

# Adolescent Health Care: Chiropractic's Investment in the Future

PHILLIP S. EBRALL

**ABSTRACT:** Some specific health needs of adolescents are identified, and the size of the adolescent market in Australia is given. The proportions of adolescents attending a sample of Victorian chiropractic clinics do not differ from those which could be expected. Chiropractors can therefore be considered well placed to improve the community's provision of preventive and curative health care to adolescents. Three proposals are made: first, that the time is right for a post graduate certification program in adolescent health care to be introduced for chiropractors, second, that the age range of adolescence be extended to include 10 to 24 years, and third, that it is appropriate for Victorian chiropractors to be utilised as a part of any future implementation by government of health care strategies designed for adolescents.

**INDEX TERMS:** adolescence; adolescent medicine; chiropractic; dysmenorrhoea; growth; headache; spine; sports medicine.

Chiropr J Aust 1991; 21:13-9

## INTRODUCTION

Adolescence is remembered as a time of optimism, idealism and potentiality.<sup>1</sup> Sadly today it is also a time of stress and social conflict.<sup>2</sup> Adolescents actively look for a form of structure in their lives and in some cases find it in the shopping malls of suburbia.<sup>3</sup> A most alarming statistic is the number of adolescents who have considered committing suicide at some time in their lives, 25% of boys and 42% of girls.<sup>4</sup> It is even more heartbreaking to note that the rate of suicide has doubled in some states since 1965, and West Australian government hospital admissions for attempted suicide in boys aged 14 and under has trebled in the past 10 years.<sup>5</sup>

On the one hand, adolescence is a time when the individual faces many potential health care problems; on the other, it is the ideal time for preventive care.<sup>1</sup> Adolescent medicine has existed as a discipline for about 35 years; today it is growing, with a developing number of professional organisations for those interested in providing health services to this group.<sup>6,7</sup>

The medical profession is coming to grips with its responsibilities to provide specialised health care for the adolescent population.<sup>8,10</sup> The five major issues being addressed by the Society for Adolescent Medicine are:

- the quality of health care for adolescents;
- research;
- health services for adolescents;
- communications among health professionals caring for adolescents;
- training of individuals providing care to adolescents.<sup>9</sup>

These five issues are equally applicable to chiropractors, even though it is accepted that the prerogative to provide health care to the adolescent lies generally within orthodox medicine, and particularly with paediatricians.<sup>10</sup>

It is proposed that adolescents have needs and problems sufficiently distinguishable to warrant consideration as a distinct group for health care provision.<sup>11</sup> The response of Victorian adolescents suggests that the health professions are failing in their efforts to specifically reach them. Not only is consultation time seen as inadequate, but medical practitioners were felt to be hard to approach and impersonal. Among the suggestions and strategies to remedy this problem is mention of the requirement for greater awareness of youth needs, and greater availability of doctors for young people.<sup>12</sup>

From the musculoskeletal perspective, adolescence is the time of greatest growth and change. By taking up the stimulating challenge of providing specialised care for the musculoskeletal system in this period, chiropractors can make two unique contributions to a young life: first, the relief of pain through the correction of musculoskeletal dysfunction and second, the provision of a corrected structural foundation that will allow a more normal adult life.

The World Health Organisation has identified two approaches necessary to effectively deliver complete health care to adolescents, namely 'curative' and 'preven-

---

Phillip S. Ebrall BAppSc (Chiropractic)  
Lecturer, School of Chiropractic & Osteopathy  
Phillip Institute of Technology  
Bundoora, Victoria 3083

Presented at Chiropractic Australia, joint conference of the Australian Chiropractors' Association and United Chiropractors' Association of Australasia, Melbourne, September 1990.

Table 1.

