Cost-effective Osteopathic Manipulative Medicine: A Literature Review of Cost-effectiveness Analyses for Osteopathic Manipulative Treatment

Russell Gamber, DO, MPH; Shane Holland, DO; David P. Russo, DO, MPH; des Anges Cruser, PhD, MPA; and Peter E. Hilsenrath, PhD

Despite the value that osteopathic manipulative medicine (OMM) may offer to healthcare consumers in a managed care, evidence-based healthcare system, very little research has been published on the cost-effectiveness of osteopathic manipulative treatment compared with other treatment modalities. The authors searched MEDLINE and OSTMED for English-language articles published between January 1966 and June 2002 using the key terms cost-effectiveness, osteopathic medicine, workers’ compensation, hospital length of stay, healthcare providers, and manipulative medicine. The authors then extended their search by reviewing the reference lists provided in the articles initially identified as relevant by these databases. The purpose, methods, findings, and conclusions of each study were evaluated for how the cost-effectiveness of OMM was analyzed. The authors conclude that the osteopathic medical profession needs to conduct and publish research that is consistent with current practices in the conventional medical literature.

Studies of the clinical efficacy of osteopathic manipulative medicine (OMM) typically have not included direct measures of cost as part of the research design and data collection. The absence of cost-analysis data on clinical outcome studies using osteopathic manipulative treatment (OMT) has limited the power of the osteopathic medical profession to exert a favorable impact on efficient healthcare policies in the United States and to offer more choices to consumers of healthcare services. Deficits in OMM cost-effectiveness analysis persist despite the opportunities presented to the osteopathic medical profession by soaring healthcare costs. Furthermore, insurance coverage remains limited for this promising restorative treatment modality.

Osteopathic manipulative medicine is a medical specialty unique to osteopathic physicians. Among the general public and even among some healthcare providers, this specialty is not well understood. For example, few healthcare consumers or professionals know that osteopathic physicians (DOs) are fully licensed physicians, with the same education, training, and residency requirements as allopathic physicians (MDs), but with additional specialty training in manual medicine—though this is only one of the many features that distinguish DOs from MDs. Experience tells us that healthcare consumers are generally unclear about differences between osteopathic manipulative medicine and other forms of body-based manual therapies, such as chiropractic care.

Although manual therapies exist in other professions, OMT is the term used to describe the specific set of techniques osteopathic physicians use to treat patients’ musculoskeletal complaints as well as other dysfunctions and disorders.

Members of the chiropractic profession and healthcare insurance carriers have conducted studies comparing the costs of healthcare services provided by chiropractors with those provided by osteopathic physicians and allopathic physicians. Some of these studies used existing data from state workers’ compensation claims to compare costs and outcomes by the type of healthcare services used. Other researchers analyzed case studies to compare the costs of ineffective traditional medical treatment with subsequent effective OMM treatments. Although most OMM treatment efficacy studies have not included direct measures of cost in the design, some researchers have used proxy variables or measurements that permit the imputation of costs.

These imputed measures of cost include, for example, “effort invested by the provider,” “hospital length-of-stay,” or “time lost from work.” However, these measures are somewhat imprecise proxies for actual direct and indirect cost data. These variables are sometimes called “imputed costs” because they are not actual expenditures or costs; rather, a dollar value is imputed to them. Experienced statisticians and health services researchers caution against using outcome variables that can only be assumed as associated with actual costs to draw inferences on real cost-effectiveness.

In the osteopathic medical literature, we found few studies that include indirect measures of cost, and we believe this
study to be the only systematic review of the few that were identified. Socially responsible healthcare coverage policies and well-informed consumers depend on reliable information about the cost of healthcare services, especially when the clinical outcomes may be the same. The osteopathic medical profession should be taking steps to provide valid research findings to patients, providers, insurance carriers, and policymakers about the costs of OMM, both as an alternative to other medical treatments and as an adjunctive treatment to improve outcomes of standard care.

For the analysis in this paper, we focused on available published literature and reports of studies that claimed to measure healthcare costs and specifically included OMM or osteopathic physicians. These articles represent the current body of information on the cost-effectiveness of OMM. We analyzed this information with consideration for how future OMM cost-effectiveness analysis might be designed and conducted. Considerations included, for example, whether the researchers asked prospective cost questions, precisely defined the source and elements for their cost data, or collected direct measures of cost in a rigorously controlled design.

In this paper, we describe existing information and suggest how future OMM cost-effectiveness analysis might better inform economic and practice policies on healthcare.

