Healthcare costs.....	8
Pharmaceutical costs.....	9
Pharmaceutical use	9
Healthcare models of care.....	10
Time to treatment.....	10
Remission rates.....	10
Continuous enrolment in the first year	11
Economic analysis of findings	12
Disease remission.....	14
Biological DMARD therapy	14
Sensitivity analysis	15
Increasing rheumatologist clinic costs.....	15
Reducing the costs of bDMARDs.....	15
Reducing the effectiveness of early treatment at reducing bDMARD use	16
Reducing the proportion of early presentation patients.....	16

Economic analysis limitations18

Funding models.....19

Conclusions20

References21

Background

Introduction

The Australian Healthcare and Hospitals Association (AHHA), on behalf of Arthritis Australia, completed a study to assess the current and potential role, scope of activities and value of rheumatology nurses in Australia. This cost-benefit analysis was prepared as part of this broader study which also included a literature review and stakeholder surveys and interviews. The results of these research activities are summarised in the report *Rheumatology nursing: Adding value to arthritis care*.

Overview

The [Time to Move: Rheumatoid Arthritis](#) strategy recommends increasing the rheumatology nurse workforce in Australia to enhance education and support for people with inflammatory arthritis, including in rural and regional areas, and to assist in improving timely access to rheumatologists (Arthritis Australia 2014).

While the benefits of rheumatology nurses overseas are well documented, little is known about the rheumatology nurse workforce in Australia and its value in this context.

A literature review has been undertaken to identify evidence for the potential benefits of increasing the rheumatology nurse workforce from the perspective of consumers, rheumatologists and general practitioners as well as the health system more broadly. It provides the background and academic context for qualitative research with stakeholders, through both targeted online surveys and interviews, to further explore the current and potential role, scope of activities and distribution of rheumatology nurses in the management of chronic inflammatory arthritis in Australia. The literature review is provided in the consolidated report.

A cost-benefit analysis has been undertaken to determine the feasibility of funding rheumatology nurse positions from the perspective of the service provider and the wider health system.

The results of the above research activities have been collated into a report which includes a range of recommendations to advance the proposal to build the rheumatology nurse workforce, including potential funding options.

Purpose of the cost benefit analysis

This cost-benefit analysis has been prepared to identify and examine the costs and benefits associated with inflammatory arthritis models of care that involve rheumatology nurses from the perspective of both service providers and the wider health system. The outcomes of this analysis will also identify potential funding options.

Roles and scope of activities for rheumatology nurses in Australia

General practitioners are usually the first point of contact within the health system for people with chronic conditions, and their role in the diagnosis and early management of inflammatory forms of arthritis such as rheumatoid arthritis is critical. Early diagnosis and treatment, ideally within three months of symptom onset is critical in many of these conditions to slow or prevent disease progression and joint destruction. Ideally treatment with disease modifying anti-rheumatic drug (DMARD) therapy should be initiated by a rheumatologist or clinical immunologist, so appropriate early referral from the GP to a specialist rheumatologist is essential.

However, with the current number and distribution of rheumatologists, people in Australia can face long delays in accessing specialist care. In 2012, half of all patients had to wait more than the recommended period for an urgent initial consultation with a rheumatologist (Piper 2012).

Internationally, predictions that the demand for rheumatology services will outstrip the supply of rheumatologists have led to the expansion of roles of non-rheumatologists such as nurses. The development of the rheumatology nursing role is relatively new, but evolving rapidly, with studies exploring and evaluating their contribution to care.

The European League Against Rheumatism (EULAR) provides recommendations for the role of the nurse in the management of chronic inflammatory arthritis based on evidence and expert consensus.

Recommendations for the contribution of nurses to care and management related to:

- **Education:** improving patients' knowledge of inflammatory arthritis and its management throughout the course of their disease
- **Comprehensive disease management:** early detection of arthritis, making referrals, determining necessary interventions, disease and medication monitoring and changing medications with the aims of controlling disease activity, reducing symptoms and improving patient-preferred outcomes
- **Psychosocial issues:** identifying, assessing and addressing psychosocial issues to minimise the chance of patient anxiety and depression
- **Self-management:** promoting self-management skills in order that patients might achieve a greater sense of control, self-efficacy and empowerment
- **Continuity of care:** providing nurse-led telephone services to enhance continuity of care and to provide ongoing support.

Studies in the US and UK have identified similar roles and responsibilities for rheumatology nurses, as well as demonstrating the potential for rheumatology nurses in the diagnostic process and to monitor DMARD therapy (Kuznar 2014; Solomon et al. 2014; Smith et al. 2017; Mintz, Jones & Reiff 2015; Hill, Ryan & Hassell 2009; Kroese et al. 2011; Larsson et al. 2015; Oliver 2011; Butt, Newman & Smith 2016).

With the prevalence of chronic musculoskeletal conditions expected to rise considerably in coming decades and extensive systemic and sector-wide changes in health service delivery and funding, changes in the ways health professionals are trained and provide care are imperative.

Models of care that include nurses offer the potential to provide safe and effective care at less cost than traditional delivery modes. Hill et al. (1994) reported that nurse practitioner led outpatient rheumatology clinics can provide patients with effective and safe care. Patients seen by a rheumatology nurse had greater understanding of their condition and were more satisfied with their care. Rheumatology nurse practitioners saw fewer patients per clinic, compared with their rheumatology colleagues (8.3 versus 17.8), potentially

providing greater time with each patient. Ndosi et al. (2013) similarly found increased client consultation time in rheumatology nurse-led care compared with rheumatologists-led care, while achieving similar quality of life and outcomes at lower costs. A 2015 Swedish study found nurse-led rheumatology clinics cost 13 per cent less than traditional rheumatologist-led clinics (Larsson et al. 2015).

While the role of Australian rheumatology nurses varies across services (AHHA 2017), the models of care align generally with the EULAR recommendations. Australian models of care involving rheumatology nurses include:

- A Rheumatology Nurse Practitioner model that aims to build the capacity and capability of the multidisciplinary team. The nurse practitioner is based in the hospital and works autonomously and collaboratively with outpatients, biologics clinics, specialist clinics, inpatient wards and day units, among others. They perform tasks such as the direct referral of patients, prescribing medications and ordering diagnostic investigations (Melbourne Health 2014).
- A Rheumatology Nurse model where the nurse undertakes tasks such as coordinating and conducting assessments, monitoring medication toxicity, scheduling reviews, performing audits and ensuring continuation of PBS funded therapy (Government of Western Australia Department of Health 2009).
- A Clinical Nurse Consultant model where a nurse provides care coordination of all services, targeted and specific child and family education, ongoing family support and nursing care for the child (Royal Children's Hospital Melbourne 2012).
- A Rheumatology clinic model where a nurse triages referrals and monitors disease activity, also communicating with GPs and pathology providers (Government of Western Australia Department of Health 2009).