SOME MUSCULOSKELETAL CONSIDERATIONS IN ADOLESCENCE<sup>18,76-8</sup>

<p>Spinal:</p> <ul style="list-style-type: none"> <li>Scheuermann's disease (spinal osteochondrosis)</li> <li>adolescent disc syndrome</li> <li>subluxogenic pain</li> <li>postural scoliosis</li> <li>idiopathic scoliosis</li> <li>tuberculosis of the spine</li> <li>sprain/strain syndromes</li> <li>prolapsed intervertebral discs</li> <li>Schmorl's nodes</li> <li>ankylosing spondylitis</li> <li>pyogenic osteitis</li> <li>coccydynia</li> <li>spinal stenosis</li> <li>sickle cell disease</li> <li>diskitis</li> <li>disk space calcification</li> <li>sacroiliac pyoarthritis</li> <li>spinal epidural abscess</li> <li>juvenile rheumatoid arthritis</li> <li>spondylolysis</li> <li>spondylolisthesis</li> <li>neoplasia (vertebral column and intraspinal)</li> <li>transverse myelitis</li> <li>classic (juvenile) myaesthesia gravis</li> <li>Bertolotti's syndrome<sup>35,37</sup></li> </ul>	<p>Hand:</p> <ul style="list-style-type: none"> <li>trigger finger/thumb</li> </ul>
<p>Systemic:</p> <ul style="list-style-type: none"> <li>ataxia</li> <li>fatigue, lassitude</li> <li>hypotonia</li> <li>Lyme disease</li> <li>periarticular-onset juvenile rheumatoid arthritis</li> <li>psoriatic arthritis</li> <li>inflammatory bowel disease</li> <li>acne fulminans</li> <li>systemic lupus erythematosus</li> <li>syncope—vasodepressor               <ul style="list-style-type: none"> <li>micrurition</li> <li>orthostatic</li> <li>tussive</li> <li>psychological</li> </ul> </li> <li>vertigo—cervicogenic</li> <li>tall stature disorders—familial               <ul style="list-style-type: none"> <li>Marfan's syndrome</li> <li>Klinefelter's syndrome</li> </ul> </li> <li>stress related enuresis</li> </ul>	<p>Cervical:</p> <ul style="list-style-type: none"> <li>Klippel Feil syndrome</li> <li>subluxogenic pain</li> <li>non-traumatic torticollis</li> </ul> <p>Head:</p> <ul style="list-style-type: none"> <li>headache—vascular, non-migraine</li> <li>vascular, migraine</li> <li>cluster</li> <li>tension</li> <li>cranial inflammation</li> <li>ear/eye/sinus disorders</li> <li>traction, tumor</li> <li>traction, abscess</li> <li>intracranial hemorrhage</li> <li>psuedo tumor cerebri</li> <li>psychogenic</li> </ul> <p>Foot:</p> <ul style="list-style-type: none"> <li>March fracture</li> <li>Freiberg's disease</li> <li>pes cavus, verruca pedis</li> <li>tarsal coalition</li> <li>early hallux rigidus</li> <li>bunion</li> <li>hallux valgus</li> <li>nail problems</li> <li>cuneiform exostosis</li> <li>peroneal flat foot</li> <li>calcaneal exostosis</li> <li>bursitis</li> <li>Sever's disease of late onset</li> <li>fifth metatarsal head exostosis</li> <li>fifth metatarsal base exostosis</li> </ul> <p>Ankle:</p> <ul style="list-style-type: none"> <li>osteochondritis tali</li> <li>tendo calcaneus</li> <li>footballer's ankle</li> </ul> <p>Leg:</p> <ul style="list-style-type: none"> <li>tibial stress fracture</li> <li>osteoid osteoma</li> <li>osteoblastoma</li> <li>osteosarcoma</li> <li>Ewing's sarcoma</li> <li>Brodie's abscess</li> <li>anterior compartment syndrome</li> <li>shin splints</li> <li>Blount's disease of late onset</li> </ul>
<p>Chest:</p> <ul style="list-style-type: none"> <li>costochondritis</li> <li>osteomyelitis</li> <li>slipping rib syndrome</li> <li>lower cervical/upper thoracic nerve root compromise</li> <li>pectus excavatum</li> <li>pectus carinatum</li> <li>congenitally absent pectoral muscles</li> </ul>	<p>Knee:</p> <ul style="list-style-type: none"> <li>osteochondritis dissecans</li> <li>Osgood-Schlatter's disease</li> <li>longitudinal meniscus tears</li> <li>first incidents of patella dislocation</li> <li>chondromalacia patellae</li> <li>fat pad injury</li> <li>popliteal cyst</li> </ul>
<p>Shoulder:</p> <ul style="list-style-type: none"> <li>recurrent dislocation</li> <li>acromioclavicular dislocation</li> <li>sternoclavicular dislocation</li> <li>staphylococcal osteitis</li> <li>uncommon infections—tuberculosis and gonococcal arthritis</li> <li>Sprengel's deformity</li> <li>scapula exostosis</li> </ul>	<p>Hip:</p> <ul style="list-style-type: none"> <li>infective arthritis</li> <li>slipped femoral capital epiphysis</li> <li>ankylosing spondylitis</li> <li>Reiter's syndrome</li> <li>pelvic inflammatory disease</li> <li>osteoid osteoma</li> <li>osteo-arthritis secondary to Perthes'</li> <li>undetected congenital dislocation of the hip</li> <li>undetected Legg-Calve-Perthes disease</li> <li>benign limb pain (muscle overuse)</li> </ul>
<p>Elbow:</p> <ul style="list-style-type: none"> <li>epicondylitis</li> <li>post-trauma myositis ossificans</li> </ul>	
<p>Wrist:</p> <ul style="list-style-type: none"> <li>extensor tenosynovitis</li> </ul>	