Methods
We searched OSTMED, the Osteopathic Literature Database (http://ostmed.hsc.unt.edu/ostmed/index.html), and the National Library of Medicine’s MEDLINE database for English-language articles published between January 1966 and June 2002, containing the key terms cost-effectiveness, osteopathic medicine, workers’ compensation, hospital length of stay, healthcare providers, and manipulative medicine. We extended our literature search by reviewing the references provided in the articles these databases identified as relevant.

We evaluated the purpose, methods, findings, and conclusions of each report to discuss their contributions to the literature about the cost-effectiveness of OMM. We included peer-reviewed journal articles, non-peer-reviewed journal articles, and government reports.

Studies excluded from our review include those that did not (1) identify, define, and refer in the conclusions to specific direct, indirect, or imputed measures of cost associated with OMM, or (2) specifically identify osteopathic physicians as a study group. We included only published results and papers that specifically discussed insights on the cost of OMM compared with standard medical care.

The healthcare literature has evolved in recent decades to include a substantial body of quality cost-effectiveness analysis. Standards and criteria for cost-effectiveness analysis that are generally accepted in the conventional medical literature have been developed but are also not yet well established.17 These standards and criteria should be adopted and adapted by osteopathic medical researchers and clinicians attempting to measure the cost-effectiveness of OMM. Any study of medical cost-effectiveness and cost benefits should measure the “opportunity cost” of resources used in the provision of healthcare services.17 For example, resources, or factors of production, need to be identified, defined, and valued at competitive market rates in practice and certainly in published reports. Wage and benefit rates for labor inputs or prices for nonlabor inputs are commonly used to measure market value, but some markets are sufficiently uncompetitive so as not to require alternative measurement approaches.

The physician service market is one example where Resource-Based Relative Value Scales (RBRVS)18 are sometimes used. Healthcare cost studies often include direct medical costs and other indirect costs, such as the lost output of labor, time lost from work, or the cost of patient transportation. Although some of these indirect costs are borne by consumers of healthcare services and not directly by the healthcare sector, they are true economic costs and should be included in cost-effectiveness analysis to adhere to a higher standard of research for this type of study. In this way, all costs and benefits would be accounted for, regardless of their distribution.

Results
We identified 16 published research papers and reports (11 in peer-reviewed journals and 5 in non–peer-reviewed journals) that met our criteria for inclusion in the study. We also located four government reports that address treatment cost-effectiveness by provider type.

Some articles that had a stated purpose of measuring cost-effectiveness did not actually include any cost data. We included these, however, because of the prevalent tendency of researchers to “assume” (by imputing costs) that certain outcomes would logically have some relationship to the cost of care. These values are used as proxy variables (eg, length of hospital stay).

To emphasize the distinction between measures of direct cost and proxy variables, we grouped the studies according to whether they used actual1–5,19–22 or imputed6–14 cost information. Table 1 provides a summary of the scope, design, and methods for each source document (eg, direct cost variables, indirect/imputed cost variables) in this paper.

Studies Using Direct Cost Variables
Nine published reports that used a direct measure of treatment costs or social costs of the health condition being studied were identified.1–5,19–22 Six reports used existing workers’ compensation claims data to examine or describe the cost of spine-related injuries and treatment by type of provider.1–4,19,21 Two reports used mixed models for the research.7,10

