**Objective:** To describe the practice characteristics and pediatric care of chiropractors.

**Study Design:** Cross-sectional, descriptive survey.

**Setting:** Chiropractic practices in the Boston, Mass, metropolitan area.

**Participants:** One hundred fifty licensed chiropractors.

**Main Outcome Measures:** Demographics, practice characteristics, and fee structure. Practitioners were also asked about their approach to childhood immunizations and a clinical scenario. Data were analyzed using simple descriptive statistics.

**Results:** Ninety (60%) chiropractors responded. All were white and 65% were men. Respondents had on average 122 patient visits weekly, of which 13 (11%) were from children and adolescents. Typical visit frequency ranged from 1 to 3 times weekly. Average visit fees were $82 and $38 (initial and follow-up) and 49% of the fees were covered by insurance. Seventy percent of the respondents recommended herbs and dietary supplements. For pediatric care, 30% reported actively recommending childhood immunizations; presented with a hypothetical 2-week-old neonate with a fever, 17% would treat the patient themselves rather than immediately refer the patient to a doctor of medicine, doctor of osteopathy, or an emergency facility.

**Conclusions:** Children and adolescents constitute a substantial number of patients in chiropractics. An estimated 420,000 pediatric chiropractic visits were made in the Boston metropolitan area in 1998, costing approximately $14 million. Pediatric chiropractic care is often inconsistent with recommended medical guidelines. National studies are needed to assess the safety, efficacy, and cost of chiropractic care for children.

"Chiropractic Care for Children"

Anne CC Lee, BSE; Dawn H. Li, MD; Kathi J. Kemper, MD, MPH

From the Harvard Medical School, Boston, Mass (Ms Lee and Dr Kemper); Columbia Medical School, New York, NY (Dr Li); and Children’s Hospital, Boston (Dr Kemper).

In 1997, patients in the United States visited more practitioners of complementary and alternative medicine (CAM) than all US primary care physicians. Doctors of chiropractic (DCs) are the most frequently consulted CAM providers and are licensed in all 50 states. Chiropractic care is reimbursed by Medicare, and 45 of 50 states mandate that major insurers provide chiropractic benefits. An estimated 11% to 16% of Americans visited DCs in 1997. There are more than 50,000 licensed DCs in the United States, and the number is expected to double by 2010. For many families in the United States, chiropractic care is no longer an alternative, but an integral part of regular health care, both for health promotion and the treatment of common diseases.

Family chiropractic care (including patients ranging from neonates to the elderly) became widespread in the early 1990s, as DCs began to hold community screenings and offer chiropractic workshops at public schools. The concept of pediatric chiropractic care gained increasing popularity through national campaigns aimed at “drawing more children and infants into practices for basic health care.” Advertisements flourished in major national newspapers. Organizations such as the International Chiropractors Association (ICA), Arlington, Va, introduced workshops on pediatric chiropractic care. Several chiropractic colleges incorporated pediatric courses into their curriculum and offered postgraduate seminars to educate DCs in pediatric care.
SUBJECTS AND METHODS

SAMPLE

We performed a cross-sectional survey of DCs in the greater Boston metropolitan area (Boston Primary Metropolitan Statistical Area, as defined by the National Census Bureau) from July to November 1998. Six data sources were used to identify DCs for the study: the greater Boston area yellow pages, the Commonwealth of Massachusetts Board of Registration in Medicine (Boston), the ICA membership list, ACA practitioner referral list, International Chiropractic Pediatric Association (Stone Mountain, Ga), and the Council on Chiropractic Pediatrics (Arlington). The Figure depicts the number of providers identified from the aforementioned sources.

Of the 658 Boston DCs listed in these sources, we selected 160 chiropractic practices. To focus on those DCs most likely to treat children, all DCs belonging to pediatric societies (n = 20) and all practices with the name “family” (n = 40) were selected. We excluded practices with the words “pain,” “back,” and “injury” in their practice name (n = 13). The remaining DCs (n = 100) were chosen by computer randomization from society, licensing board, and greater Boston area yellow pages listings.