tive.<sup>13</sup> Traditionally the curative care for adolescents is delivered by remote professional figures who are specialists in mainly medical areas, in contrast to chiropractors, who have a reputation of being easily approachable primary contact practitioners.<sup>14,16</sup> This places chiropractors in a unique position to be able to develop a practice style of curative musculoskeletal care that adolescents feel comfortable with.

The curative approach is problem oriented. The ability to gain ready access to an adolescent population must be supported by clinical competency in the wide spectrum of musculoskeletal disorders encountered in adolescence (Table 1). Such an ability would be gained through the implementation of postgraduate certification courses for registered chiropractors, modeled on existing programmes such as the Certificate in Clinical Chiropractic Paediatrics.<sup>17</sup>

The preventive approach is designed to address the needs of adolescents, and involves a wide selection of qualified paramedics with an emphasis on psychosocial aspects. There is a very broad scope for chiropractors to implement preventive strategies related to musculoskeletal health. Again, the most appropriate strategies would be identified within the context of a postgraduate training program and ideally be supported by appropriate clinical research.

From 1991 the undergraduate course at Phillip Institute School of Chiropractic and Osteopathy will include an introductory unit in Adolescent Health, similar to existing units in Geriatrics and Paediatrics.

## THE AGE OF ADOLESCENCE

Adolescence is generally accepted as commencing around the time of puberty, in the second decade of life. Accordingly, 10 years is considered a demarcation for entry into adolescence,<sup>18</sup> although 12 may be a more convenient age with regard to census age and school grouping.<sup>19</sup>

The point where adolescence ends, however, is not as clearly defined. The age range for which the specialty of paediatrics has specific responsibility is set from prior to birth to 21 years, with the proviso that in special cases, such as chronic disease, paediatric care may continue past 21.<sup>20</sup> This is in agreement with the 1972 statement of policy from the American Academy of Paediatrics which extends the 1938 policy statement that set its upper limit at about the 16th to 18th year of life.<sup>10</sup>

There are two arguments in favour of the more appropriate end point to adolescence being the 25th birthday, namely:

1. Adolescence is a period of physical growth, and includes the 'growth spurt' of high peak annual height velocity,<sup>21,22</sup> although it is shown that the spurt occurs earlier in females than males.<sup>23</sup> Growth concludes with the fusion of the secondary ossification centres of the spine by about the 25th year.<sup>22,24-26</sup>
2. Adolescence is a period of psychosocial growth and central nervous system maturation, with the development of formal operational thinking.<sup>6</sup> In recognition of this, the statistical measurement of

young people is generally grouped as 15-19 and 20-24 years. The former excludes late adolescents; the latter includes them.<sup>19</sup>

This paper proposes that, from the perspective of the neuromusculoskeletal system, the most appropriate age range for "adolescence" is 10 to 24 years.

On this basis, the size of the Australian adolescent market by 1986 Census is 25% of the total national population, ranging between 23.4% in the rural/urban fringe up to 29.4% in an outer Melbourne suburb. The implication is that a chiropractic practice should reasonably expect to see adolescents as new patients. It is important for chiropractors to be conversant with the competencies required when treating adolescents as patients.

## ADOLESCENT ATTENDANCE FOR HEALTH CARE

Whilst adolescents suffer many real and significant health problems, they are not regarded as prolific users of the health care system, especially for counseling.<sup>11,12,27</sup> A major problem with implementing health care strategies for adolescents is gaining access to them as individuals.<sup>3,12,19,27,30</sup>

Specific reports of the usage of chiropractors by adolescents are not available, and estimates need to be derived from studies of a broader population<sup>31,33</sup> or from pilot studies.<sup>34</sup>

The proportion of adolescents in the general population surrounding three Victorian chiropractic clinics ranges between 23.8% to 29.4%, and the proportion attending as new patients to these clinics ranges from 12% to 29.2% (Figure 1).<sup>34</sup>

Using large sample hypothesis testing for the population proportion, it is shown that the proportions of adolescents attending as new patients at these three chiropractic clinics do not differ from those which could be expected in the three respective populations. It is therefore appropriate for Victorian chiropractors to be utilised as a part of any future implementation by government of health care strategies designed for adolescents.

