Retrospective Medical Record Review of an Osteopathic Manipulative Medicine Hospital Consultation Service

Karen T. Snider, DO; Eric J. Snider, DO; Brett R. DeGooyer, DO; Allison M. Bukowski, DO; Regina K. Fleming, DO; and Jane C. Johnson, MA

From the Department of Osteopathic Manipulative Medicine (Dr K. Snider) and the Department of Neurobehavioral Sciences (Dr E. Snider) at A.T. Still University-Kirksville College of Osteopathic Medicine in Missouri; the Department of Osteopathic Principles and Practice at the Pacific Northwest University of Health Sciences, College of Osteopathic Medicine in Yakima, Washington (Dr DeGooyer); Sound Physicians of Centura Health at St. Mary-Corwin Medical Center in Pueblo, Colorado (Dr Bukowski); Northeast Regional Medical Center in Kirksville, Missouri (Dr Fleming); and the A.T. Still Research Institute at A.T. Still University in Kirksville, Missouri (Drs Snider and Snider and Ms Johnson).

Financial Disclosures: None reported.

Support: The current study was supported by a grant from the A.T. Still University Strategic Research Fund.

Address correspondence to Karen T. Snider, DO, Department of Osteopathic Manipulative Medicine, A.T. Still University-Kirksville College of Osteopathic Medicine, 800 W Jefferson St, Kirksville, MO 63501-1443.

E-mail: ksnider@atsu.edu.

Submitted: October 26, 2012; final revision received April 13, 2013; accepted April 22, 2013.

Context: In the first half of the 20th century, nearly all osteopathic physicians used osteopathic manipulative medicine (OMM) in the care of hospitalized patients. Over the past few decades, however, inpatient OMM care has declined and is more commonly provided by OMM specialists.

Objective: To retrospectively evaluate the details of a specialty-level OMM inpatient consultation service.

Methods: Inpatient OMM consultations that took place at Northeast Regional Medical Center in Kirksville, Missouri, between July 1998 and March 2008 were identified from billing records. Consultations were reviewed for demographic information, admission location, postoperative status, intensive care unit and mechanical ventilation usage, admission and discharge diagnoses, consultation reasons and final diagnoses, areas of somatic dysfunction treated and types of osteopathic manipulative treatment (OMT) techniques used, and hospital length of stay (LOS).

Results: A total of 1509 OMM consultations were identified (580 for male patients [38%]; 929 for female patients [62%]; mean [SD] age, 54 [31] years [range, 0-99 years]), representing 11% of all inpatient consultations. Of these, 1372 consultations (91%) were initiated in the inpatient acute care facility, 87 (6%) in the inpatient acute rehabilitation facility, and 50 (3%) in the skilled nursing facility. Further, 265 consultations (18%) were for postoperative patients, 187 (12%) were for patients in the intensive care unit, and 54 (4%) were for patients receiving mechanical ventilation at the time of the consultation. The most common admission diagnoses were hypertension, routine newborn care, lower respiratory infection, chronic obstructive pulmonary disease, and gastrointestinal symptoms. The most common reasons for OMM consultation were chest/rib pain, spinal pain, lower respiratory infection (adjunctive treatment), cranial asymmetry, and infant feeding disorder. The most common types of OMT techniques used were myofascial release, balanced ligamentous tension, muscle energy, soft tissue, and inhibition. The mean (SD) LOS was 5.7 (3.3) days (range, 0-48 days), while the mean (SD) number of days the patient received OMT was 3.1 (2.2) days.

Conclusion: Medical records reviewed in the current study revealed that OMM consultations were ordered primarily for musculoskeletal complaints, respiratory problems (adjunctive treatment), and newborn care. A variety of OMT techniques were used. Further retrospective study is warranted to determine if OMM had an effect on LOS.

J Am Osteopath Assoc. 2013;113(10):754-767
doi:10.7556/jaoa.2013.045

Osteopathic manipulative medicine (OMM) is the integration of osteopathic philosophy, structural diagnosis, and osteopathic manipulative treatment (OMT) in the evaluation and treatment of patients.[1] In the first half of the 20th century, OMM was part of the care of nearly all patients in osteopathic hospitals, which allowed students and interns to learn more about their patients and to directly observe the psychological and medical value of OMT.[2] "Standing orders" for OMT were discontinued by the 1960s because of technological advancements, increased regulations from state and federal agencies, and increased demand from third-party carriers and accreditation agencies to provide proper documentation for the use of OMT as a therapeutic intervention.[2] Eventually, the Healthcare Facilities Accreditation Program required osteopathic hospitals to establish entities to oversee the utilization of OMM during inpatient care,[3] a requirement that, as of 2013, is still present and affects nearly 200 hospitals nationwide.[4]

Both prospective and retrospective studies have documented improved health outcomes and decreased hospital length of stay (LOS) with the use of OMM for surgical and medical inpatients.[5-11] Studies have shown OMT to be efficacious in the management of influenza,[2] pneumonia,[12] and chronic obstructive pulmonary disease (COPD).[4] Radjieski et al[9] found a mean reduction of hospital LOS of 3.5 days in patients diagnosed with pancreatitis. In 2000, Noll et al[7] demonstrated a mean reduction in hospital LOS of 2.0 days (P=.01) in elderly patients diagnosed with pneumonia, and in 2009, the larger Multicenter Osteopathic Pneumonia Study in the Elderly (MOPSE)[12] revealed a mean reduction in hospital LOS of 1.0 days (P=.01) in a similar population. The use of OMT by osteopathic physicians is declining, however, and fewer patients are receiving this type of treatment.[13-15]

Despite this decline, a multihospital osteopathic postdoctoral training institution medical record review[16] found higher rates of osteopathic structural examinations and OMT applications at institutions employing OMM specialists, who provide specialty-level OMM in the hospital setting through OMM consultations. One of the first OMM consultation services was established in 1973 at the Waterville Osteopathic Hospital of Maine.[17] This service provided OMM for a variety of clinical conditions from congestive heart failure to congenital torticollis.

To further investigate the role of OMM consultation services, we retrospectively evaluated specialty-level OMM consultations at 1 hospital. Medical records were reviewed for demographic information, admission location, postoperative status, intensive care and mechanical ventilation usage, admission and discharge diagnoses, consultation reasons and final diagnoses, areas of somatic dysfunction treated and types of OMT techniques used, and hospital LOS. The data obtained during the current study were also collected to facilitate future case-matched, controlled, retrospective reviews focusing on specific inpatient scenarios. On the basis of our experience, we expected most OMM consultations to be for musculoskeletal complaints.