There are also many other models used in Australia for nurses in extended roles in other clinical areas.

Internationally, rheumatology nurses have taken on roles in the diagnostic process, monitoring biologic therapies in nurse-led rheumatology clinics, providing telephone advice and consultations from clinics, as well as leading clinics for joint injections or infusion of biological DMARD (bDMARD) therapy.

Initiation of pharmacological therapy

Pharmacological management

Disease modifying anti-rheumatic drugs (DMARDs) including conventional, biological and biosimilar drugs are the cornerstone of inflammatory arthritis management (Jones, Nash & Hall 2017). These medications control symptoms, prevent disease progression and joint erosion, reduce mortality and increase the likelihood of achieving disease remission (Jones, Nash & Hall 2017; Smolen et al. 2010).

With early instigation of DMARDs remission is now a recommended and achievable goal (Sokka et al. 2008; Smolen et al. 2016). Achieving remission rapidly will halt further joint damage (Smolen et al. 2008).

Delays in initiating treatment

In rheumatoid arthritis 75 per cent of joint erosions occur within the first two years of the disease (van der Horst-Bruinsma et al. 1998). Delays in diagnosis and instigation of therapy are likely to result in avoidable burden of disease and disability (van der Linden et al. 2010).

Introducing effective therapy early, prior to the development of permanent joint damage, joint erosions and declines in physical function, limits the impact of the disease (Lard et al. 2001; Nell et al. 2004; Verstappen et al. 2003), reduces the disease burden (Bykerk & Emery 2010) and increases the likelihood of remission (van der Linden et al. 2010; Nell et al. 2004; Gremese et al. 2013; Möttönen et al. 2002).

While broad agreement exists that early initiation of treatment for inflammatory arthritis within 3–4 months of symptom onset, during the ‘window of opportunity’, can improve patient outcomes, international studies have shown that delays are common. Median times from symptom onset to commencement of DMARD therapy have been reported at 5–11 months (Sokka & Pincus 2002; Tavares et al. 2012; Raza et al. 2011; UK National Audit Office 2009, Nanji et al. 2012, van der Linden et al. 2010), with delays of up to 19 in Spain (Hernandez-Garcia et al. 2000) and 42 months and Korea (Cho et al. 1998).

Australian studies have reported median times to initiation of DMARD therapy of between 4.5 months and 6.4 months (Van Doornum et al. 2013; Reed et al. 2005; Jamal et al. 2011), with delays of up to two years from symptom onset to rheumatologist review in some parts of rural Queensland (Roberts et al. 2012). A 2011 study found that only 23 per cent of patients with early rheumatoid arthritis in Australia started on DMARD therapy within 3 months (Jamal et al. 2011).

Delays can occur at a number of points along the care pathway between:

- the onset of symptoms and seeking medical care;
- review by a primary care physician and referral to a rheumatologist; and
- referral and review by a rheumatologist.

(van der Linden et al. 2010; Bykerk & Emery 2010)

Timely access to appropriate rheumatology care can be limited due to barriers in accessing appropriate healthcare providers such as specialist medical rheumatologists. Piper in 2012 reported that there were 195 full-time equivalent rheumatologists in Australia, or one per 118,000 Australians. This falls short of international benchmarks, such as the UK where one full-time equivalent specialist medical rheumatologist is recommended per 86,000 people (Royal College of Physicians 2013).

Future shortage of Australian rheumatologists is predicted due to increasing prevalence of arthritic disease (Roberts et al. 2006), population growth and an ageing medical workforce. Existing shortages of rheumatologists and paediatric rheumatologists will also be exacerbated due to limited specialist training positions and funding for training (Arthritis Australia 2014).

Avoiding delay

Optimal management of inflammatory arthritis requires early diagnosis and initiation of treatment. Reducing delays in initiation of pharmacological treatment is likely to result in substantial health-cost savings due to higher rates of remission (Nell et al. 2004; Gremese et al. 2013; van der Linden et al. 2010), reduced need for expensive bDMARD therapy (Gremese et al. 2013), avoided and delayed joint replacement surgery (Moura et al. 2015), reduced medical referrals and consultations (Ryan 1997; Sørensen et al. 2015), reduced hospital admissions (Oliver & Leary 2010) and reduced healthcare costs (Barnabe et al. 2013). There is also likely to be significant societal gains through greater social participation and economic productivity improvements (Finckh et al. 2009; Roberts et al. 2006).

Effective provision of care by rheumatology nurses can assist in reducing extensive delays in accessing rheumatologist care. This role can support the care of those with new disease or high disease activity and can also provide monitoring for those with low disease activity or those in remission. This allows resources to be effectively reallocated improving access to rheumatologists (Larsson et al. 2015), particularly for those patients who are newly referred.

The Time to Move report (Arthritis Australia 2014) identifies 'early arthritis clinics' as a potential option to improve access and reduce delays for those with early inflammatory arthritis. This model of care has been shown to reduce delays using a structured process-based care approach (Roberts et al. 2005).

Rheumatology nurse-led arthritis clinics in the UK have been reported to reduce the average delay in access to specialised rheumatology care from 3 months to 3.4 weeks, with commencement of DMARD therapy occurring at 2–5 weeks instead of 8–10 months (El Miedany, Palmer & El Gaafary 2006).

Economic analysis

An economic analysis was conducted to compare the costs and potential savings from two alternative models of care for those requiring ongoing treatment for rheumatoid arthritis; one providing a public outpatients clinic led by a rheumatologist and the other providing a similar service but supported by the addition of rheumatology nursing care. These models were informed by the available empirical evidence in both the peer reviewed and grey literature. A key constraint performing this analysis was the lack of critical data to appropriately populate an economic model. The model was therefore structured around those health services that could be accurately estimated with respect to patient flow parameter values and the cost of providing in scope health services. While this economic analysis predominantly focuses on rheumatoid arthritis as a result of the available evidence in the peer-reviewed literature, people with other forms of inflammatory arthritis may achieve similar outcomes as modelled in the two models of care considered here.