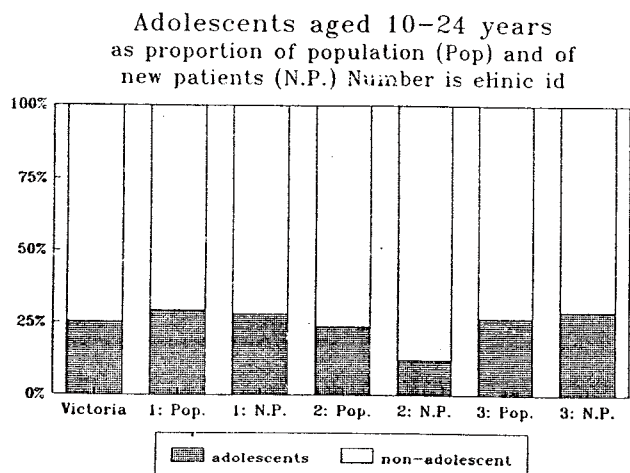


Fig. 1 (Ref 34).

## **SPECIFIC ADOLESCENT HEALTH ISSUES**

Adolescence is perhaps the last period in which lasting corrections can be made to postural habits. The education of posture revolves around passive and active exercises. Contracted musculature can be treated with soft tissue techniques after Bates, which involves passive stretching combined with gentle, specific trigger point work.<sup>35</sup>

The motor strength of postural muscle groups can be enhanced by specific daily exercises designed to match the improving motor performance of various muscle groups.<sup>36</sup> It is also important to correct any pelvic inclination in the sagittal plane with exercise. A reduction in pelvic tilt will be reflected by a decrease in other spinal curves with a concomitant improvement in posture and gait.<sup>37</sup>

Scoliosis is a specialty subject in itself, with numerous current developments and proposals regarding etiology and treatment. As such it is beyond the scope of this paper. Table 1 lists many other musculoskeletal conditions that surface during adolescence. In addition to these specific entities, there are several important and common considerations.

### **THE ADOLESCENT SPINE**

The adolescent disc is more prone to herniation than older, adult discs. It has been shown that after the third decade of life the nucleus of the disc is not sufficiently fluid to be expressed through an annular fissure under most normal circumstances. For older discs to herniate, the nucleus needs to undergo autolysis and relative liquefaction, whereas the adolescent nucleus is relatively fluid.<sup>38</sup>

Weak points in the cartilage plates at the former notochordal track are identified as the sites of origin for Schmorl's nodes in adolescence.<sup>26,39</sup> Taylor also identifies potential tracks along the remnants of the vascular canals, which run between the ring apophysis and centrum of the developing adolescent vertebra. It is along these channels that nuclear material may herniate through the cartilage plates into the anterior vertebral spongiosa or out under the anterior longitudinal ligament.<sup>26,39</sup>

During adolescence the sexual dimorphism of the spine becomes clearer. The female spine grows more rapidly in height, while the male spine grows more rapidly in transverse diameter up to about age 13. After 13 years, the growth in vertebral height is greater in males, together with the greater growth rate in vertebral girth. The female spine thus becomes more slender, less stable and less resistant to bending forces than the male spine,<sup>23,26,39</sup> a finding confirmed by Veldhuizen, Baas and Webb.<sup>40</sup>

The lumbar disc height of adolescent females is similar to that of adolescent males, but the end-plate length is considerably shorter, another factor to explain the greater flexibility of adolescent females.<sup>38,41</sup>

### **SPORT**

Adolescent health care is inseparable from chiropractic sports medicine. It presents an ideal opportunity for

chiropractors to be involved through a secondary college and then to broaden their involvement as a health care professional with the school.

The most injury-prone sport is American football, followed by gymnastics, while the most severe injuries happen on the track and in basketball. Sprains and strains account for 57% of all injuries.<sup>42</sup>

The most common adolescent sporting injury in soccer is reported as ankle sprain.<sup>43</sup> Back pain has an incidence ranging up to 75% in young athletes, which is up to twice the frequency in general populations of the same age.<sup>44</sup>

It is reported that over 70% of running injuries involve the knee or leg. Females report more leg injuries, while males report more knee injuries, and over two thirds of all injuries result from a training error.<sup>45</sup> Traditional teaching is that disruption of the ligaments about the knee is a rare injury in younger adolescents, because the ligaments are stronger than the adjacent growth plates, and that injuries that tear adult ligaments will produce epiphyseal disruption in an immature skeleton.<sup>46</sup>

The current concept is that ligamentous injuries, although uncommon in the skeletally immature patient, can be found either in isolation or in association with physeal injury.<sup>47</sup> The recognition and management of ligamentous injuries in the adolescent is important if good recovery is to be made by the patient.