Workers’ Compensation Claims Studies—Low back pain afflicts millions of people in the United States and is the cause of major economic costs to other nations as well.23 Studies of workers’ compensation claims provide important informa-
<table>
<thead>
<tr>
<th>First Author</th>
<th>Publication (Year)</th>
<th>Study Objective</th>
<th>Design, Methods, Results</th>
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<tbody>
<tr>
<td>Assendelph(^1)</td>
<td>Journal of Manipulative Physiological Therapies (1999)</td>
<td>Methodological review of workers' compensation-claim-based studies published from 1986 to 1990, as found on MEDLINE.</td>
<td>Compares methods and findings of studies, identifies study limitations, and recommends that future studies include specifically defined cost variables and clinical outcome measures.</td>
</tr>
<tr>
<td>Li(^4)</td>
<td>Texas report of workers' compensation claims (1999)</td>
<td>Analysis of trends in cost per claim by provider type.</td>
<td>Uses average cost per service by provider type. No clinical outcomes data presented.</td>
</tr>
<tr>
<td>Lipton(^5)</td>
<td>AAO (American Academy of Osteopathy) Journal (1994)</td>
<td>Comparison of results for subjects acting as their own retrospective controls for outcomes associated with standard care (pretreatment) and OMT (posttreatment).</td>
<td>Compares estimated costs of lost time at work and reduction of pain for OMT outcomes compared with previous standard treatment outcomes. Costs computed with a formula to estimate lost time at work and treatment costs.</td>
</tr>
<tr>
<td>Steno(^2)</td>
<td>Journal of Manipulative Physiological Therapies (1993)</td>
<td>Comparison of healthcare costs by provider type to determine whether insurance restrictions on chiropractors were a factor in lower costs for chiropractic care.</td>
<td>Two years of claims data analyzed for subjects with one or more neuromusculoskeletal ICD-9 diagnosis codes (N=993). Study includes the cost of inpatient episodes. Reported lower costs for chiropractors.</td>
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<td>Studies Using Indirect/Imputed Cost Variables</td>
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<tr>
<td>Anderson(^6)</td>
<td>New England Journal of Medicine (1999)</td>
<td>Comparison of clinical outcomes for low back pain (OMT versus standard medical care).</td>
<td>Prospective, randomized study (N=155), but without blinding or control. Reported no difference in pain relief or functioning level after 12 weeks. Costs associated with less use of prescription pain medication and physical therapy among OMT patients. No cost data reported, though it is reported that the differences in costs were significant. Recommends future analysis of actual costs associated with medication and use of physical therapy.</td>
</tr>
<tr>
<td>Cantier(^7)</td>
<td>AAO (American Academy of Osteopathy) Journal (1997)</td>
<td>Retrospective review of length of hospital stay (OMT versus standard medical care).</td>
<td>Records reviewed from 18 hospitals in 67 DRGs. Many descriptive results in this study reporting reduced length of hospital stay for patients receiving OMT during hospitalization for 16% of DRGs, with acutely psychotic patients having the largest reduction in length of stay. No cost data reported.</td>
</tr>
<tr>
<td>Gamber(^8)</td>
<td>JAOA—Journal of the American Osteopathic Association (2002)</td>
<td>Comparison of clinical outcomes in women with fibromyalgia syndrome divided into four experimental groups.</td>
<td>Prospective, randomized clinical trial (N=24) found significant group receiving standard care only, improvement in daily functioning in OMT group compared with all others, but no differences among the four groups on increased feelings of well-being. No cost data reported. Cost savings could be found in restoring daily function.</td>
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* OMT indicates osteopathic manipulative treatment; RBRS, Resource-Based Relative Value Scales; E&M, evaluation and management; and DRG, diagnostic-related groups.
1 Indirect/imputed cost variables include costs from lost work time, total work of provider, medication, and use of physical therapy.
2 Indirect/imputed cost variables include hospital length of stay.
3 Indirect/imputed cost variables include early detection and treatment of potentially debilitating chronic conditions or restoration of daily functioning.
tion about the cost of treating low back pain and other spine-related conditions. Most states maintain claims data by injury type, healthcare provider type, treatment costs, and time lost from work. In their 1993 article, Assendelft and Bouter reviewed workers’ compensation studies published between 1966 and 1990. They recommended that future studies use prospective, randomized clinical trials, and specific cost data in addition to clinical and systems outcome measures. The authors also emphasized that, when researchers accept imputed costs (ie, outcomes assumed to be associated with cost), they are technically using invalid measures of actual costs.

Table 1 (continued)