Methods

The OMM department of Gutensohn Clinical Associates at the A.T. Still University-Kirksville College of Osteopathic Medicine in Missouri maintains searchable electronic billing records that date back to 1998. Further, Gutensohn Clinical Associates provides an inpatient OMM consultation service at the Northeast Regional Medical Center (NRMC) hospital in Kirksville, Missouri, which maintains searchable electronic patient medical records that date back to 1996. For the current study, the electronic billing records of Gutensohn Clinical Associates' OMM department were searched for current procedural terminology (CPT)[18] initial hospital consultation codes 99251 through 99255 that were billed from 1998 to 2008 by the 13 osteopathic physicians who

participated in the OMM consultation service during that period. All participating physicians were either board certified or board eligible in neuromusculoskeletal medicine (NMM)/OMM or had a Certification of Special Proficiency in OMM. Many of the physicians were also board certified in other specialties, such as family practice/OMT or physical medicine and rehabilitation, so not all consultations billed by these physicians were for OMM. After records were obtained from NRMC, non-OMM consultations were manually excluded from data collection. Only consultations specifically for OMM were included in the current study. Patient names were obtained from the billing records that met the search criteria. The electronic medical records for the OMM consultations of those patients were then obtained from the NRMC electronic database and reviewed electronically for the variables outlined in *Table 1*. After data collection and prior to statistical analysis, the patients' names and medical record numbers were removed, and a separate anonymous patient identifier was created and assigned to each medical record. To estimate the percentage of inpatients receiving an OMM consultation each year, deidentified data on the total number of inpatients per year and the total number of consultations performed per year were obtained directly from the NRMC for the study period. All elements of the current study were reviewed and approved by the A.T. Still University-Kirksville Institutional Review Board.

Medical records for male and female patients of all ages, races, and ethnicity groups who were seen at the NRMC by physicians in the OMM consultation service from 1998 to 2008 were included in the current study. When only a portion of the hospital medical record was available, useable data from those patients were limited to the accessible information. Patients whose hospital records were sealed or otherwise unavailable or who were seen for reasons other than OMM evaluation and management were excluded from the data pool.

During the study period, the NRMC maintained an inpatient acute care facility, an inpatient acute rehabilitation facility, and a skilled nursing facility (SNF) in the same building. If a patient was transferred between

Table 1.
Retrospective Information Collected From Inpatient Medical Records With Osteopathic Manipulative Medicine Consultations

Patient Information	Admission Information	Consultation Information	OMT Information	Discharge Information
Name	Admission date	Consultation date	Was the OMT primarily for homeostasis?	Discharge date
Medical record number	Admitting physician specialty	Reason for the consultation	Number of days OMT was performed	Top 4 discharge diagnoses
Date of birth	Admitting physician degree	Final consultation assessment	Areas of somatic dysfunction treated	Was the consultation continued from a previous admission?
Sex	Top 4 admission diagnoses	Was the consultation related to the admitting diagnoses?	Types of OMT used	
Race and ethnicity	Location—acute, rehabilitation, or SNF	Was the patient postoperative at the time of consultation?	Did a resident physician participate in the consultation?	
	ICU usage	Was the consultation ordered as part of clinical pathway admission orders?		
	Mechanical ventilation usage	Role of the ordering physician (attending vs consulting)		
		Ordering physician specialty		

Abbreviations: ICU, intensive care unit; OMT, osteopathic manipulative treatment; SNF, skilled nursing facility.

facilities within the hospital, each facility stay was considered a separate hospital stay and required separate admission and discharge summary reports.

Patients were considered postoperative if they had had a major surgical procedure during their current acute care hospital stay or during their stay at the inpatient acute care facility immediately preceding admission to the inpatient acute rehabilitation facility or the SNF. Intensive care unit (ICU) usage was recorded if the patient was admitted directly to the ICU or if the patient was in the ICU at the time of the OMM consultation. Mechanical ventilation usage was recorded if the patient received mechanical ventilation prior to or at the time of the OMM consultation. The admission and discharge diagnoses were obtained from the admission history and physical reports and discharge summary reports, respectively.

During the study period, the NRMC had a mixed staff that included both osteopathic physicians (ie, DOs) and allopathic physicians (ie, MDs) and residents in multiple American Osteopathic Association–accredited residency programs. The primary specialty of the physician who wrote the admission orders or the primary specialty of the attending physician who supervised the resident physician who wrote the admission orders was recorded as the specialty of the admitting physician. The primary specialty of the physician who wrote the OMM consultation order or the primary specialty of the attending physician who supervised the resident physician who wrote the OMM consultation order was recorded as the specialty of the consulting physician. The subspecialties of internal medicine, such as pulmonology and gastroenterology, were grouped together and recorded as internal medicine.

The reason for the OMM consultation was obtained from either the original hand-written order form or the initial OMM consultation report. The consultation was considered to have been ordered as part of clinical pathway admission orders if the OMM consultation option was checked on the preprinted standard admission order list. During the study period, the OMM consultation option was only available on standard admission order lists for pneumonia and COPD. The reason for the consultation was considered to be related to the admission diagnosis if the chief complaint of the patient during the OMM consultation involved the same body area as that involved in the primary reason for hospital admission. For example, if the patient was admitted for chest pain and the OMM consultation was ordered for rib pain, then the reason for the consultation was considered to be related to the admission diagnosis. In some cases, the primary purpose of the OMM consultation was to diagnose and treat somatic dysfunction that was affecting a patient's homeostatic mechanisms. For these cases, the reason for the OMM consultation was considered to be related to homeostasis if the chief complaint was identified by the attending physician as biomechanical dysfunction in the same body area as that involved in the primary reason for hospital admission. For example, if the patient was admitted for pneumonia and the OMM consultation was ordered for rib stiffness, then the reason for the consultation was considered to be related to homeostasis.