The pre-participation sports assessment of adolescents is mandatory.<sup>48-53</sup> There is clearly a potential in this field for postgraduate training and development of chiropractors.

It is also important for sports chiropractors to develop protocols for assessing sports activity levels and limitations in adolescent athletes with knee disorders, in a manner similar to that of Noyes *et al.*<sup>54</sup> This will allow a stronger case to be made for chiropractic supervision of training programs. Recommendations for participation in competitive sports by adolescents can be based on those published by the American Academy of Paediatrics Committee on Sports Medicine.<sup>55</sup>

Further, it is shown that there is an entity of knee pain in adolescence associated with segmental spinal dysfunction, and that such pain may be relieved by a specific treatment programme that includes spinal manipulation.<sup>56</sup>

### **HEADACHES**

Headache activity in adolescents is of a frequency to be of concern. King and Sharpley studied 900 Australian youth aged 10 to 18, and report only 36.8% as never experiencing a headache. Some 4.6% indicated that they experienced headache almost all the time, 24.8% every few days or once a week, and 33.7% every 2-3 weeks or once a month. Almost a third of respondents affirmed their headaches to be a problem, and more than three-quarters considered it was difficult to concentrate in class or on their homework during a headache.<sup>57</sup>



When the frequency categories were collapsed into high frequency (once a week) and low frequency (once every 2-3 weeks and below), girls were found to report significantly more headaches than boys.<sup>57</sup>

Linnet *et al.* report that 6.9% of males and 15% of females aged 18-23 had consulted a physician within the preceding 12 months because of headache, while 4.4% (male) and 1.2% (female) had consulted a chiropractor. Within this age grouping, 56.8% (males) and 78.3% (females) reported their most recent headache as occurring within the last 4 weeks. The incidence is similar in the 12-17 age grouping, being 55.9% (male) and 73.6% (female).<sup>58</sup>

It can therefore be appreciated that headaches in adolescents are more common than generally appreciated<sup>59</sup> and that there is a specific opportunity for chiropractors to develop and demonstrate further expertise with the problem.

## DYSMENORRHOEA

Primary dysmenorrhoea is painful menstruation which develops within a few years of menarche in the absence of any organic pelvic disease. Verbowski and Matthews, in a 1990 study of 427 female adolescents (aged 10-12) in Melbourne, report the incidence of dysmenorrhoea as 82.1%. Further, 19.3% of girls missed school or classes because of the pain, and another 24% limited their activities for the same reason.<sup>60</sup> A Finnish study reports an incidence of 48% among 12-year-old girls, rising to 79% at age 18.<sup>61</sup>

Dysmenorrhoea was reported by one-third of the Melbourne girls as occurring with their first period, while two-thirds reported the onset as being within the first 16 months of menstruating. Interestingly, while a higher incidence was found in overweight girls, the underweight girls suffered from more severe pain.<sup>60</sup>

Posture was considered an etiological factor as early as 1943,<sup>62</sup> so it is not surprising to note that chiropractic treatment is considered beneficial for patients with dysmenorrhoea.<sup>63,64</sup> Liebl and Butler describe one case where a patient suffering dysmenorrhoea realised fewer episodes of pain as well as lower pain ratings during the treatment phase.<sup>65</sup>

Dysmenorrhoea is a prevalent problem in adolescence and represents a leading cause of periodic school absenteeism.<sup>66</sup> As such it warrants further and full investigation by chiropractic researchers.

## RESEARCH ISSUES

Notwithstanding spondylosis and spondylolisthesis,<sup>67</sup> it is generally accepted that acute episodes of low back pain usually start after adolescence, at about the age of 25,<sup>68</sup> and that back pain is an uncommon complaint in childhood.<sup>69</sup> Three studies show an incidence of low back pain in fit adolescents of about 26%,<sup>68,70,71</sup> however the incidence rises dramatically when athletes are studied.<sup>44,72,73</sup>

In Victoria, the adolescents aged 15-19 have a low representation in the Accident Compensation Commission-reported liability claims, while the group aged 20-24 has the highest, showing a trend of rapidly increasing susceptibility to work injury and subsequent compensation claims among older adolescents.<sup>74</sup> The question arises as to the mechanisms that lead to this increased incidence of spinal pain and low back injury, whether there is a natural predisposition to such conditions, and what preventive measures can be implemented.