The modelling approach adopted considers the two alternative models of care in a public hospital setting only. While there are rheumatology nurses working in private practice, this only represents 14 per cent of the overall rheumatology nurse workforce time (AHHA 2017). Furthermore, empirical evidence on critical parameters to populate an economic model of care in a private practice setting could not be identified.

This analysis examined the costs and benefits associated with assessment and treatment of a cohort of newly referred patients in a single enrolment year to a public hospital outpatient rheumatology clinic and followed the likely treatment pathways of these individuals over four years. Costs and benefits assessed included the costs of healthcare provision, and conventional and biological DMARD therapy. The time period of four years was selected as longitudinal peer-reviewed evidence demonstrating remission rates for early and delayed DMARD therapy was only available up to 36 months (Nell et al. 2004). The analysis compared the costs associated with a rheumatologist only clinic and then compared this service to a similar service supported by rheumatology nursing care.

The analysis showed that provision of rheumatology care supported by a rheumatology nurse increased patient access and reduced delays to care. Care supported by a rheumatology nurse through shared clinics with a rheumatologist and rheumatology nurse, and rheumatology nurse only clinics increased the volume of patients able to access rheumatology care and hence increased annual patient throughput.

There are two key economic implications of the alternative model of care involving rheumatology nurses in a public hospital setting. The first is that the capacity to treat patients is expanded ie a volume effect, increasing the total cost of care. The second is that this expanded capacity will result in patients being examined earlier than would otherwise be the case with patients then being placed on an appropriate pharmacological regimen to manage their condition. This brings forward the cost (or prevents the delay) of providing PBS subsidised pharmaceuticals.

These additional costs are offset by a number of benefits and potential savings in other areas. In particular, earlier initiation of treatment has been shown to improve patient outcomes because it increases the chances of achieving remission and reduces the need to progress to expensive bDMARD therapy (Nell et al. 2004; Gremese et al. 2013; van der Linden et al. 2010). These benefits have been factored into the analysis. Additional benefits and savings such as reduced future health service utilisation costs and improved workforce participation, as discussed in the section on limitations, have not been quantified in this analysis. While the savings will be real, they have not been estimated either due to a lack of available empirical evidence on which to base the calculations or because the required economic modelling is beyond the scope of this project. Consequently this analysis provides a conservative estimate of the impact of rheumatology nurses in patient care and identifies areas that warrant further examination.

The results presented here consider the likely costs of the alternative models of care over a representative four year period. All costs were estimated in Australian dollars adjusted to 2016–17 price levels for the base year (AIHW 2016). The value of future costs has been estimated at current prices to provide constant prices in the evaluation, as per the Pharmaceutical Benefits Advisory Committee (PBAC) guidelines (PBAC 2016). Discounting has been applied at an annual rate of 5 per cent after the first year as per the PBAC guidelines (PBAC 2016).

Assumptions

Patient treatment pathways

Patient flows are modelled in three month intervals with a pattern of care based on the type of contact the patient would have in the public hospital clinic with varying assumptions on the model of care and the proportion of people that receive delayed treatment.

Patients are initially reviewed by a rheumatologist, or rheumatologist and rheumatology nurse and are followed up at 3 months by the rheumatologist, or rheumatologist and rheumatology nurse. Patients responding adequately to conventional DMARD therapy are then seen annually by a rheumatologist or a rheumatology nurse. Those patients who require biologic DMARD therapy are seen at 6 months, 9 months and then every 6 months by a rheumatologist or by a combination of rheumatologist and rheumatology nurse (see Figure 1).

Patient treatment pathways

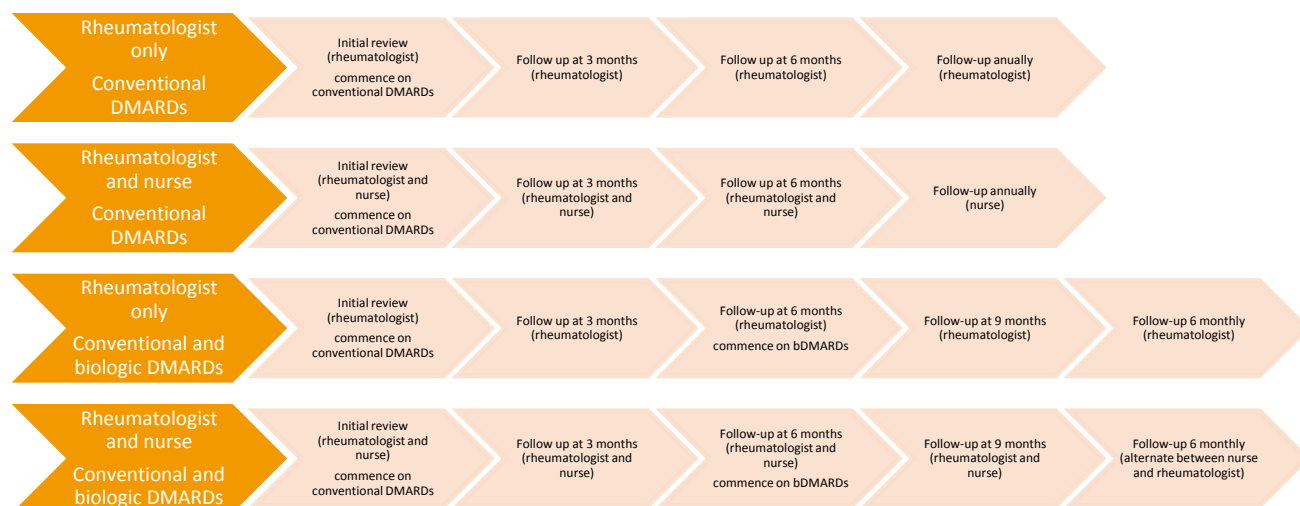


Figure 1 Patient treatment pathways for traditional and rheumatology nurse supported care for individuals requiring conventional or a combination of conventional and biologic DMARDs (Smolen et al. 2017).

For the purpose of the economic model, patients receiving delayed care received the same care as those who have had early treatment, except that care was delayed by 3 months.