<table>
<thead>
<tr>
<th>First Author</th>
<th>Publication (Year)</th>
<th>Study Objective</th>
<th>Design, Methods, Results</th>
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<tbody>
<tr>
<td>Hess</td>
<td>Journal of Manipulative Physiological Therapies (1999)</td>
<td>Comparison of responses to case vignettes using RBRVS by provider type to encourage the reduction of restrictions on E&amp;M codes used by chiropractors.</td>
<td>Compares responses of chiropractors to two case vignettes of spine-related conditions to responses by osteopathic and allopathic physicians, as obtained in results of a previous survey (RBRVS). Suggests that chiropractors perform the same E&amp;M procedures and total work intensity as physicians and that total work equals cost. No discussion of what cost implications might be. Suggests RBRVS is used in calculating Medicare fee schedules and thus has merit in comparing service choices made by provider type per specific clinical cases.</td>
</tr>
<tr>
<td>Klock</td>
<td>AAO (American Academy of Osteopathy) Journal (2002)</td>
<td>Examined differences in hospital length of stay between two groups to determine whether structural abnormalities may reliably predict coronary artery disease and whether OMT would reduce length of stay or risk for readmission.</td>
<td>Modest in rigor, this study has interesting clinical findings associated with reduced length of hospital stay. Imputed costs are associated with the ability of the physician to detect disease earlier and avoid higher future costs.</td>
</tr>
<tr>
<td>Knebel</td>
<td>JAOA—Journal of the American Osteopathic Association (2002)</td>
<td>Comparison of improvements in range of motion in elderly patients (OMT versus sham manipulative treatment).</td>
<td>Prospective, randomized study finds significant improvement in OMT group and deterioration in the control group but increases in pain in both groups at 6 weeks’ posttreatment follow-up, though the rate of rise in pain scores was nearly two times greater for the control group. Cost implications are for reduced nursing and other chronic healthcare services in elderly patients.</td>
</tr>
<tr>
<td>Licciardone</td>
<td>JAOA—Journal of the American Osteopathic Association (2002)</td>
<td>Examination of the relationship between patient satisfaction and pain reduction in patients receiving OMT in an ambulatory clinic.</td>
<td>Survey method (N=459) for a correlation study finds most dissatisfaction reported for poor health insurance coverage for OMT and significant correlations between overall patient satisfaction levels and a decrease in pain. Study suggests insurance coverage should be extended to improve quality of healthcare.</td>
</tr>
<tr>
<td>Radjiesk</td>
<td>JAOA—Journal of the American Osteopathic Association (2000)</td>
<td>Comparison of patients hospitalized with pancreatitis (OMT versus standard medical care).</td>
<td>Length of hospital stay is significantly shorter in OMT group than in study group receiving standard care, even though patients did not differ in requests for pain medication or days spent without oral intake. No cost data collected.</td>
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</table>

* OMT indicates osteopathic manipulative treatment; RBRVS, Resource-Based Relative Value Scales; E&M, evaluation and management; and DRG, diagnostic-related groups.

† Indirect/imputed cost variables include costs from lost work time, total work of provider, medication, and use of physical therapy.

‡ Indirect/imputed cost variables include hospital length of stay.

§ Indirect/imputed cost variables include early detection and treatment of potentially debilitating chronic conditions or restoration of daily functioning.
Two of the studies reviewed by Assendelft and Bouter are of particular interest. The first was a study of data from Florida workers’ compensation claims in fiscal year 1986 to ascertain differences in treatment costs for patients with back-related injuries by the type of healthcare provider used: osteopathic physicians, allopathic physicians, or chiropractors.

Two limitations of this study must be noted, however. First, Assendelft and Bouter did not include measures of injury severity or the costs of prescription medications used by patients. Second, a larger proportion of the patients under the care of allopathic physicians were hospitalized, thereby influencing the total cost of care.

With the available data, the study reported that osteopathic physicians had the lowest total cost and the lowest average cost per claimant, the shortest average length of compensation period, and the lowest average indemnity cost per claimant. Table 2 summarizes cost comparisons in various categories between provider groups for nonsurgical patients using data from this study. The second article was a survey of all back and neck sprain and strain injury claimants on the workers’ compensation rolls in Iowa in 1984. This 1999 study used a survey to collect data on the number of patients’ lost workdays by type of healthcare provider. Patients treated by chiropractors lost, on average, 2.3 days fewer than those treated by allopathic physicians, and 3.8 days fewer than those treated by osteopathic physicians. However, the direct costs for the services of osteopathic physicians were lower than the direct costs for the services of chiropractors or allopathic physicians. It appears that chiropractic care produced better outcomes than did treatments by osteopathic physicians, but at a higher cost. However, the authors of this study did not consider individual patient differences, including the severity of injury or medical history.

### Table 2

<table>
<thead>
<tr>
<th>Provider Type</th>
<th>Services Provided</th>
<th>Average Cost (US Dollars) Per Claimant by Provider Type and Service Provided*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Provider and Prescribed</td>
<td>Hospital</td>
</tr>
<tr>
<td>Chiropractors</td>
<td>1,003</td>
<td>1,070</td>
</tr>
<tr>
<td>Allopathic</td>
<td>1,558</td>
<td>1,220</td>
</tr>
<tr>
<td>Osteopathic</td>
<td>496</td>
<td>794</td>
</tr>
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† Indemnity insurance costs are averaged by provider type based on costs in the state of Florida in 1986.

