The costs of musculoskeletal disease: health needs assessment and health economics

Deborah P. Lubeck* PhD
Adjunct Professor
Department of Urology, University of California, San Francisco
Senior Medical Scientist
Division of Rheumatology, Stanford University
Department of Urology, University of California, San Francisco and Stanford University, 3333 California Street, Suite 282, San Francisco, CA 94118, USA

Arthritis and musculoskeletal conditions dominate the national illness burden worldwide. This chapter presents information on the different types of societal and individual impacts of musculoskeletal conditions, and describes the appropriate way to evaluate and present these effects. There are three types of ‘costs’ associated with musculoskeletal conditions: direct, indirect and intangible. The direct costs of care are those associated with ambulatory and inpatient medical care; these costs may be borne by the patient or society. The indirect costs are those paid and unpaid activities, such as employment, schooling and homemaking, that result from disability associated with the health condition; these costs may be borne by employers, society or the individual patient. The intangible costs of the disease are pain, emotional impairment, health worry and other effects on the patient’s quality of life. All of these components of costs may, and should be, accurately measured to get the full picture of the burden of musculoskeletal conditions.

Key words: costs of illness; musculoskeletal disease; quality of life in rheumatology.

Arthritis and musculoskeletal diseases dominate the national illness burden. They are the most prevalent of health problems in the USA, affecting over 40 million people aged 45 years and older and are projected to affect more than 60 million persons, or 22% of the population, in the year 2030.1,2 While mortality from these conditions is low, they have a major affect on disability, medical costs and patient quality of life. As the average age of the population rises, the impact of musculoskeletal conditions on society will increase in parallel.

The way in which musculoskeletal disease affects an individual is a function of the severity of the condition, the characteristics of the individual and the length of time with the condition. Patient factors that also affect the outcome of disease include: age, gender, lifestyle and preferences for specific outcomes. Over the past 20 years,
assessment of patient health outcomes has moved from a focus on clinical parameters, such as sedimentation rate or radiographs, to an emphasis on outcomes based on the patient’s personal assessment of their health status. Specific instruments have been developed for this purpose.

The disability associated with certain musculoskeletal conditions, such as arthritis, the most prevalent musculoskeletal condition, affects society in a significant way. Many individuals with severe musculoskeletal conditions lose the ability to participate in leisure or volunteer activities. Most musculoskeletal conditions affect females disproportionately, and in households where the wife or mother has severe disease, family members may spend additional hours on household work. In the worst case, the individual’s ability to lead an independent life may be compromised. Numerous studies have documented the dramatic impact of musculoskeletal conditions on employment, particularly when such conditions lead to disability. For example, among working-age individuals, labour force participation was 20–25% lower among men and women with arthritis than among similar individuals without arthritis. Employers and society are then faced with the costs associated with lost productivity, increased sick leave and healthcare expenses.

Due to the significant economic and individual effects of arthritis and musculoskeletal disease, these conditions have become a focus of strategies to reduce disability and prevent the occurrence and progression of arthritis. In this chapter, I discuss general terminology regarding the ‘costs’ of musculoskeletal disease, present data on their severity, and discuss the implications for clinical care to provide a context for understanding the large burden of these conditions.

‘COSTS’ OF MUSCULOSKELETAL DISEASE

The costs of illness are generally divided into three categories: direct costs, indirect costs and intangible costs. Direct costs include expenditure for medical care and related items. These include expenditure for physician visits, diagnostic tests, prescription and over-the-counter medications, hospital stays, aids and devices, and outpatient surgical procedures. All of this expenditure may be borne solely or in combination by the patient, his or her health insurer, an employer or a federal or state government entity. Direct costs also include other expenditure, generally paid for by the patient, such as transportation to and from the doctor or other allied health worker, higher food bills associated with a special diet, or expenditure to adapt the home environment to make functioning easier. Direct costs can be measured in many ways, including counting the number of healthcare services used and assigning a standard charge per service, obtaining billing or insurance records for the actual amounts charged for each service, or the amount reimbursed by the insurance company.

Indirect costs are those resulting from lost function in one’s usual activity, including work disability, sick leave or reduced productivity associated with a reduction in work hours or a need to change the nature of one’s work to reduce pain and improve physical function. This is a broad category encompassing paid work, schooling, parenting or maintenance of a home. A number of studies have shown the significant effect of musculoskeletal conditions on employment. Depending on the specific condition, the indirect costs of musculoskeletal conditions may equal, or even exceed, the direct costs.