A study of a sample of some 1300 adolescent males is underway in Melbourne to collect information in order to advance our knowledge of the age at which currently identified musculoskeletal correlates of low back pain first appear. It will also report the incidence of low back pain in Melbourne adolescent males. This knowledge may later be applied by others to the development of programs designed to decrease the subsequent development of symptomatic low back pain and spinal injury.<sup>75</sup>

## CONCLUSION

This paper demonstrates that the adolescent musculoskeletal system is of special interest to the chiropractor. The changes that accompany growth continue until about the 25th birthday, suggesting that it is quite appropriate to extend the age range for adolescence to include 24 years.

Adolescents represent about one quarter of the population and are deserving of both the preventive and the curative care of chiropractic. As with any sub-speciality, the expanding knowledge base creates an imperative for further study of the adolescent musculoskeletal system. This knowledge could be competently delivered within the structure of a postgraduate program in adolescent musculoskeletal health.

It is shown by a pilot study that the proportions of adolescents attending as new patients at three chiropractic clinics do not differ from those which could be expected in the three respective populations. It is therefore appropriate for Victorian chiropractors to be utilised as a part of any future implementation of health care strategies designed for adolescents.

Dr. Oliver Wendell Holmes was once asked "When should the training of a child commence?" His answer, "One hundred years before birth." Similarly, if we ask, "When should the introduction of post-graduate training for adolescent musculoskeletal care commence?" we should be able to answer, "Now, today." For every year that we delay, one-quarter of the community we supposedly serve is denied the most appropriate care for their growing bodies.

## ACKNOWLEDGEMENTS

The author wishes to thank Dr Bruce Ellis and Dr Bruce Walker for their assistance with the pilot study.