The final consultation diagnosis was taken from the progress notes if the final diagnosis was not readily apparent on the initial consultation report. In some cases, when a patient was discharged from 1 hospital facility, such as inpatient acute care, and admitted to another facility, such as SNF, the attending physician requested that OMM consultation be continued at the new facility. For the purposes of data collection, OMM consultations for the same patient occurring in different facilities were recorded as separate consultations, but a notation was made that the consultation was a continuation of a previous consultation. The first 4 admission, consultation, and discharge diagnoses listed in the assessment portion of the admission history and physical reports, consultation reports, and discharge summary reports were entered into the database. These diagnoses were entered into the database as recorded in the medical record. After data collection, but prior to data analysis, synonymous

diagnoses such as "heart failure," "congestive heart failure," and "acute heart failure" were changed to a single *International Classification of Disease, 9th edition* (ICD-9) diagnosis, such as "congestive heart failure unspecified" (ICD-9 428.0).[19]

The frequency of diagnosis of the 10 body regions of somatic dysfunction and the frequency of use of the different types of OMT were based on the number of separate patient consultations in which a specific somatic dysfunction diagnosis was made or a specific type of OMT was performed. If somatic dysfunction of a particular body region was diagnosed during 1 or more consultation encounters with a patient during his or her hospital stay, then that somatic dysfunction diagnosis was counted 1 time. For example, if thoracic somatic dysfunction was diagnosed at 2 of 3 consultation encounters with a patient during his or her hospital stay, then thoracic somatic dysfunction was counted 1 time. Each type of OMT was counted once per OMM consultation, even if a technique was performed at more than 1 consultation encounter during the patient's hospital stay. Resident physicians were assumed to be involved in the consultation if the initial consultation report or any of the progress notes were written by a resident physician.

The LOS for each patient was calculated by subtracting the date of admission from the date of discharge. If a patient was admitted and discharged on the same date, the LOS was recorded as 0. The number of days the patient received OMT during his or her hospital stay was recorded. Mean LOS was calculated for all inpatient medical records reviewed, for each admission location, and for those who had ICU usage. Mean LOS was not calculated for each admission and discharge diagnosis.

Statistical Analysis

The data were analyzed using SAS statistical software (version 9.3; SAS Institute Inc). All available data were used in analyses; no missing data were imputed. Descriptive statistics (frequencies and percentages, means and standard deviations) were used to summarize the observational data. A χ^2 goodness-of-fit test was used to compare the distribution of DOs and MDs admitting patients to the hospital to the distribution of DOs and MDs ordering OMM consultations. In addition, *t* tests were used to compare hospital LOS between patients in the ICU and those not in the ICU. $P \leqslant .05$ was considered statistically significant.

Results

The review of Gutensohn Clinical Associates' billing records resulted in 2316 initial inpatient consultation codes billed between July 24, 1998, and March 25, 2008. Of these, 1509 were specifically OMM hospital consultations with available electronic medical records. The remaining 807 were consultations for reasons other than OMM or from patients whose medical records were unavailable for review. The number of OMM consultations performed by the OMM consultation service per year is presented in *Table 2*. These results do not include OMM consultations performed by physicians outside of the Gutensohn Clinical Associates practice. Osteopathic manipulative medicine consultations accounted for 1509 (11%) of all consultations ordered at the NRMC between January 1, 2001, and March 31, 2008, and a mean of 3% of hospital inpatients received an OMM consultation per year. Five hundred eighty consultations were for males (38%) and 929 were for females (62%). In 1475 consultations (98%), the patient was white; in 15 (1%) the patient was Hispanic; in 8 (<1%), the patient was black; in 6 (<1%), the patient was Asian; and in 5 (<1%), race was not reported. The mean (SD) age was 54 (31) years (range, 0-99 years). Newborns accounted for 280 consultations (19%). Further, 1372 consultations (91%) were ordered in the inpatient acute care facility, 87 (6%) were ordered in the inpatient acute rehabilitation facility, and 50 (3%) were ordered in the SNF. Sixty-nine consultations (5%) were continuations of previous consultations when the patient was transferred between hospital facilities.

Table 2.
Osteopathic Manipulative Medicine (OMM) Consultations (N=1509) Performed by the OMM Consultation Service[a] and Total Hospital Inpatients and Consultations[b]

Year of Admission	Total OMM Consultations, No. (%)[c]	Total Hospital Inpatients, No.	OMM Consultations/ Total Hospital Inpatients, %	Total Inpatient Consultations, No.	OMM Consultations/ Total Inpatient Consultations, %
Jul-Dec 1998[d]	82 (5)	NA	NA	NA	NA
1999[d]	181 (12)	NA	NA	NA	NA
2000[d]	128 (8)	NA	NA	NA	NA
2001	110 (7)	4659	2	1492	7
2002	92 (6)	4903	2	1387	7
2003	137 (9)	4520	3	1354	10
2004	101 (7)	4621	2	1304	8
2005	218 (14)	4481	5	1540	14
2006	210 (14)	4442	5	1693	12
2007	200 (13)	4180	5	1024	20
Jan-Mar 2008	50 (3)	1918	3	436	11

[a] From July 24, 1998, to March 25, 2008.
[b] From January 1, 2001, to March 31, 2008.
[c] Percentages do not total 100 because of rounding.
[d] Total hospital inpatient census not available (NA) for 1998-2000.

The patient was postoperative in 265 consultations (18%). The patient was in the ICU during his or her hospital stay in 189 cases (13%), and the initial consultation occurred in the ICU in 187 cases (12%). Those patients who were admitted directly to the ICU had longer LOS than those patients who were not admitted directly to the ICU (mean [SD] 9.1 [8.3] vs 5.2 [4.8] days, $P<.001$). Those patients in the ICU at the time of the consultation had longer LOS than those who were first seen outside the ICU (mean [SD] 9.9 [9.5] vs 5.1 [4.4] days, $P<.001$). The patient was receiving mechanical ventilation prior to the consultation in 66 cases (4%) and receiving mechanical ventilation at the time of the consultation in 54 cases (4%).