### Table 3

<table>
<thead>
<tr>
<th>Provider Type</th>
<th>Body Region Injured</th>
<th>Average Claim Payments Made (US Dollars) Per Case by Provider Type and Body Region Injured*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Neck</td>
<td>Upper Extremity</td>
</tr>
<tr>
<td>Chiropractors</td>
<td>6,809</td>
<td>3,737</td>
</tr>
<tr>
<td>Allopathic</td>
<td>2,080</td>
<td>1,193</td>
</tr>
<tr>
<td>Osteopathic</td>
<td>542</td>
<td>791</td>
</tr>
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</table>

Although we were unable to find more recent published studies of workers’ compensation claims data that compare costs by provider type, we did review three available state government reports (i.e., Colorado, Hawaii, and Texas). Although the data from these reports have only been described and were not systematically analyzed, these state reports remain of interest.

Hawaii’s 1994 report of workers’ compensation claims shows that chiropractors had the highest average cost per claim, while osteopathic physicians had the lowest average cost per claim. Table 3 shows average costs for the three provider types by areas of treatment. One limitation of the Hawaii analysis, noted by the organization conducting the study, is that payments for chiropractic services might have been higher because the state contracted on a rate-per-case basis with no outcome requirements.

The two Colorado reports provide detailed information on trends in indemnity costs, medical costs, total costs, and the impact on costs of claimant attorneys and choice of provider. Figure 1 illustrates the average cost of claims by provider type for six years in Colorado. During the study period (1991 to 2001), per-claim costs were consistently highest for allopathic physicians and lowest for osteopathic physicians. This analysis did not consider clinical outcomes, however.

Figure 2 illustrates the average claim amount paid per service by provider type based on three years of data (1995 to 1997) from a Texas report on workers’ compensation claims. Again, cost per service was consistently highest for allopathic physicians, but osteopathic physicians were second highest, and chiropractors incurred the lowest per-claim cost. However, the data also illustrates a clear upward trend in all healthcare provider fees—except for those from osteopathic physicians. We were unable to locate updated figures for these data in this format, and no information was available on the clinical outcomes associated with the costs described.

Studies using actual cost of “lost work time” and provider services—the last two reports in this category of direct cost variables were published in the professional literature, one in a non-peer-reviewed journal and one in a peer-reviewed journal.

In a 2002 study by Lipton et al. researchers examined the cost-effectiveness of using OMT for a group of US Navy personnel who served as their own retrospective controls. The researchers defined “effectiveness” through subjective measures of pain reduction and a decrease in time away from work. This study retrospectively examined treatment outcomes for patients for whom standard medical care and pain medication had been unsuccessful. This group of subjects had an average of 47 visits to the medical clinic to reduce their average visual analogue pain scores (VAS) from 75 to 48. All subjects received OMT for an average of 2.56 treatments, after which their average VAS decreased to 11 from 38 at baseline. With standard care alone, patients had accumulated an average of 1374 hours of light duty and 107 hours of bed rest at home ($6,397 in average costs per patient). With OMM, subjects had an average of 0.20 hours of light-duty time and no bed rest ($69 in average costs per patient).

In 1993, Stano used two years of retrospective insurance claims data for a large sample (N=390,000) to compare third-party payments by type of provider for the neuromusculoskeletal International Classification of Diseases, 9th Revision (ICD-9-CM) treatment codes. Stano’s study found that allopathic physicians had the highest associated costs, followed by osteopathic physicians and chiropractors. The focus of Stano’s research was specifically on whether chiropractic care cost less because of restrictions in insurance coverage. He attributed some of the lower costs of chiropractic care to a lower provision of inpatient services provided by doctors of chiropractic. Cost information for this study was confined to the amounts paid by third-party payers for specified services.

Studies Using Imputed Cost Variables—The 11 research reports using imputed cost variables were included because a reference was specifically made to cost-effectiveness even though actual cost data were not collected and/or cost was not directly measured or defined. Rather than using direct measures of cost, these reports impute costs from proxy variables—including the use of other medical services, length of...
The first three articles define cost-effectiveness respectively as (1) “work time of the provider,” (2) an estimate of “lost work time,” and (3) “prescription drug and physical therapy use.”

Hess and Mootz used case vignettes describing spine-related problems and asked chiropractors to answer questions about how they would assess and treat the patient. Researchers then compared chiropractors’ responses with responses from osteopathic and allopathic physicians who completed the 1990 national RBRVS survey, which has been considered a valid and reliable instrument and is used to measure costs and establish fee structures for Medicare payments. As noted, RBRVS survey results estimate regional costs of physician services by quantifying human capital and adding this to costs associated with overhead and malpractice insurance. Researchers found that in both of the case scenarios used, osteopathic physicians reported the lowest amounts of total work and face-to-face time with patients, compared with allopathic orthopedic surgeons, physical medicine specialists, neurologists, and chiropractors.