## ADOLESCENT HEALTH CARE EBRALL

### REFERENCES

1. Nelms BC. Adolescent health care—the need is great. *J Paediatr Health Care* 1987; 1(2):59.
2. Eckersley R. Casualties of change: social and economic issues affecting youth. *Bull Nat Clearinghouse Youth Stud* 1988; 7(4):3-8.
3. Thomas L. Adolescent health. *Ala Med* 1988; 57(9):41-2.
4. Editorial. Adolescents: In more trouble than we think? *Patient Care*. 1990; 30 Jan:18-9.
5. Hart B. Youth suicide: prevention taskforce position paper. *Bull Nat Clearinghouse Youth Stud*. 1989; 8(1):48-53.
6. McAnarney ER. Adolescent medicine: growth of a discipline. *Paediatr* 1988; 82:270-2.
7. Campbell D. From the editor: community education. *Aust Assoc Adolesc Health Nat Newsletter* 1990; 1:3.
8. Christensen RD. Physicians must take the initiative in adolescent health care. *Minn Med* 1989; 72:529-30.
9. Jenkins RR. Reassessing our leadership role for the health of adolescents. *J Adolesc Health Care* 1989; 10:435-7.
10. Sanders Jr JM. Health care delivery to adolescents and young adults by paediatricians. *Paediatr* 1988; 82(3)Pt2:516-7.
11. Wheeler MJ. Adolescents and health care. *Nurs* 1981; 1:1028-30.
12. Youth Policy Development Council. Health for youth final report. Health Promotion Unit. Victoria Health Department. 1987.
13. Friedman HL. World Health Organisation initiatives in adolescent health and some future directions. In: Bennett D, Williams M, eds. *New universals, adolescent health in a time of change*. Curtin, ACT: Broga Press, 1988:72-5.
14. Coulehan JL. Chiropractic and the clinical art. *Soc Sci Med* 1985; 21:383-90.
15. Wardwell WI. The Connecticut survey of public attitudes toward chiropractic. In: *Proceedings of 1989 International Conference on Spinal Manipulation*. Arlington, Va: Foundation for Chiropractic Education and Research 1989: 230-5.
16. Jamison JR. Chiropractic's functional integration into conventional health care: some implications. *J Manipulative Physiol Ther* 1987; 10:5-10.
17. Phillip Institute of Technology School of Chiropractic and Osteopathy. Course outline. 1990.
18. Hofman AD, Greydanus DE. *Adolescent medicine*, 2nd ed. Norwalk, Conn: Appleton and Lange, 1989:203-30.
19. Coulter ID. The chiropractic patient: a social profile. *J Can Chiropr Assoc* 1985; 29:25-8.
20. Council on Child and Adolescent Health. *Academy of Paediatrics. Age limits of paediatrics*. *Paediatr*. 1988; 81:736.
21. Brunader RA, Moore DC. Evaluation of the child with growth retardation. *Am Fam Physician* 1987; 35:165-76.
22. Lowry GH. *Growth and development of children*, 7th ed. Chicago: Year Book Medical, 1979:207-99.
23. Taylor JR, Twomey LT. Sexual dimorphism in human vertebral body shape. *J Anat* 1984; 138:281-6.
24. Bullough PG, Boachie-Adjei O. *Atlas of spinal diseases*. New York: Gower Publishing, 1988:47-52.
25. Moore KL. *Before we are born*. Toronto: WB Saunders, 1983.
26. Taylor JR, Twomey LT. Vertebral column development and its relation to adult pathology. *Aust J Physiother* 1985; 31(3):83-8.
27. Joffe A, Radius S, Gall M. Health counseling for adolescents: what they want, what they get, and who gives it. *Paediatr* 1988; 82(3)Pt2:481-5.
28. Patrick K. Student health. Medical care within institutions of higher education. *JAMA* 1988; 260:3301-5.
29. Nyiendo J, Haldeman S. A prospective study of 2,000 patients attending a chiropractic college teaching clinic. *Med Care*. 1987; 25:516-27.
30. Phillips RB. A survey of Utah chiropractic patients. *J Chiropr* 1981; 15:S113-34.
31. Research staff, Uniquet Limited. *The Uniquet survey*. Brisbane: Uniquet Limited. 1985:33.
32. White TP. Demographic and epidemiological study of all new patients entering the CMCC outpatient clinic during 1985-1987. *Proceedings, 1989 International Conference on Spinal Manipulation*. Arlington, Va: Foundation for Chiropractic Education and Research. 1989:180-4.
33. Terrett AGJ. Vascular accidents from cervical spine manipulation: report on 107 cases. *J Aust Chiropractors' Assoc* 1987; 17:15-24.
34. Ebrall PS. Adolescent attendance at chiropractic clinic. A pilot study. Unpublished research. School of Chiropractic and Osteopathy, Phillip Institute of Technology, 1990.
35. Bates T. Myofascial pain. In: Green M, Haggerty R, eds. *Philadelphia: WB Saunders*, 1977:147-8.
36. Beunen GP, Malina RM, Hof MA, *et al*. Adolescent growth and motor performance—a longitudinal study of Belgium boys. Champaign, Illinois. *Human Kinetic Books*, 1988:10-27.
37. Keim HA. *The adolescent spine*. New York: Grune and Stratton, 1976:23-6.
38. Twomey L, Taylor JR. Structural and mechanical disc changes with age. *J Manual Med* 1990; 5:58-61.
39. Taylor JT. The development and adult structure of lumbar intervertebral discs. *J Manual Med*. 1990; 5:43-7.
40. Veldhuizen AG, Baas P, Webb PJ. Observations on the growth of the adolescent spine. *J Bone Jt Surg* 1986; 68-B:724-8.
41. Bradford DS, Hensinger RN. Development of the vertebral column. In: Bradford DS, ed. *The paediatric spine*. New York: Thieme, 1985:9-14.
42. McLain LG, Reynolds S. Sports injuries in a high school. *Paediatr* 1989; 84:446-50.
43. Editorial. Soccer injuries and physical maturity. *Am Fam Physician* 1989; 39:312-5.
44. Sward L, Hellstrom M, Jacobsson B, Peterson L. Back pain and radiological changes in the thoraco-lumbar spine of athletes. *Spine* 1990; 15:124-9.
45. Paty JG, Swafford D. Adolescent running injuries. *J Adolesc Health Care* 1984; 5:87-90.
46. Kannus P, Jarvinen M. Knee ligament injuries in adolescents. *J Bone Jt Surg* 1988; 70-B:772-6.
47. Sullivan JA. Ligamentous injuries of the knee in children. *Clin Orthop* 1990; 255:44-50.
48. Fields KB, Delaney M. Focusing the preparticipation sports examination. *J Fam Pract* 1990; 30:304-12.
49. Kreipe RE, Gewanter HL. Physical maturity screening for participation in sports. *Paediatr* 1985; 75:1076-80.
50. Committees on Sports Medicine and School Health. *American Academy of Paediatrics. Organised athletics for preadolescent children*. *Paediatr* 1989; 84:583-4.
51. Braden DS, Strong WB. Preparticipation screening for sudden cardiac death in high school and college athletes. *Physician Sports Med* 1988; 16(10):128-40.
52. Bar-Or O, Lombardo JA, Rowland TW. Prepubertal exercise: how much, when? *Patient Care* 1988; 30 Oct:59-70.
53. Bar-Or O, Lombardo JA, Rowland TW. The pre-participation sports exam. *Patient Care* 1988; 30 Oct:75-102.
54. Noyes FR, Barber SD, Mooar LA. A rationale for assessing sports activity levels and limitations in knee disorders. *Clin Orthop* 1989; 246:238-49.
55. Committee on Sports Medicine. *American Academy of Paediatrics. Recommendations for participation in competitive sports*. *Paediatr* 1988; 81:737-9.
56. Sweeting RC, Crocker B. Anterior knee pain and spinal dysfunction in adolescence. *J Manual Med* 1989; 4:65-8.
57. King NJ, Sharpley CF. Headache activity in children and adolescents. *J Paediatr Child Health*. 1990; 26:50-4.
58. Linet MS, Stewart WF, Celentano DD, Ziegler D, Sprecher M. An epidemiologic study of headache among adolescents and young adults. *JAMA* 1989; 261:2211-6.
59. Rothner AD. Headaches in children and adolescents. *Postgrad Med* 1987; 81:223-9.