Healthcare costs

Healthcare service costs have been calculated using activity based funding data from the Independent Hospital Pricing Authority (IHPA) (IHPA 2016a). Cost per service has been estimated using National Weighted Activity Units (NWAUs) and the National Efficient Price (NEP) for 2016–17 (IHPA 2016b).¹

The role of rheumatology nurses working in community and private practice environments has not been included in this evaluation due to the low representation of nurses working in these environments in the AHHA rheumatology nurse workforce survey and the dearth of empirical evidence regarding models of care in these environments. The limited evidence available on rheumatology nurses working in the community

¹ The cumulative average growth rate of IHPA activity based funding data based on NWAUs and the NEP has varied across clinics and services during short existence of the ABF funding framework. This data shows that there has been an annual average growth rate of 3.0 per cent for rheumatology medical consults with a rheumatologist only (clinic number 20.30), 4.8 per cent for rheumatology medical consults with multiple healthcare providers (clinic number 20.30) and negative average annual growth of 16 per cent for orthopaedics interventions—single provider allied health and/or clinical nurse specialist (clinic number 40.44).

has described that community care was associated with non-significant higher costs and without significant differences in clinical outcome (Watts et al. 2015).

Pharmaceutical costs

Not all DMARD therapy used for the treatment of inflammatory arthritis are subsidised by the Pharmaceutical Benefits Scheme (PBS). Medicines that are not subsidised include (AIHW 2011):

- medicines that are not listed on the PBS;
- medicines that cost less than the patient co-payment amount (for example methotrexate, cyclophosphamide and penicillamine are commonly priced below the general patient co-payment);
- medicines that are used to treat conditions that they are not listed on the PBS (restricted benefit category); and
- where an authority is not given for an authority-required medication under the PBS.

As a result, data collected to analyse annual consumption of pharmaceuticals including conventional and biologic DMARDs on the PBS are incomplete and prices only reflect those medicines subsidised by the PBS.

This analysis conservatively assumed that disease state did not change pharmaceutical utilisation and costs other than DMARD therapy (conventional and biologics).

Conventional DMARD therapy

Contemporary treatment of newly diagnosed rheumatoid arthritis and other inflammatory arthritis involves early instigation of conventional DMARD therapy. If an individual is assessed by a rheumatologist or clinical immunologist with expertise in the management of inflammatory arthritis after a minimum of 12 weeks on conventional DMARD therapy and is shown to have failed to respond to these medicines they may qualify for PBS subsidised bDMARD therapy. It is a requirement under the PBS for bDMARD therapy to be prescribed in combination with the conventional DMARD methotrexate.

In 2003–2007 the average yearly cost per person in Australia for conventional DMARD therapy, inclusive of PBS subsidy and patient co-payment, was \$960 and \$506 for those individuals before and after bDMARD initiation, respectively (AIHW 2011). This cost has not been indexed to adjust to 2016–17 dollars as the PBS pharmaceuticals Health Price Index has remained almost static, rising only 0.1 per cent in the decade between 2004–05 and 2014–15 (AIHW 2016).

Biological DMARD therapy

The average annual cost of bDMARD therapy has been calculated using the average PBS dispensed price for the maximum quantity per item in 2016–17 of nine bDMARDs on the PBS (Infliximab, Rituximab, Adalimumab, Etanercept, Tocilizumab, Abatacept, Tofacitinib, Certolizumab and Golimumab). The price per item has been adjusted to identify the annual cost for a year's supply of the PBS subsidised bDMARD. The average annual cost per biologic DMARD was \$14,097 in 2016–17 (PBS 2017). As the average annual cost of bDMARD therapy is un-weighted, this implies equal distribution of each bDMARD. While this may not be entirely reflective of current prescribing practices, no data could be identified to calculate a more accurate weighted average. The impact on the model results of this parameter is tested in the sensitivity analysis section.

Pharmaceutical use

Gremese et al. (2013) described that for those treated very early in the disease (less than 12 weeks since symptom onset), 90.5 per cent were treated with conventional DMARD therapy only and 9.5 per cent required escalation to biological DMARD therapy. This compares with those seen more than 12 weeks from

symptom onset where 74.4 per cent were treated with conventional DMARD therapy and 25.6 per cent required escalation to biological DMARD therapy (Gremese et al. 2013). These parameter values are used in conjunction with the patient treatment pathways shown above.

Healthcare models of care

A standard rheumatologist only outpatient clinic was assumed to occur two times per week seeing 17.8 patients per clinic (Hill et al. 1994). This was compared with the addition of a rheumatology nurse role, to support the original rheumatology clinic two times per week seeing 17.8 patients each, as well as an additional nurse-led clinic seeing 8.3 patients (Hill et al. 1994) two times per week. Clinics were assumed to run for 46 weeks of the year to allow for scheduled holiday shut-down periods.

Time to treatment

In the rheumatologist and nurse model of care there is a volume effect with more patients able to be seen compared to the rheumatologist only model of care (the counterfactual cohort). However, it is not known what proportion of this additional cohort of patients that will be early presenters and thereby obtain the benefits associated with early intervention in the treatment of their disease.

Under the rheumatologist model of care, empirical evidence in Jamal et al. (2011) suggests that 23.0 per cent of patients are early presenters and commence on DMARD therapy within 3 months of symptom onset. However, it is reasonable to assume that this proportion will be greater for the counterfactual cohort in the rheumatologist and nurse model of care. For example, empirical evidence has shown that availability of nurse-led clinics significantly increases access to care and reduces waiting times (Firth et al. 2016), with the addition of nurse-led care reducing waiting times from 3 months to 3.4 weeks (El Miedany, Palmer & El Gaafary 2006).

While this demonstrates the positive impact of nurse-led care on waiting times, it does not enable a specific proportion to be inferred of early presentation patients in the counterfactual cohort. For the purposes of the base case, it is assumed that all the counterfactual cohort of patients are early presenters ie 100 per cent. Under this assumption, the rheumatology nurse and rheumatologist model resulted in 47 per cent of the patients being seen and commenced on DMARD therapy within 3 months of symptom onset. This assumption is then tested in the sensitivity analysis section of the report.

An alternative approach would be to assume that 23 per cent of the counterfactual cohort of patients are early presenters as per the base case. However, this is unlikely to be the case as the additional capacity in the rheumatologist and nurse model of care is used to provide treatment for otherwise unmet need.

Remission rates

At 12 months 47.6 per cent of patients who commenced treatment within 12 weeks of symptom onset were in remission, compared with 30.6 per cent who commenced treatment after 12 weeks (Gremese et al. 2013).

At 36 months 50 per cent of those patients who started DMARD therapy at a median time of 3 months after symptom onset achieved a remission like state, compared with 15 per cent who commenced on DMARD therapy later (Nell et al. 2004).

