

## Chiropractic: A Profession at the Crossroads of Mainstream and Alternative Medicine

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Chiropractic is a large and well-established health care profession in the United States. In this overview, we briefly examine the development of chiropractic from humble and contentious beginnings to its current state at the crossroads of alternative and mainstream medicine. Chiropractic has taken on many of the attributes of an established profession, improving its educational and licensing systems and substantially increasing its market share in the past two decades. The public increasingly uses chiropractic largely for spinal pain syndromes and appears to be highly satisfied with the results. Of all the so-called alternative professions, chiropractic has made the largest inroads into private and public health care financing systems and is increasingly viewed as an effective specialty by many in the medical profession. Much of the positive evolution of chiropractic can be as-

cribed to a quarter century-long research effort focused on the core chiropractic procedure of spinal manipulation. This effort has helped bring spinal manipulation out of the investigational category to become one of the most studied forms of conservative treatment for spinal pain. Chiropractic theory is still controversial, but recent expansion in federal support of chiropractic research bodes well for further scientific development. The medical establishment has not yet fully accepted chiropractic as a mainstream form of care. The next decade should determine whether chiropractic maintains the trappings of an alternative health care profession or becomes fully integrated into all health care systems.

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Chiropractic is the largest, most regulated, and best recognized of the professions that have traditionally functioned outside of mainstream medical institutions and, in the new lexicon, have fallen into the category of "complementary and alternative medicine." It is unique in the United States as the most widely disseminated indigenous U.S. system of healing. Its steadily increasing acceptance and use by the public and payers indicate that chiropractic is no longer the "marginal" or "deviant" profession it was once considered to be (1). According to surveys of patients seeking alternative care, chiropractors are used more often than any other alternative provider group (2), and the satisfaction with chiropractic care is very high (3, 4). The number of chiropractors is growing: The current number of 60 000 is expected to reach 100 000 by 2010 (5).

Although some observers suggest that the profession may be entering the health care mainstream (6, 7), chiropractic remains a young profession; in 1995, it celebrated its 100th anniversary. Until the mid-1970s, chiropractic was considered to be outside mainstream medicine, often an outcast, and most chiropractors viewed themselves as differing in philosophy and practice from other health care practitioners (8). During the past two decades, there has been a marked change in the manner in which chiropractic is viewed, not only by mainstream medical practitioners (9) and institutions

(10, 11) but also by members of the profession itself (12). Examining the factors that led to this change in attitude and the legitimization of chiropractic as a method of treatment and as a profession, as well as the conflicting emotional discussion that has accompanied these changes, is an interesting and informative exercise in health care sociology (13). The changes in the chiropractic (and medical) profession are, however, still in the transitional phase, and the acceptance and even the future role of chiropractic in the overall health care system remain controversial (14, 15).

### THE ORIGINS AND HISTORY OF CHIROPRACTIC

Chiropractors have designated 18 September 1895, when Daniel David Palmer reportedly gave his first spinal adjustment, as the origin of the chiropractic profession; however, spinal manipulation is one of the oldest and most widely practiced healing methods. References to spinal manipulation, and even the term *subluxation*, can be traced back as far as Hippocrates and Galen (16), and manual and manipulative procedures have been depicted in the art and writings of most ancient cultures. Although manipulation has been part of orthopedic medical practice for centuries, most nonmedical practitioners of spinal manipulation in the 19th century were

“bonesetters” who had learned their skills primarily by apprenticeship and observation (17).

The early and middle years of chiropractic were dominated by charismatic and authoritarian figures who often disagreed with one another. Many of the early schisms around the theory and scope of practice from this period still exist in some form (9, 17). Daniel David Palmer, who originally practiced as a lay magnetic healer, is credited with professionalizing the practice of spinal manipulation. He integrated popular natural health and scientific models of the day to present a unique theory of chiropractic. He did this by incorporating the concept of an inherent healing ability of the body, which he named “innate intelligence,” into concepts drawn from contemporary knowledge about anatomy and physiology. He eschewed the use of drugs and surgery as unnatural invasions to the body and focused on what he perceived as normalizing the function of the nervous system as the key to health (17).