It is a challenge to quantify the indirect costs of care because lost wages, or lost hours of school or household work, are difficult to evaluate. There are several approaches to quantifying these costs, with the primary approaches being the human capital approach and the willingness-to-pay approach. The human capital approach
assigns a value to the hours of work lost—based on the hourly wage paid for the individual job or activity. The human capital approach may be based on individual or societal data. Individual data evaluate the costs of lost productivity in relation to the reported income of each individual with musculoskeletal disease. These costs may include gross income, payments associated with sick leave, and payments for social security. Societal costs assume that a day of lost productivity costs society the same as the average daily wage for the population as a whole. This accounts for a wide range of labour costs for all gainfully employed workers.

The human capital approach tends to underestimate the work loss or disability days of older individuals and females, the persons who are most likely to have musculoskeletal conditions. In addition, for those non-market activities—such as homemaking, parenting, schooling or community volunteer activities—there is no definitive method for assigning a monetary value, which means that these activities are undervalued with this approach. Thus, estimates of costs using this approach may be considered the lowest level of the total burden of illness.

The alternative approach, willingness to pay, values what individuals are willing to pay (in monetary terms) for a change that results in improvement in health, such as a reduced probability of morbidity. This method allows individuals to indicate how they value health and death, and can be calculated from a societal perspective. However, the technique is difficult to implement, and the exercises for obtaining these values are often difficult for a layperson to understand because they ask an individual to place a value on increased survival, often in the context of earnings, or in terms of medical costs averted.

Intangible costs are those associated with loss in function, increased pain and reduced quality of life. As noted, disability is a significant outcome of musculoskeletal diseases. The limitations associated with these conditions include limitations in activities of daily living, reduction in leisure and community activities, chronic pain, psychological problems, including depression and anxiety, and reduced general health. The inverse of the intangible costs of arthritis is the benefit a patient receives from effective treatment. If measurement of the costs of care is to have relevance for clinical decision making, it must also consider the effects of disease and therapy on the patient’s health and well-being.

The Economics Working Group of the OMERACT (Outcome Measures in Rheumatology) Conference published a report on guidelines for economic analyses in rheumatology, and identified areas in which research needed standardization.12 The recommendations for these studies are presented in Table 1 and should be used as a guideline for reviewing and conducting studies.

**DIRECT COSTS OF MUSCULOSKELETAL CONDITIONS**

The direct costs associated with musculoskeletal conditions are substantial, especially among persons with arthritis. The driving force behind these increased direct medical costs is the increasing number of higher-cost drug therapies and the additional costs, including visits from the physician and laboratory tests to monitor for drug toxicity. Other kinds of medical utilization with attendant high costs include total joint replacement surgery, which is common among persons with rheumatoid arthritis and osteoarthritis and will increase over the coming decades with the growing prevalence of musculoskeletal disease in an ageing population. In a study published in 1995, Yelin and Callahan reported that the cost of musculoskeletal conditions was almost $150 billion, with almost half due to the direct medical care expenditures. These figures
were based on National Survey Data. Projections over the next decades indicate an associated increment in costs of 25%.  

The specific musculoskeletal condition results in different direct costs. Rheumatoid arthritis alone is estimated to cost $1–2 billion per year (estimated in 2000 dollars), a value two to three times higher than the average costs for individuals of similar age and gender in the general population. Similar results have been reported from European studies. 

In several studies on rheumatoid arthritis, average direct costs ranged from US$2299 to US$8500. Yelin et al. analysed data from a longitudinal cohort of persons with rheumatoid arthritis recruited in the San Francisco Bay area (California, USA). Total annual costs were US$8500, with hospitalizations accounting for between 55 and 62% of all expenditure. Ward et al. used the San Francisco database and data from the National Ambulatory Medical Care Survey and estimated total average expenditures of US$4200, with inpatient costs averaging approximately 68% of total direct costs. Clarke et al. reported on costs for patients with rheumatoid arthritis in two Canadian