The authors suggest that the time a provider gives to specific treatments and related patient care tasks should be considered a confounding variable in studies of cost because different providers may have developed certain efficiencies in order to maximize billing capabilities. Researchers also recommended that more attention be given to content and construction of case vignettes that might be used to compare perspectives of osteopathic physicians and chiropractors for the same clinical conditions. This study did not evaluate condition severity, assessment and diagnostic techniques used, or expected treatment outcomes.

In the second of this group of studies, Swords surveyed patients treated for low back pain with OMT (N=101) in an effort to determine whether the widespread use of this treatment modality might lower national costs for the clinical management of this condition. Swords applied information from that survey to national statistics to estimate the potential cost savings in a healthcare model that used OMT to treat all patients with low back pain. Just more than 68% of the 61 respondents who had been treated with OMT reported “a lot of” to “complete” relief from pain. Among respondents, 86% reported that OMT alleviated their need for physical therapy. Seventy-three percent reported that, after OMT, they no longer needed medication for pain control. No cost analysis was conducted, however, and no cost data were reported.

In the third report in this group of studies, Andersson et al conducted a prospective, randomized study (N=155) of patients who received OMT or standard medical care to examine whether OMT might be a less expensive method of achieving the same treatment outcomes for chronic low back pain. In this 1999 New England Journal of Medicine study, the outcome measures were “primary – change in pain,” “secondary – prescription medication,” and “primary – functioning, sec-

**Figure 1.** Average workers’ compensation costs for six years by provider type in Colorado. Sources: An independent analysis of claims for the Colorado workers’ compensation claims. Denver, Colo: Milliman and Robertson; 2001; Independent analyses of claims for the Colorado workers’ compensation claims. Denver: Tillinghast–Towers Perrin; 1996.
In the primary outcome measures, there were no significant differences between the OMT and standard care treatment groups. In addition, 90% of both groups reported being satisfied with their care. However, in the secondary outcomes, which may be of clinical and cost importance, OMT patients reported using less prescription medication and less physical therapy than patients treated with standard medical care. No actual cost data were reported in this study, however, and the question remains whether OMT achieved the same or better outcomes at less cost, with proxy cost variables being of secondary interest in the study’s aims.

Cost Imputed by Length of Hospital Stay—We identified four studies that defined cost in terms of hospital length of stay.\textsuperscript{6,10–12} Two of these studies used retrospective data,\textsuperscript{6,10} and the other two used prospective, randomized clinical trials.\textsuperscript{11,12}

In the first of these studies, Cantieri\textsuperscript{6} compared hospital length of stay data in 67 diagnostic-related groups (DRGs) for one calendar year at 18 hospitals for two groups of patients—one group that had received OMT only and one that had received standard care only. For 16% of the 67 DRGs, when patients receiving standard medical care are compared with patients receiving OMT, patients in the latter group stayed in the hospital for more than one day less often. Osteopathic manipulative treatment had the largest impact on hospital length of stay in cases of acute psychosis, reducing length of stay by 3.14 days. No estimates of the cost of a hospital day are provided in this study, however.\textsuperscript{6}

In the second study of length of hospital stay, Klock\textsuperscript{10} evaluated medical record data for inpatients treated with percutaneous transluminal coronary angioplasty with or without stent placement (N=484). Some of these patients (n=134) received OMT. The purpose of Klock’s study was to explore whether structural abnormalities are reliable predictors of coronary artery disease, whether patients receiving OMT stayed in the hospital a shorter amount of time, and whether patients receiving OMT were less likely to be readmitted. The author\textsuperscript{10} suggested that findings on length of stay were of some clinical importance and might have economic interest. Imputed costs in this study were associated with whether screening methods for abnormalities might lead to early diagnosis of coronary artery disease, thereby affecting future cost savings.\textsuperscript{10}

In a 2000 JAOA—The Journal of the American Osteopathic Association study of length of hospital stay, researchers used prospective, randomized clinical trials for inpatients seeking care for pancreatitis (N=14).\textsuperscript{4} Six subjects in this JAOA study were assigned to standard care plus OMT, and eight subjects received standard care only. There were no significant differences between the groups in the total requests for pain medications, days spent without oral intake, or subject age. The OMT group, however, had a significantly shorter length of hospital stay (4.5 days) compared with the standard care–only group, with (8 days) (P=.039). Again, no actual costs were reported.\textsuperscript{4}