The survey was pilot-tested by telephone on 20 DCs. Minor revisions were made, and the remaining 140 chiropractic practices were mailed surveys in July 1998. Six weeks after the initial mailing, nonrespondents were called for follow-up; 10 weeks after the initial mailing, nonrespondents received second surveys.

Of the initial 160 chiropractic practices surveyed, 10 addresses were nondeliverable, yielding a final sample size of 150. Ninety DCs completed the survey for a response rate of 60%. We attempted to reach all nonrespondents by telephone; reasons for nonresponse included lack of interest in the study, little experience with children, and being “too busy.”

SURVEY CONTENT

The survey was based on questions from the National Ambulatory Medical Care Survey from the National Center for Health Statistics (Hyattsville, Md) and was developed in collaboration with a licensed DC. The survey was 4 pages long and required approximately 15 minutes to complete.

Considerable numbers of children and adolescents seek chiropractic care. Children made an estimated 20 million visits to DCs in 1993.10 According to a 1994 survey,11 DCs were the alternative practitioners most often consulted by pediatric patients. Although most adults (85%) consult DCs for musculoskeletal conditions, children frequently visit DCs for respiratory problems, ear, nose, and throat problems, and general preventive care.11,12 Common pediatric conditions treated by DCs include otitis media, asthma, allergies, infantile colic, and enuresis. However, randomized controlled clinical trials of chiropractic care for pediatric conditions are rare. One of the first such trials reported that chiropractic care offered no significant benefits for pediatric patients with asthma.13

A complex and historical schism exists within the chiropractic profession—the opposing groups being the “straights” and the “mixers.”3,14 The straights rely primarily on chiropractic adjustments to promote health.3,14 They believe that vertebral subluxations disrupt spinal nerves and can lead to a wide array of functional problems, and that chiropractic care corrects subluxations, maximizes the body’s self-healing capabilities, and is vital to optimum health.3 The straights are well represented in the ICA, which is a small but vocal organization (comprising 5% to 10% of all DCs in the United States) known for its promotion of pediatric chiropractic care and opposition to mandatory immunizations. In contrast, the mixers use a broader range of diagnostic tools and therapies, such as laboratory tests, advanced imag-
We sought to describe chiropractic care in our metropolitan area for (1) practice patterns, including visit length, frequency, fees, and insurance reimbursement; (2) pediatric care, including training, techniques, specialization, and clinical judgment; and (3) peer recommendation of pediatric providers.

## RESULTS

### DEMOGRAPHICS AND TRAINING

All 90 respondents were white and 65% were men. The mean (± SD) age of the respondents was 40 (±7) years. In addition to a DC, 88% held a college degree (BA or BS), 4% held a master's degree, and 2% had obtained a diplomate degree in pediatric chiropractics (1000 hours of supervised training). On average, the respondents were graduated in 1986 and were licensed in Massachusetts in 1987.

Forty-one percent of respondents were members of the ACA and 22% belonged to the ICA. Few (4%) reported membership in both national associations (ACA and ICA). Among our respondents, members of pediatric associations (the International Chiropractic Pediatric Association and ICA Council on Pediatrics) were primarily ICA members (70%).

### SCOPE OF PRACTICE

Doctors of chiropractic reported performing various diagnostic tests: neurologic examination (77%); radiographic examination (59%); orthopedic examination (22%); and laboratory tests (8%). Respondents reported performing radiographic examinations for an average 55% of their patients. The main therapeutic technique used was the spinal adjustment (89%). More than 100 manual techniques are used by DCs. Techniques used by respondents were diversified (62%), activator (40%), and sacro-occipital (37%). Definitions of these techniques are as follows:

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**Table 1. Practice Characteristics of DCs**

<table>
<thead>
<tr>
<th>Type of practice</th>
<th>54% Group; 46% solo</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patient visits per week</td>
<td>122 (±73)†</td>
</tr>
<tr>
<td>Visit length, min</td>
<td></td>
</tr>
<tr>
<td>Initial</td>
<td>52 (±15)†</td>
</tr>
<tr>
<td>Follow-up</td>
<td>19 (±6)†</td>
</tr>
<tr>
<td>Fees, $</td>
<td></td>
</tr>
<tr>
<td>Initial visit</td>
<td>82 (±40)†</td>
</tr>
<tr>
<td>Follow-up visit</td>
<td>38 (±9)†</td>
</tr>
<tr>
<td>Chiropractic fees covered by insurance, %</td>
<td>49 (±32); 0-90; 55; 0</td>
</tr>
<tr>
<td>DCs with sliding scale fees, %</td>
<td>42</td>
</tr>
<tr>
<td>DCs accepting Medicaid, %</td>
<td>47</td>
</tr>
</tbody>
</table>

*DCs indicates doctors of chiropractic.
†Mean (±SD).
‡Range.
§Median.
||Mode.