The top 10 admission and discharge diagnoses are presented in *Figure 1*. The consultation was ordered as part of clinical pathway admission orders for 203 cases (13%). The consultation was related to the admission diagnosis in 692 cases (46%) and to homeostasis in 541 cases (36%). The top 10 consultation reasons and final consultation diagnoses are presented in *Figure 2*. With the exception of adjunctive treatment for lower respiratory tract infection, bowel ileus, and infant feeding disorder, OMM consultations were primarily ordered for musculoskeletal complaints. Of the physicians admitting the patients who received OMM consultations, 45 (68%) were DOs and 21 (32%) were MDs. For the 1490 OMM consultations in which the physician who ordered the consultation was identified, DOs ordered 1237 of the OMM consultations (83%) and MDs ordered 253 (17%). Of the 106 physicians who admitted patients to the NRMC during the study period, 81 (76%) were DOs and 25 (24%) were MDs. Osteopathic physicians accounted for 36,600 of 43,512

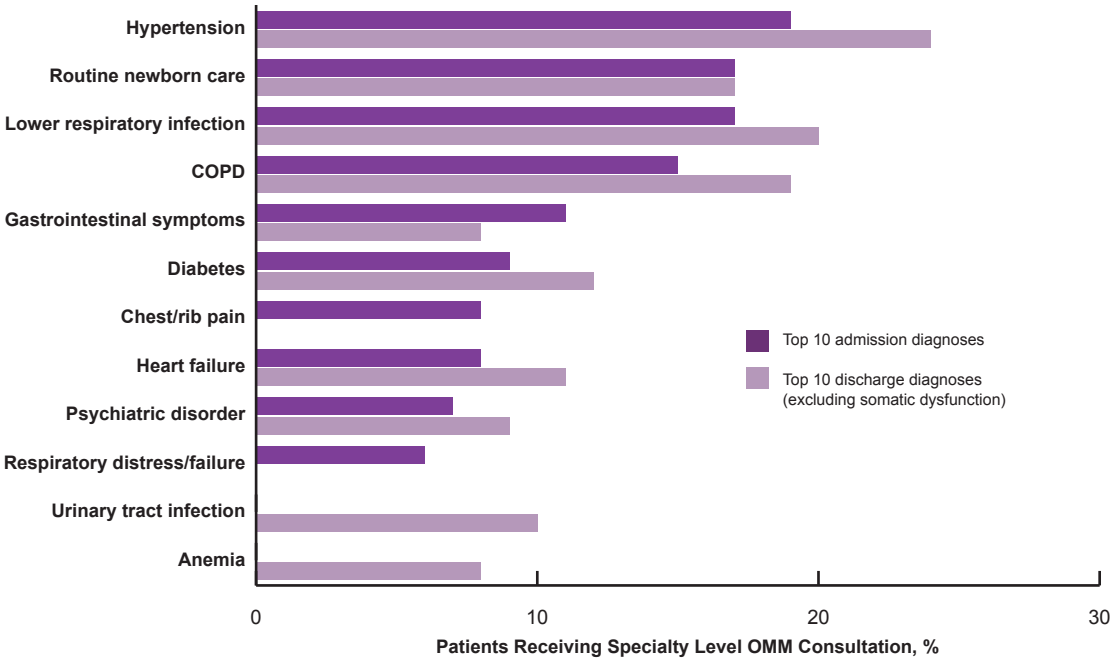

Figure 1.
Top 10 admission and discharge diagnoses of patients receiving osteopathic manipulative medicine (OMM) consultations (N=1509). Percentages were calculated from the total number of medical records with the diagnosis as 1 of the top 4 assessments listed on the initial admission history and physical reports for admission diagnoses and as 1 of the top 4 assessments listed on the discharge summary reports for discharge diagnoses. *Abbreviation*: COPD, chronic obstructive pulmonary disease.

admissions (84%), and MDs accounted for 6912 (16%). When comparing the distribution of DOs and MDs ordering OMM consultations to the distribution of DOs and MDs admitting all patients to the NRMC during the study period, there was no significant difference (P=.22). A resident physician participated in the consultation in 938 OMM consultations (62%). The specialties of the admitting and ordering physicians are outlined in *Table 3*.

The frequency of diagnosis of the 10 areas of somatic dysfunction is presented in *Table 4*. The frequency of use of the different types of OMT is presented in *Table 5*. Mean (SD) LOS for all hospital admissions reviewed in the current study was 5.7 (3.3) days (range, 0-48 days). Mean (SD) LOS for inpatient acute care was 5.1 (5.0) days (range 0-48 days). Mean (SD) LOS for inpatient acute rehabilitation was 13.1 (7.2) days (range, 3-36 days). Mean (SD) LOS for SNF was 8.7 (3.9) days (range, 2-17 days). Mean (SD) number of days patients received OMT during their hospital stay was 3.1 (2.2) days (range, 1-27 days).

Comment

In 2008, the final year of the current study, the average LOS for acute care hospital inpatients in the United States was 4.6 days,[20] which is shorter than the mean LOS (5.1 days) for the acute care hospital inpatients re-