From the beginning, chiropractors understood that professional self-regulation and independent legal status were crucial to survival. This stormy history of the first century of chiropractic includes many milestones on the march to professionalization, some of which are listed in **Table 1**. Although chiropractic originated in the United States (the primary training ground and theoretical inspirational source for chiropractors), it took less than 10 years for chiropractors to immigrate and begin practice in other countries. In 1923, the province of Alberta in Canada became the first jurisdiction to license chiropractic outside of the United States; in 1939, the canton of Zürich in Switzerland was the first to license the profession outside of North America. Today, chiropractors are licensed and regulated in many countries throughout the world (18) and are permitted to practice in most countries, pursuant to general law.

### CHIROPRACTIC IN HEALTH CARE

One indicator of chiropractic mainstreaming is the steadily increasing use by patients in the United States, which has tripled in the past two decades from about 3.6% according to a 1980 survey (19) to an estimated 11% according to a 1997 national random telephone survey (2). This translates to an estimated 190 million patient visits to chiropractors in a year, or about 30% of visits to all complementary and alternative practitioners (2). One

**Table 1. Events in the Historical Development of Chiropractic**

Year	Historical Milestones
1905	Minnesota is the first state to license chiropractic as an independent profession.
1922	California recognizes and licenses chiropractors.
1933	The U.S. Council of State Chiropractic Examiners is established with a mandate to provide unified standards for licensure. It is now the Federation of Chiropractic Licensing Boards.
1944	The Foundation for Chiropractic Education and Research is established and remains the profession's foremost agency for funding postgraduate training and research.
1963	The National Board of Chiropractic Examiners is established to create standardized examinations and promote consistency and reciprocity between state examining boards.
1974	Louisiana is the last state to grant licensure to chiropractors.
1974	The U.S. Council on Chiropractic Education is recognized by the U.S. Department of Education as the sole accrediting agency for schools of chiropractic.
1975	The U.S. National Institute of Neurological Diseases and Stroke convenes a multidisciplinary conference to examine the research status of “spinal manipulative therapy.”
1976	<i>Journal of Manipulative and Physiological Therapeutics</i> is founded as a scientific peer-reviewed chiropractic journal and is indexed by the National Library of Medicine.
1987	The U.S. Supreme Court upholds a lower-court decision that finds the American Medical Association guilty of antitrust violations in its attempt to eliminate the chiropractic profession.
1994	The U.S. Agency for Health Care Policy and Research convenes an evidence-based consensus panel that rates spinal manipulation as an effective treatment for back pain.
1997	The Consortial Center for Chiropractic Research is established by a grant from the U.S. National Institutes of Health.

recent survey of family physicians and chiropractors in North Carolina (20) found that two thirds of the medical physicians felt “moderately” or “very” informed about chiropractic. Furthermore, 65% admitted referring patients to chiropractors, and 98% of chiropractors made routine referrals to physicians.

Payments for chiropractic care historically came directly from patients' pockets until chiropractic services were included in Medicare in the 1970s. In the past few decades, chiropractic has been included in a substantial proportion of private and public insurance plans, all state workers-compensation systems, and all forms of managed care (including health maintenance organizations). More than 50% of health maintenance organizations and more than 75% of private health insurance plans now offer chiropractic services (21). Under order of the U.S. Congress, the military health care system has initiated a series of demonstration projects to investigate the feasibility of providing chiropractic care to military personnel.

## CHIROPRACTIC TRAINING AND LICENSURE

From many proprietary schools hastily established during the first part of the 20th century, a stable number of chiropractic training institutions have emerged in the United States. Unlike in the United States, where all but one college are privately funded, chiropractic education in Australia, South Africa, Denmark, one college in Canada, and two in Great Britain is provided at established government-sponsored universities and colleges. Most colleges in the United States are accredited by the Council on Chiropractic Education, an agency certified by the U.S. Department of Education. Each college requires at least 4 academic years of professional education before students can qualify for licensure examinations. A minimum of 60 units of prescribed college-level courses (increasing to 90 units by 2002), mostly in the sciences, is required before admission to chiropractic college. Approximately 50% of students enter chiropractic training with a baccalaureate degree.