In the last of the clinical trial studies that used length of stay as a variable for imputed cost, this one also published in 2000 in JAOA, researchers included data on antibiotic use for inpatients diagnosed with pneumonia (N=58).\textsuperscript{12} Patients were randomly assigned to standard treatment with OMT or placebo with sham manipulative treatment. The groups were similar in age, sex, race, tobacco use, and steroid or antibiotic use before hospitalization. Subjects’ results from the Simplified
Acute Physiology Scores were also similar between the two study groups. Mean duration of intravenous antibiotic use in the hospital was significantly lower in patients receiving OMT, as was length of hospital stay. Unfortunately, no data were collected on the costs of medications and their administration, charges billed, or other hospital costs.12

**Costs Imputed for Early Detection and Treatment of Potentially Debilitating Chronic Conditions or Restoration of Daily Functioning**—The last four studies reviewed for the present study were conducted in the outpatient setting.13–16 Two of these studies used patient surveys to measure self-reported improvements in pain, quality of life, and daily functioning with OMT.13,14 The two other studies used prospective, randomized, placebo-controlled clinical trials to measure the same outcomes.15,16 Costs in these four studies were associated with potential savings that could be realized with early diagnosis and treatment of musculoskeletal conditions, improved access to preventive and restorative healthcare, and use of ancillary healthcare services.

The first of these four studies, published in JAOA in 2002, used the MOS [Medical Outcomes Study] 36-Item Short-Form Health Survey (SF-36)26 to interview patients receiving OMT in a clinic (N=185).13 Compared with patients in the normal reference range for SF-36 scores, patients referred to specialists for OMT had higher scores for pain, lower scores for quality of life, and higher scores for severity of physical limitations. The authors conclude from these findings that early detection and treatment of musculoskeletal conditions might prevent chronic debilitating conditions and reduce the deleterious effects on these patients’ quality of life. The authors further suggest that these patients may indeed suffer more pain, have a lower quality of life, and experience more physical limitations than average because there is some evidence in the literature cited that individuals with chronic musculoskeletal problems feel marginalized and stigmatized in their experiences with other healthcare providers. The study did not measure patients’ health perceptions after receiving OMT, however. Imputed costs in this study are associated with early detection preventing chronic disability.13

The second of these four studies, another 2002 JAOA paper, uses a 45-item questionnaire adapted from the Patient Satisfaction Questionnaire27 to survey patients in an ambulatory OMT clinic (N=459).14 As part of the inclusion criteria for this study, patients had to have received OMT at least twice previously. Although these patients self-reported poor health, 72% of them were very satisfied with the healthcare they received. Researchers examined the data for any relationship between pain and mobility.

Survey respondents reported a significant decline in pain and a significant increase in mobility (P<.001) after receiving OMT. Researchers also reported a significant, positive relationship between patient satisfaction and patients’ perceptions of the efficacy of OMT (P<.001), and a significant inverse relationship between pain and overall patient satisfaction (P<.001). From the results of the survey, researchers suggested that OMT would be cost-effective, but despite its potential for cost savings through reduced pain and improved mobility, access to OMT is limited by many health insurance plans.14

In the last two of these four studies, researchers suggest that costs can be associated with improved functioning and ability to care for oneself or perform daily tasks.15,16 Both JAOA studies used strong research designs for small pilot studies but did not collect cost data.15,16

In the first 2002 JAOA study under review, researchers analyzed patient responses to survey questions about pain, response to treatment, activities of daily living (ADLs), and symptoms of depression in four experimental groups of women (N=24) diagnosed with fibromyalgia syndrome.15 The four groups were as follows: (1) OMT only, (2) OMT and education on fibromyalgia syndrome, (3) moist heat only, and (4) standard medication only. This study found that the patients receiving OMT improved their attitude toward treatment and improved in their ability to perform daily tasks. Patients receiving OMT also reported higher pain thresholds, indicating a reduced sensitivity to pain. Patients in the “moist heat” and “medication only” groups reported increased feelings of well being. The authors suggested that because the non-OMT groups reported “feeling better” despite no “hands-on” treatment, this reduces the chance that improvements reported by OMT group subjects might be confounded by the physician–patient interaction factor. In that JAOA study, the researchers “impute” cost-effectiveness by suggesting that improved daily functioning and reduced use of pain medication can be tied to a social or economic cost.15