Continuous enrolment in the first year

Patients are assumed to be seen continuously through each three month period of the analysis. However, to simplify the modelling process, pharmaceuticals are assumed to be used from the start of the quarter. This is to avoid the complexity of calculating sub-quarterly periods of patient flows and associated pharmaceutical consumption. This builds a small over estimate to the total cost of patient care but equally affects both models of care considered here and so should not meaningfully impact on differences in the cost of care. Healthcare costs are not impacted by this issue as this is a flat activity based cost regardless of when the patient is seen through the quarter.

Economic analysis of findings

Key Findings:

- *The addition of rheumatology nursing to the traditional rheumatologist only model would result in improved access to rheumatology specialist care and reduced delays to treatment. The number of patients able to be seen would increase by up to 47 per cent. The proportion of patients seen within clinically relevant timeframes, resulting in delayed disease progression, would increase from 23 per cent to 47.5 per cent of patients.*
- *Due to the increased number of patients treated, the total cost of providing this care would increase by 35.2 per cent (\$6.549 million). However, the average cost of treating patients over four years would decrease from \$11,373 to \$10,483 per person.*
- *Within the representative public hospital outpatient rheumatology clinic considered here, the addition of rheumatology nursing support would result in 31.6 per cent of patients achieving remission at four years, compared with 23.1 per cent of patients in the rheumatologist only clinic over the same time.*
- *There are a number of additional costs and savings that are identifiable but cannot be estimated due to the lack of suitable evidence. The analysis presented here is therefore conservative.*

This study examined the addition of rheumatology nursing to the traditional rheumatologist only model of care for those accessing public outpatient rheumatology services. Modelling was undertaken to examine the costs and benefits associated with these pathways over a period of four years.

Individuals accessing traditional rheumatologist only rheumatology services were more likely to experience delayed care and as a result were more likely to require expensive bDMARD therapy when eventually receiving treatment (Figure 2), compared with those individuals accessing rheumatology services with the additional support of rheumatology nursing and receiving treatment earlier (Figure 3).

The addition of rheumatology nursing to the traditional rheumatologist only model would result in improved access to rheumatology specialist care and reduced delays to treatment in the representative public hospital rheumatology clinic considered here. Higher patient volume due to improved service access increased total discounted costs over the four years modelled by \$6.949 million (Figure 4). However, enhanced access to specialist rheumatology care and reduced delays to treatment decreased the average costs per patient over the four years modelled, from an average discounted cost of \$11,373 to \$10,483 (Figure 4).

Care pathways and patient flows in a representative public hospital rheumatology clinic, single enrolment year

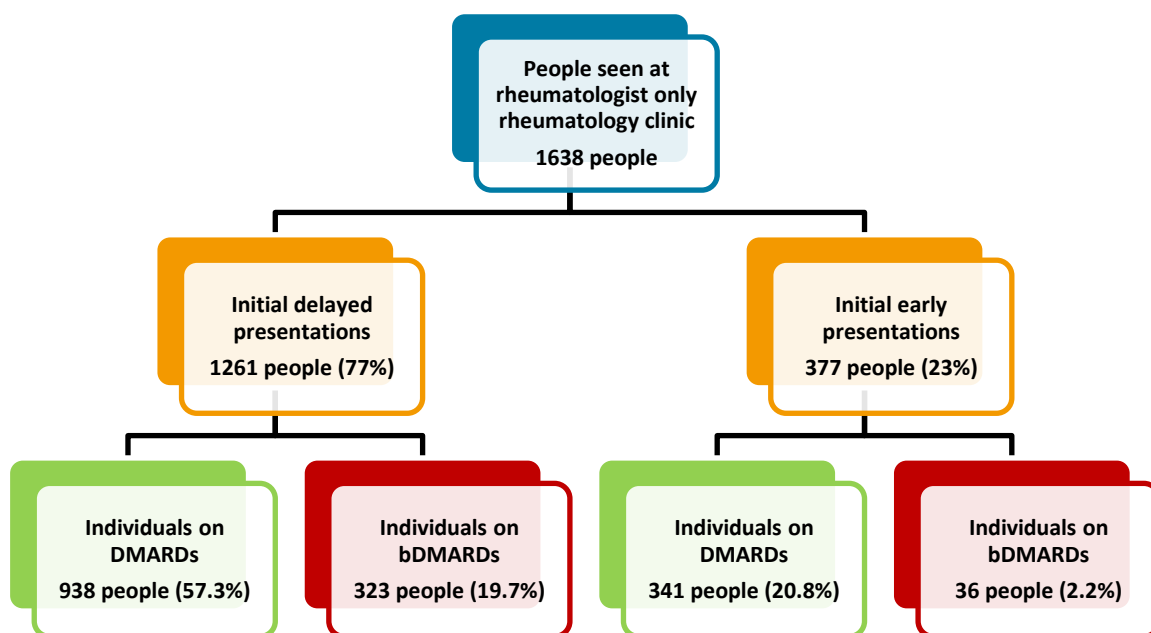


Figure 2 The care pathway and patient flows for individuals accessing traditional rheumatologist only rheumatology care.