<p>| Table 1. OMERIC ACT 5 Economic Working Group requirements for economic evaluation in rheumatology. |</p>
<table>
<thead>
<tr>
<th>Component</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding</td>
<td>Disclosure of industry funding should be mandatory</td>
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<tr>
<td></td>
<td>Statement of independence over all aspects of the study design and analysis for investigators</td>
</tr>
<tr>
<td>Study population</td>
<td>Detail on the specific population characteristics is required</td>
</tr>
<tr>
<td>Comparator</td>
<td>Possible comparators include: most widely used therapy, cheapest therapy, most effective therapy, and no therapy</td>
</tr>
<tr>
<td>Study perspective</td>
<td>The societal perspective is preferred when possible</td>
</tr>
<tr>
<td>Data sources</td>
<td>A third-party payer was an acceptable minimum</td>
</tr>
<tr>
<td>Data sources</td>
<td>Data should come from clinical trials</td>
</tr>
<tr>
<td></td>
<td>Lack of consensus about pooling of data from several studies for meta-analysis</td>
</tr>
<tr>
<td></td>
<td>Lack of consensus about modelling beyond the trial</td>
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<tr>
<td>Outcomes</td>
<td>Efficacy assessment should use international outcome measures</td>
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<tr>
<td></td>
<td>Quality-of-life measures are recommended, using standardized disease = specific or generic tools</td>
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<tr>
<td></td>
<td>Utility measures are also recommended, from patients and general population</td>
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<tr>
<td></td>
<td>All methods, i.e. rating scale, time trade-off or standard gamble, are valuable; however, they seem to explore different dimensions and thus yield very different estimates</td>
</tr>
<tr>
<td>Toxicity</td>
<td>Intervention-specific side-effects should be included in the economic evaluation of a therapy</td>
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<td></td>
<td>Both data from clinical trial and observational studies have to be taken into account</td>
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<tr>
<td>Use of resources</td>
<td>Should be reported in both resource unit (e.g. number of medical visits, hospital stay) and costs, to facilitate the transferability of results in different healthcare systems</td>
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<tr>
<td>Discounting</td>
<td>Adjustment for time preference is recommended, with a discount rate of 3–5%</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Economic evaluation should include a sensitivity analysis (at least simple one way) focusing on major variables with uncertainty</td>
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provinces. Total costs from both short- and long-term perspectives averaged US$2299. However, these costs were not a reflection of reduced utilization. Hospitalizations were responsible for more than two-thirds of expenditures, and medication costs averaged 17%.

While the average costs vary in these studies, the distribution of costs attributable to categories of care is very similar. That is, hospitalizations are responsible for the largest component of costs (40–66%) even though hospitalizations are infrequent. The one study in which hospital costs were lower than outpatient expenditure involved a cohort of patients with recent-onset rheumatoid arthritis in which hospitalizations were only 10% of total direct expenditure. However, this trend may change in the coming decades because some of the new medications for rheumatoid arthritis are more expensive than older drugs, and hospitalization seems to be declining.

For osteoarthritis, a less-severe arthritic condition, total medical costs for those persons under 65 years of age were found to be twice as high when compared with similar individuals without the condition. Among those individuals with osteoarthritis over the age of 65 years, expenditure was 50% higher than for those without the condition. Much of the difference was due to costs of hospitalization. Osteoarthritis and related conditions accounted for more than half of all total hip replacements and 85% of all total knee replacements a decade ago, and the cost for these replacements was over $300 million.

In a study using national data sets, Leigh et al evaluated the costs of osteoarthritis (OA) in the USA. They identified that OA costs anywhere from US$3.4 to 13.2 billion per year, with almost half associated with direct medical expenditure.

Work to evaluate the costs of medical care in terms of effectiveness or benefit can identify costly but effective treatments that have a durable response in terms of reduced disability or pain. Joint replacement surgery is a good example of such a treatment. However, while it is relatively easy to document the medical costs associated with these conditions, the value of treatment may be identified in savings by reducing attendant disability and work loss as measured by the indirect costs of care.

INDIRECT COSTS OF MUSCULOSKELETAL CONDITIONS

Pain and disability associated with musculoskeletal conditions results in significant work loss and inability to participate in preferred activities. For example, Yelin et al reported that the indirect costs resulting from wage loss was 52% of the total costs of care for musculoskeletal conditions in 1992. Canadian data on arthritis indicated that 64% of the costs were due to work loss. As with the direct costs of care, the impact on indirect costs varies with the type of musculoskeletal condition, as well as the cause of the loss of work or activity.

For example, the majority of musculoskeletal injuries occur among the elderly who have already left paid employment. Fractures are especially high among this age group. However, for persons of work age, the magnitude of the costs of work loss due to arthritis is very large, and would be even higher if activity losses associated with homemaking functions or other activities not easily valued could be easily priced in the marketplace. Currently, two-thirds of working-age adults in the USA are in the labour force; however, only 42% of working-age persons with musculoskeletal conditions are currently working, and activity losses for those individuals not working are not always valued in economic terms.