---

Mixers are generally well represented in the American Chiropractic Association (ACA), Arlington, which holds the highest national membership (25%).

With the growing number of DCs targeting pediatric populations, it is possible that families will ask pediatricians about chiropractic care and referring and coordinating patient services with DCs. To respond in a knowledgeable manner, pediatricians must have basic information about the practices and pediatric care of DCs. We sought to describe chiropractic care in our metropolitan area for (1) practice patterns, including visit length, frequency, fees, and insurance reimbursement; (2) pediatric care, including training, techniques, specialization, and clinical judgment; and (3) peer recommendation of pediatric providers.

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1. The diversified technique: one of the most frequently taught adjusting techniques that draws on several different sources. It is not based on a specific analytic system, but uses the normal biomechanics of a joint to create motion.  

2. The activator technique: a technique that uses an “activator adjusting instrument” that produces a light discrete torque when triggered.  

3. The sacrooccipital technique: a technique based on the mechanical relationship between the cranium and pelvis. Padded “blocks” are placed under the patient’s pelvis while the patient is prone or supine; gravity affects the mechanical relationship between sacrum and innominate. Upper trapezius muscles are evaluated for occipital fiber tone.  

Seventy percent of respondents reported recommending herbal remedies or dietary supplements, and half dispensed them in their own office.  

PEDIATRICS

In 1998, children and adolescents constituted 11% of patient visits to DCs. On average, respondents had been treating pediatric patients for 12 years. Two thirds of the respondents reported training in pediatric medicine. Pediatric training included pediatric courses in chiropractic colleges, postgraduate elective courses, or national conference workshops.

Most DCs (79%) reported modifying their therapeutic techniques for children. Pediatric techniques included using light force, using a device called an activator to deliver gentle torque, performing adjustments on a child-sized adjustment table or with a child’s head/toggle piece, performing adjustments on the mother’s lap, and familiarizing children with the adjustment by performing techniques on an animal or doll. Although not specifically questioned, several DCs reported performing fewer radiographic examinations on children (n = 4) and charging less for pediatric visits (n = 6; mean cost, $28 per visit).

CLINICAL JUDGMENT

When questioned about the number of treatments before deciding that chiropractic care was not benefiting the patient or a specific condition, 27% of practitioners declined to answer. The most common reasons for non-response included (1) that the number of visits would vary according to the condition and (2) that DCs did not treat specific diseases, conditions, or symptoms. Doctors of chiropractic with the second response stated that their focus is primarily on promoting optimal general health and disease prevention. Of those who did answer the question (n = 66), respondents reported an average of 7 visits before deciding that chiropractic was not benefiting the patient.

Thirty percent of respondents reported actively recommending childhood immunizations; 7% reported recommending against immunization. The remainder (63%) reported that they did not make any recommendations or that they educated parents to allow them to make informed decisions.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Pediatric DCs (n = 11)</th>
<th>Others (n = 79)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage with pediatric training</td>
<td>91</td>
<td>63</td>
</tr>
<tr>
<td>Prescribe herbal/nutritional supplements, %</td>
<td>36</td>
<td>72</td>
</tr>
<tr>
<td>Dispense herbs in office, %</td>
<td>18</td>
<td>50</td>
</tr>
<tr>
<td>No. of patient visits per week</td>
<td>141 (± 71)†</td>
<td>118 (± 49)†</td>
</tr>
<tr>
<td>No. of pediatric patient visits per week</td>
<td>26 (± 17); 9-40‡</td>
<td>11 (± 15); 0-75;</td>
</tr>
<tr>
<td>Would treat a neonate with a fever rather than refer to a medical doctor or doctor of osteopathy, %</td>
<td>38</td>
<td>15</td>
</tr>
<tr>
<td>Recommend immunizations, %</td>
<td>9</td>
<td>31</td>
</tr>
</tbody>
</table>

*DCs indicates doctors of chiropractic.
†Mean (± SD).
‡Range.
§Median.
||Mode.