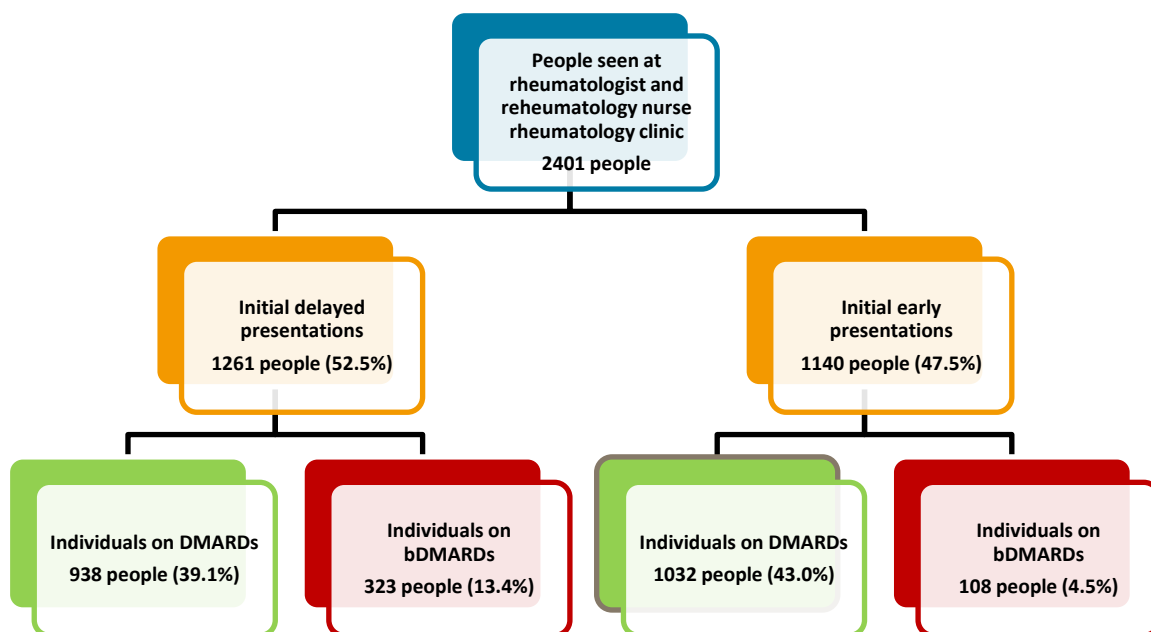


Figure 3 The care pathway and patient flows for individuals accessing the rheumatology nurse supported rheumatology care.

	Total Cost (\$m)					Average Cost (\$)				
	Year 1	Year 2	Year 3	Year 4	Total	Year 1	Year 2	Year 3	Year 4	Total
Rheumatologist only	\$3.673	\$5.016	\$4.777	\$5.159	\$18.625	\$2,242.87	\$3,062.89	\$2,917.04	\$3,150.43	\$11,373.23
Rheumatologist and nurse	\$6.267	\$6.421	\$6.092	\$6.394	\$25.174	\$2,609.87	\$2,674.21	\$2,536.96	\$2,662.82	\$10,483.86
Difference	\$2.594	\$1.406	\$1.315	\$1.235	\$6.549	\$367.00	-\$388.69	-\$380.08	-\$487.61	-\$889.37
Percentage difference	70.6%	28.0%	27.5%	23.9%	35.2%	16.4%	-12.7%	-13.0%	-15.5%	-7.8%

Figure 4 The annual costs, total costs, average costs per patient and differences in costs for cohorts receiving either the traditional rheumatologist only model of care or rheumatologist and rheumatology nurse model of care.

Disease remission

Avoiding treatment delay improves remission rates in inflammatory arthritis (Gremese et al. 2013; Nell et al. 2004). The reduced proportion of patients experiencing delay in the rheumatologist and rheumatology nursing model led to higher rates of remission in this single enrolment year cohort with 31.6 per cent (759) in remission in the fourth year, versus 23.0 per cent (377) in the rheumatologist only cohort, a difference of 382 patients (Figure 5).

	Remission (number of people)		Remission (percentage of cohort)	
	Year 2	Year 4	Year 2	Year 4
Rheumatologist only	572	377	34.9%	23.1%
Rheumatologist and nurse	938	759	39.1%	31.6%
Difference	367	382	4.2%	8.5%

Figure 5 The number of people in remission and the percentage of cohort in remission at Year 2 and Year 4 for the rheumatologist only model of care, or rheumatologist and rheumatology nurse model of care.

Achieving disease remission improves both patient and disease outcomes (van der Linden et al. 2010). Individuals who achieve early and sustained remission in the first year after diagnosis have lower radiographic progression and disability questionnaire scores, less missed work days and higher rates of long-term remission (Combe et al. 2015), resulting in broader health and societal benefits.

Biological DMARD therapy

Early instigation of treatment results in lower rates of bDMARD therapy utilisation (Gremese et al. 2013). This is relevant as bDMARD therapy is expensive and associated with serious side effects (AIHW 2011).

Lower rates of bDMARD therapy utilisation are seen in the rheumatology nurse and rheumatologist cohort, 13.7 per cent in the fourth year as a result of the reduced proportion of patients experiencing treatment delays, this compares with the rheumatologist only cohort at 17.8 per cent (Figure 6).

	bDMARD utilisation (percentage of cohort)			
	Year 1	Year 2	Year 3	Year 4
Rheumatologist only	21.9%	14.7%	14.7%	17.8%
Rheumatologist and nurse	18.0%	11.6%	11.6%	13.7%
Difference	3.9%	3.1%	3.1%	4.1%

Figure 6 The proportion of patients in the traditional rheumatologist only model of care or rheumatologist and rheumatology nurse model of care requiring bDMARD therapy in the four years modelled.

Sensitivity analysis

The economic analysis uses a number of parameters drawn from the available empiric evidence. However, there is only limited evidence available in the literature posing the issue of how generalisable key parameters are to the models of care being quantified. To better understand the impact of these parameters, a number of sensitivity analyses have been performed to assess the overall impact on the model results. The majority of parameters tested did not have a meaningful impact on the relative costs of the two models of care. The following results present the impact of more salient parameters and should be compared to the base case result presented in Figure 4.

Increasing rheumatologist clinic costs

This analysis examined the impact of increasing costs associated with rheumatology medical clinics. Clinic costs for rheumatologist medical clinics with and without a rheumatology nurse were increased by 20 per cent. For example, in the first year rheumatologist only clinic costs were increased from \$213.87 per person to \$256.64, and rheumatologist and rheumatology nurse clinic costs increased from \$331.56 per person to \$397.87. These changes amplify the 3 per cent rate of increase that has occurred for the NWAU specialist clinic costs in recent years.

The results of this analysis show that the sensitivity of the model to this parameter is limited, with total costs increasing only slightly in both models of care across all years and the difference between groups reducing slightly (Figure 7). This is consistent with the dominance of pharmaceuticals consumption on the overall cost of treating patients with rheumatoid arthritis. Similarly, the average costs per patient increases minimally in both models of care across the four year period modelled. The same pattern in the difference in the average cost of treatment is evident as in the base case, although the differences are slightly larger.

	Total Cost (\$m)					Average Cost (\$)				
	Year 1	Year 2	Year 3	Year 4	Total	Year 1	Year 2	Year 3	Year 4	Total
Rheumatologist only	\$3.885	\$5.092	\$4.850	\$5.230	\$19.057	\$2,372.12	\$3,109.63	\$2,961.55	\$3,193.98	\$11,637.28
Rheumatologist and nurse	\$6.752	\$6.438	\$6.103	\$6.406	\$25.698	\$2,811.79	\$2,681.02	\$2,541.47	\$2,667.88	\$10,702.16
Difference	\$2.867	\$1.345	\$1.253	\$1.176	\$6.641	\$439.67	-\$428.61	-\$420.09	-\$526.10	-\$935.12
Percentage difference	73.8%	26.4%	25.8%	22.5%	34.8%	18.5%	-13.8%	-14.2%	-16.5%	-8.0%

Figure 7 The annual costs, total costs, average costs per patient and differences in costs for cohorts receiving either the traditional rheumatologist only model of care or rheumatologist and rheumatology nurse model of care when the NWAU clinic costs associated with rheumatologist medical clinics were increased by 20 per cent.