A recent study described U.S. chiropractic curricula as an average of 4820 classroom and clinical hours, with about 30% spent in the basic sciences and 70% in clinical sciences and internship (22). Medical school curricula average about 4670 hours with a similar breakdown. Compared with medical students, chiropractic students spend more hours in anatomy and physiology but fewer in public health. Both programs have similar hours in biochemistry, microbiology, and pathology. Chiropractic curricula provide relatively little instruction in pharmacology, critical care, and surgery but emphasize biomechanics, musculoskeletal function, and manual treatment methods. Medical education has more than twice as many hours in actual clinical experience but 1000 fewer hours in didactic and workshop-like clinical courses. All chiropractic colleges maintain busy training clinics that deliver chiropractic care in settings similar to typical chiropractic practice. Specialty training is available in 2- to 3-year postgraduate residency programs in radiology, orthopedics, neurology, sports, rehabilitation, and pediatrics. Coursework leads to eligibility for accredited specialty board competency examinations, which confer "diplomate" or "certified" status.

Forty-six states either recognize or require passage of examinations administered by the National Board of Chiropractic Examiners in the areas of basic science, clinical science, and clinical competency before granting

a graduate a license to practice. Most states also require annual proof of continuing education credits for ongoing license renewal.

## CHIROPRACTIC HEALTH CARE AND PRACTICE CHARACTERISTICS

Chiropractic is an evolving health profession with functions, values, traditions, and training institutions similar to those of other professions. As envisioned by its founder, chiropractic was to be a revolutionary system of healing based on the premise that neurologic dysfunction caused by "impinged" nerves at the spinal level was the cause of most "dis-ease" and that spinal manipulation (adjustment) removed the interference to a full and healthy expression of life. Modern chiropractic theory and practice have moved away from the original mono-causal theory, and research is gradually redefining the nature of the discipline and its education. Many still think "chiropractic" is synonymous with "spinal manipulation," but as described below, this is only partially accurate. With the advent of the category "complementary and alternative medicine" (CAM), chiropractors themselves are divided about how to define the profession; many do not want to be termed CAM practitioners (23). Chiropractors have many of the attributes of primary care providers and often describe themselves as such (24). Others point out that chiropractic has more of the attributes of a limited medical profession or specialty, akin to dentistry or podiatry (1). This is an ongoing internal and external debate affected by dynamic health industry forces.

### Spinal Manipulation: The Chiropractic Adjustment

The core clinical action that all chiropractors agree upon is spinal manipulation. Chiropractors much prefer the term spinal "adjustment," reflecting their belief in the therapeutic and health-enhancing effect of correcting spinal joint abnormalities. Dozens of adjusting "techniques" exist, and discussions about their relative merits make up much chiropractic academic discourse (25, 26). The procedure in its broadest definition describes application of a load (force) to specific body tissues with therapeutic intent. This load, which has traditionally been delivered by hand, can vary in its velocity, amplitude, duration, and frequency, as well as anatomic location, choice of levers, and direction of force.

Although "spinal manipulation" is traditionally as-

sociated with “chiropractic” (chiropractors deliver >90% of the manipulations in the United States [27]), chiropractors also provide many other treatments and counselling services. Physical therapies such as heat, cold, electrical methods, and rehabilitation methods are common (28, 29). Chiropractors usually suggest therapeutic exercises and general fitness recommendations to most patients, and give advice to many patients about nutrition, vitamins, weight loss, smoking cessation, and relaxation techniques (30). Many chiropractors use other forms of CAM, with emphasis on massage, acupressure, and mineral and herb supplements (23).