Of the 81 DCs who responded to the question about the neonate with a fever, 68% said they would refer the patient directly to a doctor of medicine or doctor of osteopathy, 17% would perform a spinal adjustment, and 15% would take more history or perform further physical examination.

PEER-RECOMMENDED PEDIATRIC DCs

Of the 658 DCs in the Boston area, 11 (1) were recommended by at least 3 respondents other than themselves, (2) cared for at least 9 pediatric patients per week, and (3) were willing to collaborate with Children's Hospital. These DCs will be referred to as the peer-recommended pediatric DCs. Almost all in this group received pediatric training (10 vs 57 [91% vs 63%]). Forty-five percent were members of the International Chiropractic Pediatric Association. Fees and visit lengths of the peer-recommended pediatric DCs were similar to the other respondents (Table 2).

Fewer of the peer-recommended pediatric DCs prescribed herbal or nutritional supplements (36% vs 72% of the others) and dispensed herbs in their office (18% vs 50% of the others). Children and adolescents constituted 18% of their weekly visits. Of the 8 responding to the clinical scenario of the neonate with a fever, 3 (38%) said they would perform a chiropractic adjustment and 3 (38%) said they would refer the neonate directly to a physician or emergency room. Only 1 reported actively recommending childhood immunizations.

COMMENT

This study focused on questions pediatricians might ask about DCs in their communities, identifying DCs in a re-
tion, and characterizing their practice patterns, fees, and pediatric care.

The demographic and practice characteristics of Boston-area DCs were similar to those seen nationally in the ACA Physician Survey,17,18 the National Board of Chiropractic Examiners Survey,19 and other chiropractic surveys.20,21 For example, the median age of our respondents (40 years) and number of weekly patient visits (122 patients per week) were similar to other studies.17,18,21

The number of children visiting DCs is substantial and is increasing. In 1993, the ACA reported that 8% of chiropractic patients were younger than 16 years; the National Board of Chiropractic Examiners reported that 10% were younger than 17 years.19 This amounted to approximately 20 million pediatric chiropractic visits annually.16 By 1997, the ACA reported that children constituted 10% of the patients in the chiropractic practice.17,18 Similarly, children and adolescents accounted for 11% of patient visits to our respondents and 18% of visits to the peer-recommended pediatric DCs.

Although the proportion of pediatric visits has remained relatively stable from 1993 to 1997, the number of DCs has grown substantially. We estimate that 410 000 pediatric chiropractic visits were made in the Boston metropolitan area in 1997. Extrapolating the data to the entire nation, approximately 30 million pediatric visits were made in the United States in 1997, calculated as follows:

\[
\text{Average No. of Weekly Patient Visits} \times \left( \frac{\% \text{ Pediatric Visits}}{1997 \text{ ACA Data}} \right) \times (52 \text{ wk/y}) \times \left( \frac{\text{No. of Chiropractors in the Region}}{3} \right)
\]

While this projection may be affected by regional variations in practice, there are currently no other current estimates of the prevalence of pediatric chiropractic care. Our estimate represents a 50% increase in pediatric visits over 4 years, reflecting growth in the number of DCs and a broadening of the field of pediatrics to include adolescents. The expected doubling of licensed DCs in the next 10 years22 is likely to lead to additional pediatric visits to DCs.