Reducing the costs of bDMARDs

This analysis examined the impact of reducing the cost of bDMARD therapy by 20 per cent. For example, in the first year the quarterly cost of bDMARD therapy is reduced from \$3524 to \$2819. This reduction could result from PBS reforms related to price disclosure mechanisms to increase transparency around the prices pharmaceutical companies are paid by purchasers for medicines funded by the PBS, resulting in PBS price reductions. Furthermore, the development of biosimilar drugs and eventual patent expiry will likely result in reductions to the costs of bDMARD therapy.

The results of this analysis show that the model is sensitive to this variable, with total costs reducing in both models of care across all years, and the difference between groups reducing moderately due to the higher rate of bDMARD use in the rheumatologist cohort (Figure 8). Similarly, the average costs per patient reduces across both models of care across all time periods. The difference in the average cost of treatment increases slightly in the first year and then decreases more significantly in the forward years.

	Total Cost (\$m)					Average Cost (\$)				
	Year 1	Year 2	Year 3	Year 4	Total	Year 1	Year 2	Year 3	Year 4	Total
Rheumatologist only	\$3.395	\$4.368	\$4.160	\$4.447	\$16.370	\$2,073.12	\$2,667.17	\$2,540.16	\$2,715.75	\$9,996.20
Rheumatologist and nurse	\$5.887	\$5.672	\$5.378	\$5.594	\$22.530	\$2,451.51	\$2,362.14	\$2,239.76	\$2,329.58	\$9,383.00
Difference	\$2.492	\$1.304	\$1.218	\$1.146	\$6.161	\$378.39	-\$305.03	-\$300.40	-\$386.16	-\$613.20
Percentage difference	73.4%	29.9%	29.3%	25.8%	37.6%	18.3%	-11.4%	-11.8%	-14.2%	-6.1%

Figure 8 The annual costs, total costs, average costs per patient and differences in costs for cohorts receiving either the traditional rheumatologist only model of care or rheumatologist and rheumatology nurse model of care when the cost of bDMARD therapy was reduced by 20 per cent.

Reducing the effectiveness of early treatment at reducing bDMARD use

This analysis examined the impact of reducing the effectiveness of early treatment at preventing escalation of pharmacological treatment to bDMARD therapy by 100 per cent. For example, the transition probability for those seen early, who did not respond to conventional DMARD therapy and required escalation to bDMARD therapy was increased from 9.5 per cent to 19 per cent, bringing the transition probability closer to those with delayed treatment requiring bDMARD therapy (25.6 per cent).

The results of this analysis show that the model is more sensitive to this variable, with total costs increasing in both models of care across all years. Reduced delays achieved in the rheumatologist and nurse model mean that this group is more sensitive to a change in this variable, increasing the difference in total costs in each year (Figure 9). Similarly, while the average costs per patient increases across both models of care, this is greater in the rheumatologist and nurse model across all time periods. Compared to the base case, the difference in the average costs of treatment between the two models of care increase each year.

However, the benefits of early treatment of inflammatory arthritis in preventing escalation of pharmacological management has been reported widely in the academic and grey literature (Gremese et al. 2013; Smolen et al. 2016). The analysis presented here highlights the sensitivity of the model to this parameter.

	Total Cost (\$m)					Average Cost (\$)				
	Year 1	Year 2	Year 3	Year 4	Total	Year 1	Year 2	Year 3	Year 4	Total
Rheumatologist only	\$3.925	\$5.261	\$5.011	\$5.373	\$19.570	\$2,396.59	\$3,212.84	\$3,059.84	\$3,281.21	\$11,950.48
Rheumatologist and nurse	\$7.042	\$7.165	\$6.800	\$7.042	\$28.048	\$2,932.56	\$2,983.79	\$2,831.80	\$2,932.83	\$11,680.97
Difference	\$3.117	\$1.903	\$1.789	\$1.669	\$8.478	\$535.97	-\$229.05	-\$228.04	-\$348.38	-\$269.50
Percentage difference	79.4%	36.2%	35.7%	31.1%	43.3%	22.4%	-7.1%	-7.5%	-10.6%	-2.3%

Figure 9 The annual costs, total costs, average costs per patient and differences in costs for cohorts receiving either the traditional rheumatologist only model of care or rheumatologist and rheumatology nurse model of care when the effectiveness of early treatment preventing bDMARD use is reduced. The transition probability for those seen early and escalated to bDMARD therapy was increased by 100 per cent (from 9.5 per cent to 19 per cent).

Reducing the proportion of early presentation patients

A key assumption in the rheumatologist and nurse model of care relates to the proportion of additional patients that are seen who are early presenters. That is, with the extra capacity to treat patients in the alternative model of care, what proportion of them would be treated within the three month window from disease onset that otherwise would not be the case.

The analysis considered here examines the impact of reducing the proportion of early presentation patients in the rheumatologist and nurse model of care. The rate of additional individuals accessing care in the rheumatologist and nurse model and presenting early was reduced by 50 per cent, taking the number of

people modelled as presenting early from 1140 people (47.5 per cent of all patients) to 758 (31.5 per cent). This could reflect that delay to presentation is less modifiable than assumed.

The results of this analysis show that the model is very sensitive to this variable, with total costs increasing in the rheumatologist and nurse model of care across the second, third and fourth years (Figure 10). Similarly, the average costs per patient increases across the rheumatologist and nurse models of care across the second, third and fourth years. Compared to the base case, the difference in the total and average costs of treatment between the two models of care increases in the second, third and fourth years. This resulted in an increase in the total cost difference and a reduction in the differences in the average cost across each of the four years modelled. The analysis presented here highlights the sensitivity of the model to this parameter.

Compared to the base case assumption of all additional capacity being early presentation patients, as this parameter moves towards the empirical value of 23.0 per cent, the additional patients seen in the rheumatologist and nurse model of care converge on the same profile of timeliness of presentation as the base case group seen in rheumatologist only model of care. This then has the effect of increasing costs through the volume effect, but with no offsetting savings from a proportional increase in early treatment of patients.