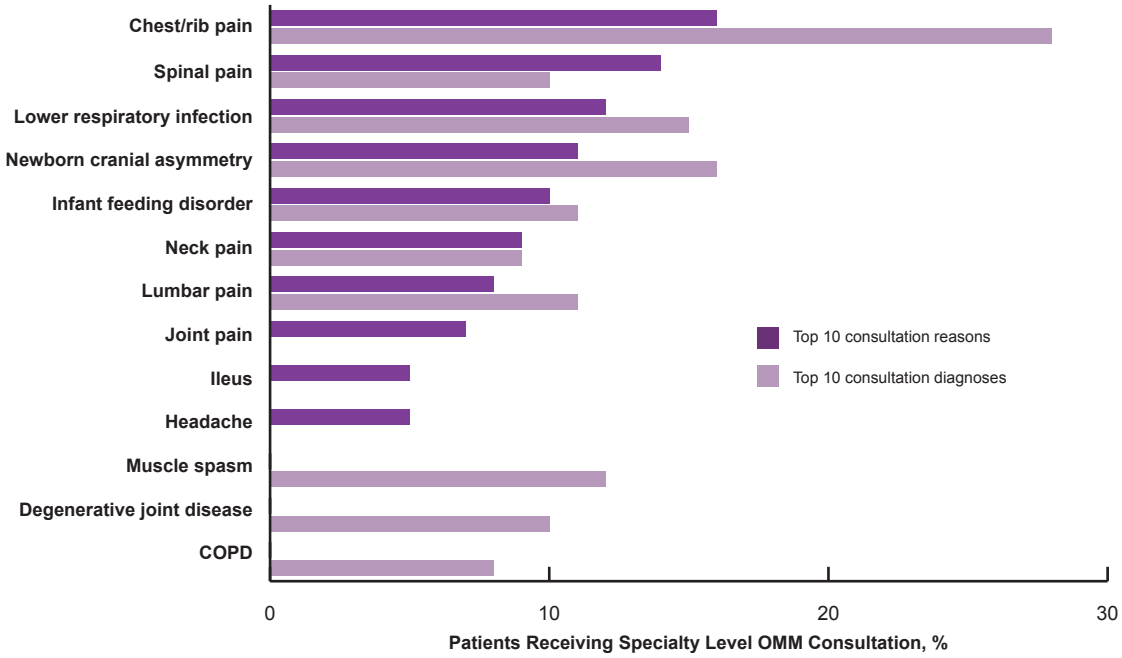

Figure 2.
Top 10 reasons for obtaining inpatient osteopathic manipulative medicine (OMM) consultations and the top 10 final OMM consultation diagnoses (N=1509). Percentages were calculated from the total number of medical records with the consultation reason as 1 of the top 4 chief complaints on initial consultation reports and from the total number of medical records with the consultation diagnosis as 1 of the top 4 assessments listed as the final diagnoses. *Abbreviation*: COPD, chronic obstructive pulmonary disease.

viewed in the current study. Further, the US average LOS for patients in an inpatient acute rehabilitation facility in 2008 was 13.3 days,[21] which is only slightly higher than the mean LOS for the same patient subset in our study (13.1 days). The 2008 US average LOS for patients in an SNF was 27 days,[21] which is more than 3 times the 8.7-day mean LOS for the same patient subset in our study. Several factors may account for the longer LOS for acute care hospital inpatients observed in the current study. First, patients for whom an OMM consultation was ordered may have been sicker than patients with the same principal diagnoses who did not receive an OMM consultation. Retrospective analyses of case-matched controls would be required to determine if severity of illness accounted for the disparity. Second, the NRMC is a rural hospital with a surrounding population that is older than the national average. The 2010 national census[22] found that the median age in the United States was 35.3 years and the median age of a Missouri resident was 37.9 years. The mean (SD) age of patients in the current study was 54 (31) years and included 280 newborns (19%). Because LOS is 1 of the determinants of the total cost of an inpatient hospital stay, further study of how OMM consultations affect LOS is justified.

The most common admission and discharge diagnoses in the current study were similar to national data.

Table 3.
Specialties of Admitting Physicians and Ordering Physicians Who Participated in an Osteopathic Manipulative Medicine (OMM) Hospital Consultation Service

Specialty	Consultations, No (%)	
	Admitting Physician[a]	Ordering Physician[b]
Emergency	30 (2)	36 (2)
Family medicine	411 (28)	402 (27)
Internal medicine (includes subspecialties)	804 (54)	811 (55)
Neurology	22 (1)	25 (2)
OMM	2 (<1)	1 (<1)
Obstetrics-gynecology	36 (2)	35 (2)
Orthopedics	39 (3)	36 (2)
Physical medicine and rehabilitation	7 (<1)	6 (<1)
Pediatrics	25 (2)	25 (2)
Surgery	100 (7)	97 (7)
Urology	14 (1)	12 (1)

[a] N=1490
[b] N=1486

In 2008, the Healthcare Costs and Utilization Project reported that the top 10 principal diagnoses for acute care hospital stays in the United States were pregnancy, childbirth, and liveborn infant (routine newborn care); pneumonia; congestive heart failure; coronary atherosclerosis; osteoarthritis; mood disorders; cardiac dysrhythmias; septicemia; nonspecific chest pain; and COPD.[20] During 2006-2008, the most common principal diagnoses for hospital stays in Missouri were pregnancy, childbirth, and liveborn infant; heart disease (including congestive heart failure, coronary atherosclerosis, and arrhythmias); mental disorders; injuries and poisoning; pneumonia and influenza; cancers; and stroke and cerebrovascular disease.[23] The principal diagnosis, which is the condition chiefly responsible for an inpatient stay,[24] is usually listed first on the admission history and physical reports and the discharge summary reports. In the current study, we did not distinguish the first diagnosis listed on the reports from the second through fourth diagnoses. Therefore, the current study also included secondary diagnoses that were managed or considered as part of the care of the patients. Consistent with this limitation, the current study found that hypertension, which was reported by the Healthcare Costs and Utilization Project as the top secondary diagnosis,[20] was the most common diagnosis listed among the first 4 diagnoses on the admission history and physical reports and the discharge summary reports. Further, we only included the first 4 admission and discharge diagnoses even though many of the patients had 8 or more diagnoses. Therefore, the current study could not accurately assess the LOS for each individual diagnosis because all diagnoses were not collected. We also could not assess the LOS for the principal diagnosis because that diagnosis was not distinguished from the secondary diagnoses.

The current study found that OMM consultations were ordered primarily for musculoskeletal complaints along with adjunctive treatment for lower respiratory tract infections, bowel ileus, and infant feeding disorder. While a large number of studies assess the benefit of manual medicine for musculoskeletal complaints, few studies assess the use of OMM in the hospital setting. In a prospective pneumonia study,[7] elderly patients who received OMT twice daily had decreased mean duration of intravenous antibiotic use of 2.08 days ($P=.005$), a reduction in total antibiotic treatment by a mean of 1.99 days ($P=.003$), and the shorter LOS mentioned previously. A prospective study[25] assessing cranial somatic dysfunction in newborns found that an abnormal cranial rhythmic impulse at age 2 weeks was related to excessive crying at age 6 weeks ($P<.001$). Another study[26] evaluated the use of OMT during labor for lumbar pain. Women receiving OMT during labor used less pain medication than those who did not receive OMT during labor ($P<.01$). Although the analgesic effect of OMT markedly reduced the use of pain medication ($P<.01$), it

Table 4.
Somatic Dysfunction Body Region Identified During Osteopathic Manipulative Medicine Consultations (N=1509)

Somatic Dysfunction Body Region[a]	Consultations, No. (%)
Thoracic	1329 (88)
Cervical	1192 (79)
Rib	1025 (68)
Head	915 (61)
Lumbar	851 (56)
Sacrum	818 (54)
Pelvis	512 (34)
Abdomen	367 (24)
Lower extremity	246 (16)
Upper extremity	204 (14)

[a] Reported on either the initial consultation reports or subsequent care progress notes.