Considering the fees and frequency of visits ($82 and $38 for initial and subsequent visits, respectively, 1-3 times per week), the costs of regular chiropractic care may be substantial. In our sample, 51% of chiropractic fees were paid out-of-pocket, comparable to reports by Eisenberg et al and Kassak21 of 44.3% and 43%, respectively. Sliding scales were offered by 42% of our respondents. Medicaid was accepted by only 47%, despite the existence of mandated coverage for chiropractic care since 1973. Only 1% of chiropractic income came from Medicaid in 1997.17

From our estimates of the annual number of pediatric chiropractic visits and the reported visit fees, $16 million were spent on pediatric chiropractic care in Boston during the past year; $8 million of this was paid by families out-of-pocket. In the United States, we estimate that approximately $1 billion was spent on pediatric chiropractic care in 1998, with $510 million paid by families out-of-pocket, calculated as follows:

\[
\text{(No. of Pediatric Chiropractic Visits) \times} \frac{\text{(Mean Reported Cost of an Established Patient Visit)}}{3}
\]

This national projection may also be affected by regional variations in practice patterns and costs; further health services research in CAM is needed to document these trends.

Safety is a major concern in pediatric health care. Doctors of chiropractic have reported few complications due to spinal manipulation; estimates of the incidence of serious neurologic or vertebralbasilar complications in adults range from 0.3 to 50.0 adverse effects per 1 million adjustments.14,23 Most serious complications have resulted from cervical manipulation. Shafrir and Kaufman24 reported a case of quadriplegia resulting from chiropractic manipulation in a child with spinal cord astrocytoma. Most of our respondents (80%) modified their procedures for children to reduce the risks of adverse effects, although none stated specifically that they avoided cervical manipulation in children. Another concern is the safety of repeated radiographic examinations in children and adolescents.25 A few DCs (n = 4) reported ordering fewer or no radiographic examinations for pediatric patients.

Many pediatricians are concerned that chiropractic care may delay or prevent appropriate medical diagnoses and treatment.26-28 The ICA Web site for consumer information states, “The DC can provide all three levels of primary care interventions and therefore is a primary care provider, as are MDs and DOs. . . . The DCs office is a direct access portal of entry to the full scope of service.”9 On its parent information site, the ICA describes the benefits of a “conservative, drugless approach to health care...a pleasant experience, one without painful injections and procedures, but with plenty of nurturing.”9 On the other hand, ICA policy obliges patient referrals to doctors of medicine or doctors of osteopathy or emergency facilities when limits of skill or authority have been reached and in serious conditions such as high fever and severe pain.9 Presented with a hypothetical case of a 2-week-old neonate with a temperature of 38.4°C, 17% of the respondent group and 38% of the peer-recommended pediatric DCs stated that they would treat the child themselves rather than immediately refer the child to a doctor of medicine, doctor of osteopathy, or an emergency facility. These results may be limited because in a real situation the practitioner might have more information about the patient, would not choose between 3 exclusive options, and could reevaluate and question the patient during an office visit. The question may also have been interpreted in different ways, (ie, that the hypothetical patient had already seen a doctor of medicine or doctor of osteopathy or was concurrently seeing a pediatrician). Nonetheless, these results may concern pediatricians considering the adverse consequences of delayed medical care.

Another issue of concern is the failure to promote childhood immunization. While the ACA officially states that “chiropractic manipulation is not a substitute for routine vaccinations, and our association considers any contrary suggestion to be unethical, unprofessional, and wrong,”29 the ICA is opposed to mandatory immunizations and “supports each individual’s right to be made aware of the possible adverse effects of vaccines upon a human body.”9 One third of American DCs believe that
“there is no scientific proof that immunization prevents disease, that vaccinations cause more disease than they prevent, and that contracting an infectious disease is safer than immunizations”; 81% felt that immunization should be voluntary.30 Less than one third of DCs responding to this survey actively recommended childhood immunizations and 7% recommended against them. The remaining respondents either did not answer or stated that they educated parents to allow them to make their own informed decisions. These issues raise great concern as more and more children and families seek chiropractic care, particularly if the care is not coordinated with a pediatrician.

Consumer Reports recently reported the frequent promotion of dietary supplements and in-office product distribution as a way of enhancing chiropractic income.7 Almost 75% of our respondents said they recommended dietary supplements or herbal remedies, with half distributing the supplements in their office. Fewer of the peer-recommended pediatric DCs recommended and distributed nutritional supplements, reflecting the greater influence of “straight” philosophy on these practitioners. The clinical therapeutic effects and toxicity of these products need to be studied in both adults and children. Additionally, DCs must be evaluated on their education in nutritional supplementation and herbal therapies to determine their qualifications to prescribe these therapies.