### Chiropractic Case Mix

Studies confirm that most patients go to chiropractors for musculoskeletal problems: about 60% with low-back pain, and the remainder with head, neck, and extremity symptoms (28, 31). Approximately one third of all patients who seek professional care for low-back pain consult chiropractors in a primary health care role (32–34). Furthermore, about half of the patients seeking chiropractic care have chronic symptoms (31, 35). Only a small number, typically fewer than 2% to 5%, seek care for other conditions. Recent studies have also documented that a minor proportion of patients visit chiropractors for general health concerns, prevention, and a feeling of well-being; they often receive standard health advice, most often with regard to physical fitness and nutrition (35–37).

### Diagnostic and Assessment Methods

The approach used in chiropractic training and practice for clinical diagnosis is similar to that of all health care disciplines: a history, physical examination, and specialty-specific assessments (25, 38). The Council on Chiropractic Education specifies that these basic clinical competencies must be taught in all accredited institutions, and chiropractors are expected to differentiate mechanical musculoskeletal problems from visceral abnormalities that may present with a similar clinical picture (29). Chiropractic practice guidelines developed by the profession rate history taking, physical examination, and periodic reassessments of progress as “necessary” attributes of good practice (39).

By using job analysis concepts, the National Board of Chiropractic Examiners has provided the most thorough description of chiropractic practice (28). Chiro-

practores rated “extremely important” the knowledge needed to arrive at a diagnosis on the basis of information gathered from a patient’s history and physical, neurologic, and orthopedic examinations. In most states, chiropractors have the statutory right and obligation to render a medical diagnosis, especially within their scope of customary and legal practice. Patients with diagnoses not amenable to chiropractic care are routinely referred (20).

Chiropractors’ use of advanced diagnostic tests is generally low, reflecting the typical nature of the musculoskeletal caseload (29). The main exception is plain-film radiography, which has been traditional in chiropractic ever since its development at the beginning of the 20th century. Much training time is spent on the technique and interpretation of musculoskeletal radiographs (22, 40, 41). In regard to radiographic examination, the job analysis survey indicated that chiropractors “frequently” obtain radiographs for new patients to determine abnormality; they “sometimes” obtain radiographs to determine instability or joint dysfunction; they “frequently” determine the possible site and nature of a manipulable subluxation; they “frequently” perform radiography on a patient whose condition is deteriorating or who is not responding to care; and they “rarely” obtain radiographs to monitor a patient’s progress. Chiropractors consider knowledge of normal radiographic anatomy and of radiographic interpretation and diagnosis to be “extremely important” (28).

Indications for radiography are hotly debated in chiropractic circles, but use appears to be declining over time (42). The use of radiography may also vary substantially by geographic region. A practice-based study comparing chiropractic and physician practices for patients with back pain in Oregon found that 26% of patients of both provider groups had radiography (43). Carey and colleagues (4) found higher rates of use in North Carolina: 67% for chiropractors and 72% for orthopedists. Of note, since the inception of Medicare 30 years ago, chiropractors had been mandated to obtain radiographs in order to be reimbursed for care. Only after persistent legislative activity has this provision finally been changed (44).

### The Chiropractic Clinical Encounter and Patient Perceptions

Chiropractors use the information from the case history and examination to ascertain the patient’s state

of health and to form a diagnostic impression, with additional studies obtained as needed. Focal joint, muscle, and soft tissue examinations are usually performed to determine the potential utility of spinal manipulation and other interventions. These usually include palpation, assessing the range and quality of joint motion, and probing for tenderness and inflammation. On the basis of the findings, the chiropractor chooses a treatment plan and estimates prognosis. Essentially, patients may receive a trial of chiropractic care, be referred for co-management, or be referred to an appropriate specialist. The profession has developed detailed consensus guidelines for quality for most aspects of case management (39), and these are didactically and clinically modeled in accredited chiropractic institutions.

The clinical encounter tends toward a high-touch, low-technology health model with more concern for the person than the disease. Chiropractors believe in the inherent healing ability of the body and communicate the hope of healing to patients. Spinal manipulation and other forms of touching care require that a level of trust develop between the patient and the chiropractor. Repeated visits allow a relationship to flourish that is often used to communicate on a social and psychological level as well as about biological implications of care (45).