In an analysis of data from the National Health Interview Survey, Yelin and Callahan reported on the extent of disability and work loss days for persons with
musculoskeletal conditions. They observed that 42% of persons with such conditions reported some type of activity limitation, and 40% reported limitation specific to work. Similar data from other national surveys report the same phenomenon of significant loss of function associated with musculoskeletal diseases that starts during prime work years, and which continues throughout the individual’s lifetime, increasing with age.

INTANGIBLE COSTS OF MUSCULOSKELETAL CONDITIONS

As described earlier, the limitations associated with musculoskeletal disability may result in reduced quality of life, including reduction in physical function, increased psychological distress and reduced social function. In recent years, emphasis has been placed on including measures of quality of life in clinical trials in rheumatology in order to evaluate the full impact of the disease and treatment. The American College of Rheumatology (ACR) has recommended that patient self-report of quality-of-life outcomes be a part of disease activity measurements.29

Health-related quality of life (HRQOL) is difficult to define because the concept has different meanings for different individuals. Although it is related to functional ability, HRQOL also encompasses other parameters, such as psychological well-being. The various scales designed to measure aspects of HRQOL emphasize different domains, with some weighted more towards the physical domains of daily life activities, and others directed more towards the psychosocial aspects, such as depression, anxiety and social function.

A critical component of any functional or global measure of health status is its ability to incorporate the patient’s perspective. Although there are multiple ways of attaining this goal, one of the simplest is through the use of a self-administered questionnaire. Self-administered questionnaires have been found to be at least as effective as other clinical tools, including traditional joint counts and laboratory assessments, in documenting clinical status and predicting long-term functional declines, work disability and mortality.30,31 Thus, these self-reports can be useful tools for guiding patient/physician decisions about treatment or for identifying areas that merit the physician’s attention. A recent study demonstrating the lack of correspondence between physicians’ rating of their own health emphasizes the need for greater communication between patients and physicians.32

For an HRQOL instrument to be useful in clinical practice, it should: (1) be reliable and well validated, (2) incorporate the patient’s perspective, (3) be responsive to change in the patient’s condition, (4) include domains reflecting all relevant areas of functioning, (5) be easy to administer, with minimal burden on the individual completing the questions, and (6) be easy and quick to score so that results are available while the patient is in the clinic.33–36

A summary of the different types of questionnaire used in studies on arthritis and musculoskeletal diseases as described by Lubeck37 is presented in Table 2.

One of the most widely used instruments for measuring health status is the Health Assessment Questionnaire (HAQ). It has been used for almost 20 years and is an ACR-sanctioned instrument for assessing physical function.38 Several versions of the HAQ exist, including a 20-page instrument designed for use in longitudinal studies; this includes a disability index, two visual analogue scales for measuring pain and global severity, and items for measuring the use of resources and the side-effects of treatment. The version of the HAQ most often used in clinical studies is a 24-question instrument that rates disability in activities of daily living and instrumental activities of daily living.
Eight domains are covered: dressing, arising, eating, walking, hygiene, reach, grip and activities. Respondents rank their ability from 0 to 3, where 0 = no difficulty, and 3 = unable to perform. The HAQ is self-administered, requires only a few minutes to complete, and can be scored easily in a clinical setting.

HAQ scores correlate well with clinical assessments of function. Additionally, HAQ scores are predictors of work disability and other indirect costs of arthritis. For example, the risk of higher indirect costs of care has been found to double with every unit increase in HAQ scores.

Over the past 20 years, the HAQ, and the Modified HAQ (MHAQ) have been used in a number of clinical studies of disease-modifying and remitting agents (DMARDs) and have demonstrated responsiveness to clinical change. These include studies of methotrexate, oral gold, intramuscular gold and the newer disease-modifying agents classified as biological response modifiers, including etanercept, infliximab and combination therapy with methotrexate. These studies have indicated that an improvement in the HAQ disability index parallels improvement in ACR criteria.

One domain of quality of life that is observed frequently among individuals with musculoskeletal disease is depressive symptoms and disorders. These conditions are associated with pain and have been noted among individuals with rheumatoid arthritis, osteoarthritis and fibromyalgia at levels higher than those found among the general population. The need to assess depressive symptoms often leads to the use of the Arthritis Impact Measurement Scale (AIMS) for assessing the impact of rheumatic disease. The AIMS evaluates physical function and social
function, pain, depression and anxiety. Crotty et al., noted that women with early rheumatoid arthritis associated their disability with their depressive symptoms as well as their disease severity.