Despite the cost, most chiropractic patients report high levels of satisfaction with the care that they receive.31,32 Several factors may play a role in patient satisfaction. The average 19-minute visit to a chiropractor was slightly longer than the average 14-minute visit to a pediatrician.31 The holistic philosophy of health and life is often shared by the practitioner and patient.3 The “laying on of hands,” the prompt availability of appointments, and psychosocial factors such as the DC’s role in “legitimizing the sick”34 are additional contributing factors. The degree of patient satisfaction among adults can lead to parents desiring chiropractic care for their children, thus contributing to the increased demand for pediatric chiropractic care.

This study has several limitations. First, the survey was confined to the Boston metropolitan area and needs to be replicated with a larger national sample. Second, more of our respondents were members of chiropractic societies (the ACA or the ICA) than the national average. Our results may be biased to reflect the views of these organizations, and therefore may not reflect those of the general chiropractic community.

Selection bias is another limitation. Because the surveys required 10 to 20 minutes to complete, busier practices and those with few pediatric patients were less likely to respond. We also selected for family chiropractic practices and members of pediatric organizations (n = 60) and excluded DCs whose practices were limited to back and neck pain or sports medicine. Therefore, the pediatric patient load, techniques, and practices of our respondents might not reflect the entire chiropractic community. On the other hand, our data describe a subset of practitioners with particular experience and interest in pediatric chiropractic care.

Another limitation is that several of the questions about practice characteristics did not specifically restate the words “for children” (ie, those on fees, visit frequency, and frequency of radiographic examinations); therefore, some reported values may vary for purely pediatric populations. A few DCs self-reported that they charge less and order fewer radiographic examinations for children. Data were also collected by self-report rather than direct observation. Future studies may include independent methods to verify key outcomes.

The survey’s inquiry about collaboration with Children’s Hospital and peer recommendations may have biased respondents’ answers. Respondents may have been more likely to either (1) report recommending immunizations and refer the neonate with a fever to a doctor of medicine or doctor of osteopathy or (2) omit the question. It is also possible that respondents may have reported higher pediatric values with respect to pediatric training and patient visits.

Finally, we used a broad definition of the general pediatric and adolescent population (age <21 years) as defined by the American Academy of Pediatrics, Elk Grove Village, Ill. Future studies might address the use within different age groups (ie, infants, school-aged children, and adolescents). This preliminary survey of practitioners also did not address patient satisfaction, efficacy, or adverse effects of chiropractic care. All of these are crucial outcomes to address in future studies.

Despite the limitations, to our knowledge this is one of the first studies to address chiropractic care for children; it adds vital information to understanding the practices of the CAM practitioners most frequently consulted by children in the United States. Approximately 30 million pediatric visits to DCs are made annually in the United States, with an estimated total cost of $1 billion and costs split approximately in half between third-party payers and families paying directly out-of-pocket. Only 30% of DCs surveyed promoted immunizations, which are proven cost-effective therapies, yet 70% recommended herbs and dietary supplements of unknown value. When presented with a neonate with a fever, 17% of respondents would treat the child with a chiropractic adjustment rather than refer the child to a medical doctor. If DCs continue to provide pediatric and primary care, the medical community may need to consider different options to enhance and ensure the quality of this care.

Although pediatricians may be unfamiliar or uncomfortable with chiropractic care, the fact that families are using these therapies needs to be acknowledged. If pediatricians wish to play a central role in coordinating comprehensive primary care for children, discussion about pediatric chiropractic care should be facilitated with patients, parents, and DCs. For example, pediatricians should inquire about all therapies that patients use for health promotion and illness, including chiropractic care, as well as herbal remedies, acupuncture, meditation, and other CAM therapies. Additional studies are needed to address the safety and effectiveness of chiropractic care and other CAM therapies for children, along with the elements of care that contribute most strongly to patient satisfaction. Our findings clearly indicate the necessity of strengthening collaboration and research.
between the chiropractic, medical, and public health communities.

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REFERENCES