	Total Cost (\$m)					Average Cost (\$)				
	Year 1	Year 2	Year 3	Year 4	Total	Year 1	Year 2	Year 3	Year 4	Total
Rheumatologist only	\$3.673	\$5.016	\$4.777	\$5.159	\$18.625	\$2,242.87	\$3,062.89	\$2,917.04	\$3,150.43	\$11,373.23
Rheumatologist and nurse	\$6.249	\$7.070	\$6.702	\$7.171	\$27.193	\$2,602.49	\$2,944.35	\$2,791.25	\$2,986.58	\$11,324.66
Difference	\$2.576	\$2.054	\$1.925	\$2.012	\$8.568	\$359.62	-\$118.54	-\$125.79	-\$163.86	-\$48.56
Percentage difference	70.1%	41.0%	40.3%	39.0%	46.0%	16.0%	-3.9%	-4.3%	-5.2%	-0.4%

Figure 10 The annual costs, total costs, average costs per patient and differences in costs for cohorts receiving either the traditional rheumatologist only model of care or rheumatologist and rheumatology nurse model of care when the effectiveness improved access at increasing early presentation is reduced. The transition probability for presenting early in those additional individuals accessing care in the nurse and rheumatologist model was reduced by 50 per cent.

Economic analysis limitations

There are a number of additional costs and savings that can be identified as being associated with the differences in the amount of care provided and the timing of this care provision. However, these have not been quantified either because the necessary data to calculate the cost and savings are not available or it is beyond the scope of this study to model the impact. These additional costs and savings include the following:

- Avoided surgeries eg hip and knee joint replacements;
- Avoided emergency department presentations, including patient transport costs;
- Consumption of other medicines;
- Economic benefits associated with increased workforce attachment and improved labour productivity;
- Other healthcare costs eg reduced need for primary care physician consultations;
- Improved patient quality of life from a reduced burden of disease.

While it is possible to speculate on the costs and savings associated with these services and activities, this would be arbitrary and likely be very sensitive to any assumptions necessarily made, and as such are not included here. Alternatively, while it is possible to model the economic effect of increased workforce attachment and labour productivity, this would require a level of sophisticated modelling beyond the scope of this project. An example of the estimation of labour market effects associated with improved chronic disease management in the case of type 2 diabetes is provided in Brown et al. 2009. In this study, models developed in three separate research centres were linked to estimate the economy wide impact of a hypothetical diabetes prevention program. A population projection microsimulation model was used to produce estimates of the number of people with type 2 diabetes and the impact on the prevalence and progression of the disease associated with the prevention program, with these results then linked to a household labour supply model to estimate the gains in employment from the intervention. These results were then linked to a computable general equilibrium model to determine the macroeconomic impacts of the labour supply shock. A twenty year projection was developed showing changes in real GDP, employment, consumption, investment, exports, imports and the impact on the terms of trade.

In the context of the chronicity of inflammatory arthritis, it could be argued that this analysis being performed over a four year period was too brief a period. This time period was used due to the absence of longitudinal empirical evidence regarding the costs and benefits associated with early or delayed access to treatment and accessing rheumatology nursing care. Similarly, while it is expected that earlier treatment for rheumatoid arthritis would result in a reduction in joint replacements, adequate empirical evidence could not be identified to parameterise this calculation. As such, the analysis presented does not fully capture the future benefits and cost savings associated with improved access to care by those with inflammatory arthritis.

An additional limitation of this economic analysis is that much of the empirical evidence utilised for assumptions relating to care models, pharmaceutical costs and patient outcomes has been limited to studies examining rheumatoid arthritis, a subset of inflammatory arthritis. This may not adequately reflect variation in the care and service provision for those with other forms of inflammatory arthritis.

Funding models

This analysis provides an example of how a model of care for inflammatory arthritis incorporating rheumatology nurses to provide better access to specialised rheumatology care could be employed. This evaluation has examined the funding of a rheumatology nurse model of care via the activity based funding (ABF) framework funded by state, territory and Commonwealth governments with funding of the PBS being a Commonwealth responsibility.

While the overall cost to governments of providing healthcare to people with rheumatoid arthritis falls primarily on the Commonwealth, the longer term benefits not quantified here also primarily accrue to the Commonwealth in terms of reduced associated healthcare consumption and the broader economic benefits such as reduced disability and increased workforce participation (Schofield, Shrestha and Cunich 2016). The existing ABF and PBS funding frameworks appropriately address the way in which the healthcare has been modelled here. The cost of providing this care is justified by meeting unmet need within the population (in terms of mitigating delayed treatment) and as an effectively preventative health intervention by delaying or avoiding disease progression.

Conclusions

Early access to specialist treatment for those diagnosed with inflammatory arthritis is a key determinant of the progression of the disease, long term patient outcomes and the associated healthcare costs. It is known that many patients do not receive specialist rheumatologist care within the 'window of opportunity' resulting in an unnecessary deterioration in their condition and eventually higher health system and broader economic costs.

The addition of a rheumatology nurse to the model of care for patients accessing public outpatient rheumatology services will improve access to rheumatology specialist care and reduce delays in receiving treatment. This will increase the total cost of care as more patients receive the care they require earlier, but lower the average cost of care after twelve months. Quality of life is also improved with earlier intervention resulting in more effective disease control.

Comparing the estimated cost of the two models of care considered here showed that the additional total discounted cost over four years within a representative public hospital rheumatology clinic for patients in a single enrolment year would be \$6.549 million. This is primarily a volume effect as more patients receive treatment earlier. Specifically, in the setting considered here, over 760 people would receive earlier treatment in the first year. However, this earlier intervention for a large cohort of patients also results in a lowering of the four year discounted average cost of treatment by \$889 per patient.

While the burden of disease is reduced and quality of life improved, it is beyond the scope of this report for these to be quantified. However, it was shown that disease remission rates would increase from 23.1% of the cohort in the rheumatologist only model to 31.6% of the cohort for the rheumatologist plus rheumatology nurse model at year 4 and the reduced direct healthcare costs associated with this outcome were estimated.

There are a number of additional costs and savings that are identifiable but cannot be quantified due to the lack of suitable empirical evidence. This points to the need for more robust data collections and trials to be conducted to better understand the impact of alternative inflammatory arthritis care pathways and the associated longer term consumption of healthcare services and other economic impacts. However, workforce constraints would likely be a limiting factor in the extent to which rheumatologist medical clinics with a rheumatology nurse could be rolled-out more broadly.

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