The final study in this group of four imputed-cost studies was also published in JAOA in 2002 and measured improvements in ADLs in elderly patients with diagnosed medical conditions that severely limit range of motion in one or both shoulder joints. Subjects were randomly assigned to OMT or sham manipulative treatment groups (N=29).16 At six weeks poststudy follow-up, only those subjects who received OMT continued to have improved range of motion. The range of motion for the sham manipulative treatment group, however, had sharply declined to below study baseline levels. Although both study groups reported a decrease in pain levels during the treatment phase of the study and an increase in pain at six weeks poststudy follow-up, the rate of increase for pain scores was almost two times greater for the control group than for the OMT group. Imputed costs were associated with avoidance of long-term, chronic rehabilitative care.16

**Comment**

Although there is a substantial amount of quality research published on the clinical efficacy of OMM, there is a considerable dearth of well-designed cost-effectiveness analysis. Studies using direct cost variables only used one aspect of cost—insurance payments to providers—and their focus was on comparing physician services with chiropractic services.
for workers’ compensation cases. None of the workers’ compensation studies reviewed in the present study addressed clinical outcomes or the rates paid for other medical care.

Clinical outcome studies that suggested OMT was more cost-effective than other services also did not collect direct cost data. Studies that included both clinical outcomes data and some estimate of cost based on available information (e.g., salaries, billing data) unfortunately either had incomplete data or did not clearly and operationally define cost variables.

Generally speaking, cost-effectiveness studies can be expected to produce one or more of the observed results displayed in Table 4. If treatment X produces better results in the outcomes under investigation compared with treatment Y—and does so at a lower cost—treatment X would be more cost-effective. However, if treatment X produces better results but is more expensive than treatment Y, the findings may be considered ambiguous and in need of further study.

Collection of cost data could be part of any OMM study of clinical efficacy. However, the credibility of the cost-effectiveness aspect of a clinical trial will unavoidably depend on focused, carefully defined cost-effectiveness questions.

A first step in crafting a strong cost-effectiveness question might be to determine the economic elements included in calculating what it costs a provider to deliver a specific treatment for a specific diagnosis. This question elicits a more practical answer than the question, “What does a patient or insurance carrier pay for a specific treatment?” Payment in excess of cost may go to profit or to what economists call “economic rent,” both of which are important cost variables for any cost-effectiveness analysis. Economic rent, economic profit, and producer surplus are all ways of expressing the same idea; a supplier enjoys surplus when the amount that it is paid by buyers for goods exceeds the economic cost to the supplier of providing those goods. Measuring cost using data on payments that are below actual costs leaves out important economic considerations.

Researchers who study the cost-effectiveness of OMM should also give careful attention to study design and to the multivariate analysis methods they will use. In considering the use of imputed cost variables, it would be useful to apply standards and criteria from cost-effectiveness analysis in mainstream medicine and models used in socioeconomic healthcare research. Formulas must be described when proxy variables are used or costs are imputed from other variables.

We recommend that studies of the cost-effectiveness of OMM begin with simple designs in which the clinical outcomes of interest have valid and reliable sources of associated cost data. Comparisons of costs of outcomes for different medical treatments for the same condition by provider type have considerable challenges to address related to study design and methodology. These studies should be able to show that all cost data are defined in the same way and cost variables include the same elements of cost. Care should be given to the selection of the populations whose outcomes are being studied. Without clear definitions of which data are used to calculate costs, the sources used for cost data (and potential threats to the validity or reliability of the cost and clinical outcomes data), researchers may not be able to generalize the findings, and the integrity of the cost variables may be spurious.

Although a quality cost-effectiveness analysis can be simple or complex, the best cost-effectiveness studies carefully link cost data with clinical outcomes, use sound statistical methods to manage limitations of the data, and clearly communicate all actual and imputed cost variable parameters. Collaborations between OMM providers, third-party payers, biostatisticians, and healthcare economists would produce the strongest research design.

Some consideration and discussion in the OMM research sector might be given to the development of an economic model to help OMM researchers work effectively with financial managers in the design of clinical studies to identify and define essential cost variables of interest, identify reliable and valid sources for cost data, and apply contemporary methods of analysis.

All of the studies reviewed were independent of each other, and none utilized recommendations from previous studies in the area of collecting cost data or defining cost variables. Because the available information on cost-effectiveness of OMM uses limited sources of cost data or imputed costs, much work remains to be done.

Cost-effectiveness analysis of OMM is needed in many areas of disease and disability, both as an alternative for, and a complement to, conventional medical care. Although prospective cost-effectiveness studies are challenging to design and execute, those in the osteopathic medical profession cannot increase their knowledge of whether OMM is more cost-effective than other treatment modalities without concerted efforts in this area of research. Cost-effectiveness analysis of OMM must be more carefully crafted to have a favorable impact on efficient healthcare policies and to offer more choices to healthcare consumers.

References