Table 5.
Osteopathic Manipulative Treatment (OMT) Techniques Used During Osteopathic Manipulative Medicine Hospital Consultations (N=1509)

OMT Technique[a]	Consultations, No. (%)
Myofascial release	1065 (71)
Balanced ligamentous tension	1035 (69)
Muscle energy	687 (46)
Soft tissue	672 (45)
Inhibition	664 (44)
Rib raising	569 (38)
Articulatory	485 (32)
Cranial	463 (31)
Other	440 (29)
Counterstrain	347 (23)
Facilitated positional release	321 (21)
Unspecified	299 (20)
Still technique	184 (12)
Visceral	150 (10)
Lymphatic	130 (9)
High-velocity, low-amplitude	118 (8)
Integrated neuromuscular release	60 (4)
Low-velocity, moderate-amplitude	24 (2)
Neurofascial release	24 (2)
PINS	3 (<1)

[a] Reported in either the initial consultation reports or subsequent care progress notes.

Abbreviation: PINS, progressive inhibition of neuromuscular structures.

did not have a statistically significant effect on the length of labor.[26] Thirty-three percent of the OMM consultations in the current study were ordered for respiratory diseases or for newborn care. A closer review of these cases may further our understanding of the effect of OMT in the hospital setting.

In the current study, the patients were postoperative in 18% of the consultations. Several hospital-based clinical trials have evaluated the use of OMT in the care of the postoperative patient. Goldstein et al[27] demonstrated that patients receiving an OMT protocol after elective total abdominal hysterectomy used less morphine than those in the group receiving a postoperative sham protocol treatment during the first 24 hours ($P=.02$) and 25 to 48 hours after the operation ($P=.01$). Sleszynski et al[10] found no difference in the incidence of postoperative atelectasis status after cholecystectomy, but patients who were treated with the thoracic lymphatic pump technique had an earlier recovery and quicker return to preoperative respiratory values for forced vital capacity and forced expiratory volume than patients who were treated with incentive spirometry. Two retrospective studies have evaluated the effect of OMT on postoperative ileus after a variety of surgical procedures. Herman[28] found that patients routinely receiving OMT

postoperatively had an extremely low incidence (0.3%) of postoperative adynamic ileus, whereas patients not receiving OMT had a higher incidence (7.6%). Crow and Gorodinsky[29] found that patients who received OMT after developing a postoperative ileus had an average LOS that was 2.7 days shorter than those who did not receive OMT. In a more recent randomized study, Le Blanc-Louvry et al[30] found that individuals receiving postoperative abdominal wall massage after a colectomy had less pain ($P<.001$), had less analgesic use ($P<.05$), and passed gas sooner ($P<.01$) than those individuals who did not receive abdominal massage. O-Yurvati et al[8] demonstrated that OMT had a beneficial effect on the recovery of patients after coronary artery bypass graft surgery as indicated by changes in cardiac function and perfusion with significant differences for mixed venous oxygen saturation ($P\leq.005$) and cardiac index ($P\leq.02$). A prospective study investigating the use of OMT in the postoperative care of patients undergoing elective knee or hip arthroplasty found that compared with patients not receiving OMT, those patients receiving OMT negotiated stairs 20% earlier ($P=.006$) and ambulated farther during the first 4 postoperative days ($P=.008$). The OMT group also required less analgesia and had shorter hospital stays, but the differences were not statistically significant.[31] Pomykala et al[32] surveyed 160 medical, postoperative, and obstetric patients who had OMM consultations and found that more than 75% of patients reported that OMT decreased stress and anxiety, improved recovery, and improved overall comfort during their hospital stay. Closer review of the postoperative cases included in the current study could identify specific types of postoperative cases to investigate in future retrospective and prospective studies.

Not all studies have shown beneficial changes with OMT. One study found that a group of hospitalized patients who were treated with OMT after knee or hip arthroplasty had lower functional independence measures ($P=.01$) and greater LOS ($P=.004$) compared with patients who were not treated with OMT.[33] In another study, Noll et al[34] found that an OMT protocol that included thoracic pump with activation worsened air trapping in stable COPD patients for 30 minutes immediately after treatment compared with participants in a sham control group. The use of OMT on hospitalized patients with acute exacerbation of COPD has not been studied but could be investigated using the data collected from the current study.

The top 5 types of OMT used in the OMM hospital consultations reviewed in the current study were myofascial release, balanced ligamentous tension, muscle energy, soft tissue, and inhibition techniques. Langenau et al[35] found the top 5 types of OMT used on the Comprehensive Osteopathic Medical Licensing Examination-USA Level 2-Performance Evaluation were myofascial release/soft tissue, muscle energy, sinus drainage, inhibition, and fascial release techniques. Although the students were choosing OMT for outpatient clinical scenarios, the most common types of OMT used by the students were very similar to those used in the current study. Several studies[2,14,36,37] have demonstrated that the use of OMT declines as osteopathic medical students progress through school and postgraduate training. This observed similarity of techniques suggests that osteopathic medical students are familiar with the types of techniques used by NMM/OMM specialists to treat hospitalized patients; therefore, the decline in the use of OMT is unlikely a result of lack of knowledge of appropriate techniques.

In the current study, a resident physician participated in the OMM care of the patient in 62% of cases. Although residents were primarily from the NMM/OMM specialty, residents from other specialties that were rotating through the OMM department of the Gutensohn Clinical Associates also participated in the OMM care of patients. Residents of NMM/OMM programs are required to participate in inpatient OMM consultations during their training, and residents are expected to provide specialty-level OMM care under the direct supervision of a physician who is board certified in NMM/OMM or who has a Certification

of Special Proficiency in OMM.[38,39] Four types of NMM/OMM residency programs are currently approved: traditional NMM/OMM, integrated Family Practice/NMM, integrated internal medicine NMM, and NMM plus one residency programs.[40] As of 2013, there were 37 programs[40] for training in specialty-level OMM. Therefore, despite the overall decline in the use of OMT in the hospital setting, these residencies ensure that a subset of osteopathic physicians is trained to use OMM in the care of hospitalized patients.