For broader assessment of other domains of health, the 36-item Short-Form Health Survey (SF-36) is often included in clinical studies of the rheumatic diseases. The SF-36 contains 36 items grouped into eight domains (physical functioning, role function—physical, bodily pain, general health, vitality, social functioning, mental health and role function—emotional. These scales are scored from 0 to 100, with a score of 100 equivalent to optimal function (e.g. no pain or physical impairment). The first four scales may also be combined to form a Physical Component Summary measure, and the last four scales may be combined to form a Mental Component Summary measure. These two summary measures also range from 0 to 100 but are standardized at the population mean of 50. Responses for the SF-36 correlate well with the HAQ and other ACR clinical measures.

While the SF-36 does not measure the full extent of disability for persons with musculoskeletal disease, it does serve as a complementary measurement to the HAQ or MHAQ, providing evaluation of the decrements in emotional and social function not included in the disability measures. One aspect of disease impact that has been demonstrated by the SF-36 is the impact of musculoskeletal conditions on fatigue and energy levels. Lubeck et al. reported clinically significant decrements in fatigue among persons with rheumatoid arthritis of long and short duration, and similar findings have been observed by others.

THE RELATIONSHIP BETWEEN CLINICAL CARE OF MUSCULOSKELETAL CONDITIONS AND PATIENT OUTCOMES

There are several areas in which clinical care and patient outcomes closely intertwine. In the musculoskeletal conditions, particularly arthritis, the relationship between level of disability and type of treatment selected affects the costs of care. For example, the recent emphasis on early aggressive treatment for rheumatoid arthritis leads to higher direct medical costs. At the same time, the most important correlate of direct medical costs is disability. In a cohort of rheumatoid arthritis patients, direct medical costs were 2.5 times higher among patients with significant disability than among those with only mild disability. The level of disability was also correlated with cumulative total direct costs in a group of individuals with arthritis followed over 5 or more years in several studies. As other data have reported, functional disability is also associated with significant work loss.

Interventions that decrease functional disability effectively may be particularly important in decreasing both the direct and indirect costs of care. One study by Kobelt et al. modelled the cost-effectiveness of different treatments in early rheumatoid arthritis. They observed that an expensive therapy, which could be administered for a limited time, and which had a durable response, could be cost-saving over the course of the disease, and as cost-effective as less costly treatment that requires continuous administration.

Traditional treatment approaches to osteoarthritis and similar musculoskeletal conditions generally rely on non-steroidal anti-inflammatory drugs (NSAIDs), or analgesic agents such as acetaminophen. A recent survey indicated that over 90% of primary care physicians and rheumatologists would prescribe an NSAID as the initial treatment. The major reason that persons with osteoarthritis seek medical care is joint pain, and the source of that pain is often unclear. While there is pain relief
associated with the use of an NSAID, that may simply be due to its analgesic effects rather than to an anti-inflammatory effect on the synovium.

In addition, these instruments can also help insurers and managed care administrators to evaluate the efficacy of a new drug. Increasingly, HRQOL self-reported measures are a part of the materials reviewed by managed care providers in making formulary and reimbursement decisions along with the evaluation of costs. For example, the ease of administering the HAQ means that the instrument can be completed in the clinic and discussed with the patient, thus allowing the patient to play a significant role in treatment decisions. The abundance of published studies and reports using such measures necessitates that administrators understand how to evaluate and interpret the results of such questionnaires.

One of the most important benefits of treatment for arthritis is that disability and reduced quality of life can be reduced or postponed, or perhaps even avoided. Due to the potential impact of medical and psychosocial interventions on arthritis-related disability, assessment of patient-based outcomes, including quality of life and disability, should be an integral part of ongoing treatment evaluations. These measures can provide important insight into the balance between the efficacy and tolerability of treatment and the extent to which treatment meets the needs of the individual.

Research agenda

- it is important that research studies use accepted standards for calculating medical care utilization and costs when evaluating the economic impact of disease. Owing to the high cost of emerging pharmaceuticals, accurate assessment of their costs and benefits is critical
- clinicians cannot overlook the significant morbidity associated with musculoskeletal disease that affects the patient’s ability to be gainfully employed or pursue other activities of interest. This morbidity, in turn, affects the patient’s ability to pay for treatment
- there are a number of valid and reliable methods for evaluating the patient’s preferred outcomes for treatment which can be incorporated in clinical care settings as well as clinical trials

REFERENCES