One recent essay opined that much of chiropractic's success and perhaps its most important contribution to health care might concern this patient-physician relationship (7). Analyses from anthropologic and sociologic perspectives have suggested that treatment by a chiropractor, especially for many patients with chronic pain, can generate a sense of understanding and meaning, an experience of comfort, an expectation of change, and a feeling of empowerment (46, 47). The hands-on and compassionate "can do" clinical behavior of the typical chiropractor seems to be concrete, reassuring, and immediately satisfying. Observational studies (3, 4) and randomized trials (48) leave little doubt that chiropractic patients are very satisfied with their management.

### CHIROPRACTIC THEORY AND RESEARCH

Throughout the short history of chiropractic, the profession has had the difficult task of justifying a treatment partially rooted in quasi-mystical concepts to a skeptical mainstream medical and scientific community. Confounding this problem has been the fact that pain, especially chronic musculoskeletal pain, remains some-

thing of a scientific enigma (49). A 1975 National Institute of Neurological Diseases and Stroke conference, "Research Status of Spinal Manipulative Therapy," pointed out the lack of any substantial research to justify claims made by chiropractors or any other practitioner of manipulation (50); by doing so the conference galvanized a quarter century-long research effort.

### Focus of Research

Two broad categories of research have been pursued: 1) clinical outcomes in randomized clinical trials and observational studies and 2) basic science efforts attempting to understand the biological mechanisms of spinal manipulation. For this report, we supplemented our own exhaustive reference collections of randomized clinical trials of spinal manipulation with additional searches of MEDLINE, MANTIS, CHIROLARS, and the Cochrane Collaboration Library. We tracked citations and manually searched relevant journals to verify that the list was as complete as possible. We made no attempt to find finished unpublished clinical trials or review non-English-language reports.

To date, at least 73 randomized clinical trials of a broadly defined spinal manipulation procedure can be found in the English-language literature. Most trials have been published in general medical and orthopedic journals (for example, *British Medical Journal*, *Journal of the American Medical Association*, *Spine*). Nineteen papers were published in the chiropractic peer-reviewed literature (for example, *Journal of Manipulative and Physiological Therapeutics*). Most first authors have medical degrees, and 23 papers were written by chiropractors. Authors did not necessarily publish in the literature of their profession. While publication bias cannot be ruled out, there is no evidence of it in this information.

Most of these studies have been conducted on patients with low-back, neck, and head pain, and a few have examined other conditions. The clinical trials include placebo-controlled comparisons, comparisons with other treatments, and pragmatic comparisons of chiropractic management with common medical management (Table 2).

Forty-three randomized trials of spinal manipulation for treatment of acute, subacute, and chronic low-back pain have been published. Thirty favored manipulation over the comparison treatments in at least a subgroup of patients, and the other 13 found no signif-

**Table 2. Results of Randomized, Controlled Trials of Spinal Manipulation**

Condition	Randomized, Controlled Trials, <i>n</i>	Results	References
Acute back pain	10	Positive	51–63
	3	Equivocal	
Subacute and chronic back pain	9	Positive	64–79
	6	Equivocal	
Mixed acute and chronic back pain	10	Positive	48, 80–94
	4	Equivocal	
Sciatica	1	Positive	95
Migraine headache	2	Positive	96–98
	1	Equivocal	
Muscle tension headache	4	Positive	99–103
	1	Equivocal	
Cervicogenic headache	1	Positive	104
Acute, subacute, chronic neck pain	4	Positive	72, 73, 91, 92, 105–113
	7	Equivocal	
Elbow pain	1	Positive	114
Dysmenorrhea	1	Positive	115, 116
	1	Equivocal	
Infantile colic	1	Positive	117
Enuresis	1	Equivocal	118
Asthma	2	Equivocal	119, 120
Premenstrual syndrome	1	Positive	121
Carpal tunnel syndrome	1	Equivocal	122
Hypertension	1	Positive	123, 124
	1	Equivocal	

icant differences. No trial to date has found manipulation to be statistically or clinically less effective than the comparison treatment. Eleven of the low-back pain trials included a placebo group; 8 of them showed an advantage to manipulation (125). Eleven randomized, controlled trials of spinal manipulation for neck pain have been conducted; 4 had positive findings and 7 were equivocal. Seven of 9 randomized trials of manipulation for various forms of headache were positive.