During the current study, CPT initial inpatient consultation codes 99251 through 99255 were used to bill for inpatient evaluation and management consultation services in the inpatient acute care facility, the inpatient acute rehabilitation facility, and the SNF. As of January 1, 2010, these codes could no longer be used for Medicare patients and were replaced with CPT initial inpatient evaluation and management codes 99221 through 99223 for inpatient acute care and acute rehabilitation facilities and with CPT initial SNF evaluation and management codes 99304 through 99306 for SNFs.[41,42] Future retrospective studies using the current study design will have to account for the changes in consultation billing codes.

The current study has several limitations. One limitation is the variability in the language used to describe OMT. For example, inhibition is a type of soft tissue technique.[1] Many participating physicians recorded inhibition technique separately from soft tissue techniques. However, some physicians may have performed inhibition technique but recorded it as soft tissue technique. Thus, the frequency of usage of inhibition technique may be underreported. Another limitation is that the results of the current study were intended to provide insights into specialty-level inpatient OMM consultations, but at least 3 other physicians not affiliated with the OMM consultation service intermittently provided inpatient OMM consultations during the study. Finally, the NRMC participated in the MOPSE study from March 2004 until April 2007. During that time, 143 pneumonia patients were enrolled in the study and ineligible for OMM consultations.[12] Given that adjunctive treatment for pneumonia was one of the most common reasons for an OMM consultation, the MOPSE study may have had an effect on the total number of consultations ordered and the reasons for ordering the consultations during that time. Despite these limitations, we believe the current study is representative of details for most OMM consultations at the NRMC. Further, OMM was provided by many attending physicians without the need of an OMM consultation; therefore, the results of this study may not be representative of all OMM provided in all the inpatient acute facilities.

Conclusion

The current study identified common admission, discharge, and consultation diagnoses associated with OMM consultations that represent new areas for inpatient OMM studies. These new areas include newborn cranial asymmetry, infant feeding disorders, COPD, hypertension, diabetes mellitus, and postoperative complications. The data from the current study can be used for case-control studies to determine if an OMM consultation has an effect on hospital LOS, morbidity, and mortality. These case-control studies can then be used as preliminary data to obtain extramural funding for prospective research studies. The first case-control retrospective study using the cases identified in the current study is in progress, assessing the application of OMM on postthoracotomy patients.

Acknowledgments

We thank Deborah Goggin, MA, from Research Support at A.T. Still University for her editorial assistance and Laura Snelling from Research Support at A.T. Still University for her assistance with medical record reviews and data entry.

(continued)

References

1. Educational Council on Osteopathic Principles. *Glossary of Osteopathic Terminology.* Chevy Chase, MD: American Association of Colleges of Osteopathic Medicine; 2011. http://www.aacom.org/resources/bookstore/Documents/GOT2011ed.pdf. Accessed September 7, 2012.
2. Richardson ME. Tracing the decline of OMT in patient care. *J Am Osteopath Assoc.* 2006;106(7):378-379.
3. Healthcare Facilities Accreditation Program. *Accreditation Requirements for Healthcare Facilities.* Chicago, IL: Health Facilities Accreditation Program; 2012.
4. Healthcare Facilities Accreditation Program. Acute care hospitals. Healthcare Facilities Accreditation Program website. http://www.hfap.org/AccreditedFacilities/index.aspx?FacilityType=HOSPN. Accessed August 30, 2013.
5. Henshaw RE. Manipulation and postoperative pulmonary complications. *The DO.* 1963;4(1):132-133.
6. Larson NJ. Manipulative care before and after surgery. *Osteopath Med.* 1977;2(1):41-49.
7. Noll DR, Shores JH, Gamber RG, Herron KM, Swift J Jr. Benefits of osteopathic manipulative treatment for hospitalized elderly patients with pneumonia. *J Am Osteopath Assoc.* 2000;100(12):776-782.
8. O-Yurvati AH, Carnes MS, Clearfield MB, Stoll ST, McConathy WJ. Hemodynamic effects of osteopathic manipulative treatment immediately after coronary artery bypass graft surgery. *J Am Osteopath Assoc.* 2005;105(10):475-481.
9. Radjieski JM, Lumley MA, Cantieri MS. Effect of osteopathic manipulative treatment of length of stay for pancreatitis: a randomized pilot study. *J Am Osteopath Assoc.* 1998;98(5):264-272.
10. Sleszynski SL, Kelso AF. Comparison of thoracic manipulation with incentive spirometry in preventing postoperative atelectasis. *J Am Osteopath Assoc.* 1993;93(8):834-838, 843-835.
11. Stiles EG. Osteopathic treatment of surgical patients. *Osteopath Med.* 1976;1(3):21-23.
12. Noll DR, Degenhardt BF, Morley TF, et al. Efficacy of osteopathic manipulation as an adjunctive treatment for hospitalized patients with pneumonia: a randomized controlled trial. *Osteopath Med Prim Care.* 2010;4:2. doi:0.1186/1750-4732-4-2.
13. Aguwa MI, Liechty DK. Professional identification and affiliation of the 1992 graduate class of the colleges of osteopathic medicine. *J Am Osteopath Assoc.* 1999;99(8):408-420.
14. Fry LJ. Preliminary findings on the use of osteopathic manipulative treatment by osteopathic physicians. *J Am Osteopath Assoc.* 1996;96(2):91-96.
15. Johnson SM, Kurtz ME, Kurtz JC. Variables influencing the use of osteopathic manipulative treatment in family practice. *J Am Osteopath Assoc.* 1997;97(2):80-87.
16. Shubrook JH. The current state of osteopathic manipulative treatment in the hospital setting. *Osteopathic Family Physician News.* 2006;6(10):1,12-13.
17. Stiles EG. Osteopathic manipulation in a hospital environment. *J Am Osteopath Assoc.* 1976;76(4):243-258.
18. Gabbert W, Kachur KH, Whitehead T, eds. *2012 Current Procedural Coding Expert.* Salt Lake City, UT: Ingenix; 2011:252-253.
19. Hart AC, Stegman MS, Ford B, eds. *ICD-9-CM 2012 Expert for Physicians: Volumes 1 & 2.* Salt Lake City, UT: Ingenix; 2011:132-133.
20. Agency for Healthcare Research and Quality. *HCUP Facts and Figures: Statistics on Hospital-Based Care in the United States, 2008.* Rockville, MD: Agency for Healthcare Research and Quality; 2010. http://www.hcup-us.ahrq.gov/reports/factsandfigures/2008/pdfs/FF_report_2008.pdf. Accessed September 7, 2012.
21. Grabowski DC; US Department of Health and Human Services. *Post-Acute and Long-Term Care: A Primer on Services, Expenditures and Payment Methods.* Washington, DC: US Dept of Health and Human Services; 2010. http://aspe.hhs.gov/daltcp/reports/2010/paltc.htm. Accessed September 7, 2012.
22. Howden LM, Meyer JA. Age and sex composition: 2010. 2010 Census Briefs. Publication C2010BR-03. US Census Bureau website. http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf. Published May 2011. Accessed September 7, 2012.
23. Missouri Department of Health and Senior Services. Inpatient hospitalization for Missouri residents: three-year moving average rates. Missouri Department of Health and Senior Services website. http://health.mo.gov/data/mica/ASPsHospitalization/Maindowna.php?cnty=929. Accessed September 7, 2012.
24. US Department of Health and Human Services; Centers for Medicare & Medicaid Services. CMS manual system: Pub. 100-04 Medicare claims processing. Centers for Medicare & Medicaid Services website. http://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/downloads/R126CP.pdf. Published March 26, 2004. Accessed September 7, 2012.
25. Kotzampaltiris PV, Chou KJ, Wall SP, Crain EF. The cranial rhythmic impulse and excessive crying of infancy. *J Altern Complement Med.* 2009;15(4):341-345. doi:10.1089/acm.2008.0579.
26. Guthrie RA, Martin RH. Effect of pressure applied to the upper thoracic (placebo) versus lumbar areas (osteopathic manipulative treatment) for inhibition of lumbar myalgia during labor. *J Am Osteopath Assoc.* 1982;82(4):247-251.
27. Goldstein FJ, Jeck S, Nicholas AS, Berman MJ, Lerario M. Preoperative intravenous morphine sulfate with postoperative osteopathic manipulative treatment reduces patient analgesic use after total abdominal hysterectomy. *J Am Osteopath Assoc.* 2005;105(6):273-279.
28. Herman EP. Postoperative adynamic ileus: its prevention and treatment by osteopathic manipulation. *The DO.* 1965;(6):163-164.
29. Crow WT, Gorodinsky L. Does osteopathic manipulative treatment (OMT) improves outcomes in patients who develop postoperative ileus: a retrospective chart review. *Int J Osteopath Med.* 2009;12(1):32-37.