60. Verbowski G, Matthews M, Tucker C. The incidence of primary dysmenorrhoea in 427 adolescent girls in years 10-12 in one Melbourne school. Unpublished paper. School Chiropractic and Osteopathy. Melbourne: Phillip Institute of Technology, 1990.
61. Teperi J, Rimpela M. Menstrual pain, health and behaviour in girls. *Soc Sci Med* 1989; 29:163-9.
62. Adams TW. Painful menstruation with a special reference to posture as an etiologic factor. *Med Sug* 1943; 42:88-98.
63. Arnould-Frochot S. Investigation of the effect of chiropractic adjustments on a specific gynecological problem: dysmenorrhoea. *Bull Eur Chiropr Union* 1977; 25(1):17.
64. Wiles M. Gynaecology and obstetrics in chiropractic. *J Can Chiropr Assoc* 1980; 24:163-6.
65. Liebl NA, Butler LM. A chiropractic approach to the treatment of dysmenorrhoea. *J Manipulative Physiol Ther* 1990; 13:101-6.
66. Alvin PE, Litt IF. Current status of the etiology and management of dysmenorrhoea in adolescence. *Paediatr* 1982; 70:516-25.
67. Hensinger RN. Spondylolysis and spondylolisthesis in children and adolescents. *J Bone JT Surg* 1989; 71-A:1098-1107.
68. Gemmell HA, Jacobson BH. Incidence of sacroiliac joint dysfunction and low back pain in fit college students. *J Manipulative Physiol Ther* 1990; 13:63-7.
69. Hensinger RN. Back pain in children. In: Bradford DS, ed. *The paediatric spine*. New York: Thieme, 1985:41-60.
70. Mierau DR, Cassidy JD, Hamin T, Milre RA. Sacroiliac joint dysfunction and low back pain in school aged children. *J Manipulative Physiol Ther* 1984; 7:81-4.
71. Fairbank JCT, Pynsent PB, Van Poortvliet JA, Phillips H. Influence of anthropometric factors and joint laxity in the incidence of adolescent back pain. *Spine* 1984; 9:461-4.
72. Kraus DR, Shapiro D. The symptomatic lumbar spine in the athlete. *Clin Sports Med* 1989; 8(1):59-69.
73. Sward L, Hellstrom M, Jacobsson B, Nyman R, Peterson L. Acute injury of the vertebral ring apophysis and intervertebral disc in adolescent gymnasts. *Spine* 1990; 15:144-8.
74. Accident Compensation Commission. Victoria. Claims statistics, published as statistical supplement. 1989.
75. Ebrall PS. The prevalence of correlates of low back pain in an adolescent population: a musculoskeletal perspective. MAppSc (Chiropractic) (Research) program. School of Chiropractic and Osteopathy. Melbourne: Phillip Institute of Technology, 1990.
76. McRae R. *Clinical orthopaedic examination*, 2nd ed. Edinburgh: Churchill Livingstone, 1983.
77. Bellet PS. *The diagnostic approach to common symptoms and signs in infants, children and adolescents*. Philadelphia: Lea and Febiger, 1989.
78. Thompson GH, Carter JR. Late-onset tibia vara (Blount's disease). *Clin Orthop* 1990; 255:24-35.

IS THIS YOUR PERSONAL COPY OF THE  
CHIROPRACTIC JOURNAL OF AUSTRALIA?

If not, don't risk missing a single issue —subscribe now.

For AUD\$50, CJA will be sent to any address in Australia, or airmailed anywhere else in the world for AUD\$65 (US\$55) for a full calendar year. Send your name, address and cheque to:

CJA Subscriptions  
P.O. Box 748  
Wagga Wagga NSW 2650  
Australia