In most of the randomized, controlled trials of manipulation for musculoskeletal pain, the positive effect sizes appear to be clinically and statistically significant but not dramatic, leaving room for various interpretations. Systematic reviews and meta-analyses conducted in the early to mid-1990s made cautiously positive or equivocal statements about the effectiveness of manipulation for low-back pain, neck pain, and headache, and called for higher-quality studies (27, 125–129).

Using formal consensus processes, in 1995 the Quebec Task Force on Whiplash-Associated Disorders concluded that spinal manipulation had at least “weak cumulative evidence,” and recommended that a short regimen of spinal manipulation may be used as a therapeutic trial for neck pain (130). In 1994, the U.S. Agency for Health Care Policy and Research similarly

concluded that spinal manipulation was safe and effective for acute low-back pain, with a strength of evidence level of “B.” This agency reviewed all clinical trials available at the time and found no other treatment to have stronger evidence, although nonsteroidal anti-inflammatory drugs received the same “B” rating (131).

A 1997 systematic review of manipulation for low-back pain concluded (132), in contrast to previous opinions (27, 128, 131), that evidence was sufficient to recommend manipulation for chronic back pain but that the evidence for acute back pain was weak. The most recent systematic review (133) used a slightly different method of analysis, taking into account study design, quality, and strength of evidence; these authors concluded that there was moderately strong evidence of a short-term benefit of manipulation for both acute and chronic back pain. They found insufficient evidence for or against the effectiveness of manipulation for sciatica. However, a recent trial found that manipulation for patients with sciatica related to disc herniation was better than chemonucleolysis in the short term and equivalent to that therapy at 12 months (95). A recent quantitative review found only equivocal evidence for the benefit of traction, exercise, and drug therapies for sciatica (134).

The heterogeneity of patients with spinal pain, the

**Table 3. Proposed Mechanisms of Spinal Manipulation**

Action	Mechanism (Reference)
Mechanical/anatomic	Alleviation of an entrapped facet joint inclusion or meniscoid that has been shown to be heavily innervated (138, 139)
Mechanical/anatomic	Repositioning of a fragment of posterior annular material from the intervertebral disc (139, 140)
Mechanical/anatomic	Alleviation of stiffness induced by fibrotic tissue from previous injury or degenerative changes that may include adaptive shortening of fascial tissue (141, 142)
Neurologic/mechanical	Inhibition of excessive reflex activity in the intrinsic spinal musculature or limbs and/or facilitation of inhibited muscle activity (143–145)
Neurologic/mechanical	Reduction of compressive or irritative insults to neural tissues (146)

lack of definitive diagnoses, and the indications in some trials that subgroups of patients appear to respond better to manipulation than others have further highlighted the need to understand the underlying physiologic and psychological mechanisms of pain and disability. The design of rigorous clinical experiments of treatment efficacy for approaches that include strong physician–patient interactions and “hands-on” therapy has been challenging, posing the question of a strong psychological effect of chiropractic treatment. Surprisingly, spinal manipulation is one of the most studied treatments for back pain (56, 132). All manipulation trials, however, have had to contend with design and execution weaknesses that need to be addressed in future studies.

The treatment of disorders not directly related to the musculoskeletal system by manipulation has been supported mainly by clinical experience and case reports. In the past few years, randomized clinical trials for primary dysmenorrhea (115, 116), hypertension (123, 124), chronic asthma (119, 120), enuresis (118), infantile colic (117), and premenstrual syndrome (121) have been completed, with variable results. Two systematic reviews, one on extant trials at the time (135) and a recent one on asthma sponsored by the Cochrane Collaboration (136), concluded that the results do not argue convincingly for or against the utility of spinal manipulation for these kinds of conditions.