30. Le Blanc-Louvry I, Costaglioli B, Boulon C, Leroi AM, Ducrotte P. Does mechanical massage of the abdominal wall after colectomy reduce postoperative pain and shorten the duration of ileus? results of a randomized study. *J Gastrointest Surg*. 2002;6(1):43-49.

31. Jarski RW, Loniewski EG, Williams J, et al. The effectiveness of osteopathic manipulative treatment as complementary therapy following surgery: a prospective, match-controlled outcome study. *Altern Ther Health Med*. 2000;6(5):77-81.

32. Pomykala M, McElhinney B, Beck BL, Carreiro JE. Patient perception of osteopathic manipulative treatment in a hospitalized setting: a survey-based study. *J Am Osteopath Assoc*. 2008;108(11):665-668.

33. Licciardone JC, Stoll ST, Cardarelli KM, Gamber RG, Swift JN Jr, Winn WB. A randomized controlled trial of osteopathic manipulative treatment following knee or hip arthroplasty. *J Am Osteopath Assoc*. 2004;104(5):193-202.

34. Noll DR, Degenhardt BF, Johnson JC, Burt SA. Immediate effects of osteopathic manipulative treatment in elderly patients with chronic obstructive pulmonary disease. *J Am Osteopath Assoc*. 2008;108(5):251-259.

35. Langenau EE, Dowling DJ, Dyer C, Roberts WL. Frequency of specific osteopathic manipulative treatment modalities used by candidates while taking COMLEX-USA Level 2-PE. *J Am Osteopath Assoc*. 2012;112(8):509-513.

36. Draper BB, Johnson JC, Fossum C, Chamberlain NR. Osteopathic medical students' beliefs about osteopathic manipulative treatment at 4 colleges of osteopathic medicine. *J Am Osteopath Assoc*. 2011;111(11):615-630.

37. Shubrook JH Jr, Dooley J. Effects of a structured curriculum in osteopathic manipulative treatment (OMT) on osteopathic structural examinations and use of OMT for hospitalized patients. *J Am Osteopath Assoc*. 2000;100(9):554-558.

38. American Osteopathic Association; American Academy of Osteopathy. *Site Visit Manual and Workbook for Osteopathic Neuromusculoskeletal Medicine and Osteopathic Manipulative Medicine Residency Training Programs: Neuromusculoskeletal Medicine and Osteopathic Manipulative Medicine (NMM/OMM)*. Chicago, IL: American Osteopathic Association; 2008. http://www.osteopathic.org/inside-aoa/accreditation/postdoctoral-training-approval/postdoctoral-training-standards/Documents/site-manual-for-osteopathic-neuromusculoskeletal-medicine.pdf. Accessed September 7, 2012.

39. American Osteopathic Association, American Academy of Osteopathy. *Basic Standards for "Plus One" Residency Training in Neuromusculoskeletal Medicine and Osteopathic Manipulative Medicine*. Chicago, IL: American Osteopathic Association; 2011. http://www.osteopathic.org/inside-aoa/accreditation/postdoctoral-training-approval/postdoctoral-training-standards/Documents/basic-standards-for-plus-one-residency-training-in-neuromusculoskeletal-medicine.pdf. Accessed September 7, 2012.

40. American Academy of Osteopathy residency training programs. American Academy of Osteopathy website. http://files.academyofosteopathy.org/files/AAO-ResidencyPrograms.pdf. Accessed September 8, 2013.

41. Centers for Medicare & Medicaid Services. Revisions to consultation services payment policy - JA6740. Centers for Medicare & Medicaid Services website. http://www.cms.gov/Medicare/Medicare-Contracting/ContractorLearningResources/Downloads/JA6740.pdf. Accessed September 7, 2012.

42. US Department of Health and Human Services; Centers for Medicare & Medicaid Services. Clarification of evaluation and management payment policy. Centers for Medicare & Medicaid Services website. http://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/downloads/R2282CP.pdf. Accessed September 7, 2012.