### Biological Rationale

Chiropractors direct spinal manipulation to a dysfunctional joint “lesion” known as a subluxation. This is

characterized as a form of joint strain or sprain with clinically associated hypomobility, malalignment, local and referred pain, inflammation, and muscle tension (137). Subluxation in the chiropractic context primarily connotes a functional and not necessarily an anatomic entity. At least five mechanical and neurologic mechanisms have been proposed (Table 3).

Chiropractic theory has held that subluxation and manipulation can have important physiologic effects: increased range of joint motion (147, 148), changes in facet joint kinematics (149), increased pain tolerance (150), increased muscle strength (151), attenuation of  $\alpha$ -motoneuron activity (152), enhanced proprioceptive behavior (153), and changes in  $\beta$ -endorphins (154) and substance P (155). A biomechanical picture of manipulation is beginning to emerge from studies on the forces involved and the resultant kinetics and kinematics (156, 157).

### Risks of Spinal Adjustments and Manipulations

The topic of complications from spinal manipulation has been controversial (126, 158, 159). Nonserious side effects of manipulation may consist of localized discomfort, headache, or fatigue that resolves within 24 to 48 hours (160). The more serious reported complications are the cauda equina syndrome from lumbar manipulation and cerebrovascular artery dissection from cervical manipulation. The apparent rarity of these accidental events has made it difficult to assess the magnitude of the complication risk. No serious complication has been noted in more than 73 controlled clinical trials or in any prospectively evaluated case series to date.

Serious complications from lumbar spinal manipulation are extremely rare, estimated to be 1 case per 100 million manipulations (27). For cervical manipulation, the risk for a cerebrovascular accident has been calculated by various authors to range from 1 in 400 000 (161) to between 3 and 6 per 10 million manipulations (126). The figures have been primarily based on retrospectively collected single case reports (126, 158) and unsubstantiated practitioner surveys (161, 162). One retrospective cohort study examined the incidence of cerebrovascular accidents after manipulation (163). It covered the experience of 99% of the practicing chiropractors in Denmark from 1978 to 1988. During this 10-year period, five cases and one death were identified,

representing approximately one serious complication for every 1 million cervical manipulations. Unfortunately, there do not appear to be any specific risk factors for vertebrobasilar artery dissection after manipulation, and the cases might represent idiosyncratic events or the aggravation of arterial dissections in progress (159).

## THE FUTURE

Significant challenges for conducting high-quality studies in the chiropractic profession continue to exist, but this is changing. The U.S. Health Resources and Services Administration's Chiropractic Demonstration Program was the first federal effort to facilitate collaborative research between chiropractic and medical institutions in 1994, and it continues to sponsor annual conferences designed to set research agenda (164). In 1997, the National Center for Complementary and Alternative Medicine initiated a research center, the Consortial Center for Chiropractic Research, at Palmer College of Chiropractic in Davenport, Iowa. It represents a collaboration of six chiropractic colleges and four state-supported universities.

Chiropractic has survived, and it has begun to embrace the values and behaviors of a mainstream health profession. In the past few decades, chiropractic has strengthened its educational system; initiated research that has validated spinal manipulation; increased its market share of satisfied patients; initiated collaborations with other disciplines in practice, research, and professional settings; and effectively used political, legislative, and legal measures to secure a role. Nevertheless, significant attitudinal and structural barriers to mainstream status still hinder chiropractic, and the advances of recent years may not be enough to ensure continuing progress in this direction.

Chiropractic still maintains some vestiges of an alternative health care profession in image, attitude, and practice. The profession has not resolved questions of professional and social identity, and it has not come to a consensus on the implications of integration into mainstream health care delivery systems and processes. In today's dynamic health care milieu, chiropractic stands at the crossroads of mainstream and alternative medicine. Its future role will probably be determined by its commitment to interdisciplinary cooperation and science-based practice.

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