Risk Assessment of Neurological and/or Vertebrobasilar Complications in the Pediatric Chiropractic Patient

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Abstract — Reports suggest that chiropractic accounts for a large percentage of visits to alternative health practitioners. Moreover, pediatric patients represent a significant proportion of these visits. In light of this trend, it is important to evaluate the risk potential to the pediatric patient presenting for chiropractic care. This paper has reviewed literature concerning the occurrence of neurological and/or vertebrobasilar (N/VB) complications in patients receiving either specific chiropractic adjustments and/or non-specific manipulations of the spine. This topic was chosen due to the potentially severe consequences of N/VB complications, regardless of etiology. The current study was conducted in a quasi-meta analysis format to derive data for the period encompassing 1977 through the first quarter of 1998, using an eclectic compilation of data from three survey sources. Based on this information, the number of pediatric visits, extrapolated to also include the periods between 1966 and 1977, was estimated to be 502,184,156. Reports of the occurrence of N/VB complications in chiropractic pediatric patients were also investigated over the same time period by searching the scientific/clinical literature. The estimate of risk due to the pediatric chiropractic patient in this category of complication was estimated to be 4.0 x 10^-7% of all visits. Stated otherwise, there would be a chance of approximately 1 in 250 million pediatric visits that a N/VB complication would result. While some pre-existing conditions may predispose a pediatric patient to a higher incidence of such complications, the estimates derived in the present study are considered applicable to the general pediatric population. The estimates derived in the present study are intended to be an initial risk assessment. Since very few reports exist relative to the incidence of N/VB complications in children, additional studies will be necessary to confirm this risk estimate.

Key Words: adjustment, child, children, chiropractic, complication, injury, manipulation, neural complication, risks, neurological incident, vertebrobasilar incident.

Introduction

The objective of the present paper has been to create a starting point from which to evaluate the specific risk factors associated with neurological and/or vertebrobasilar (N/VB) complications in pediatric patients receiving chiropractic care. Presently, the chiropractic profession is woefully lacking in the self-assessment data required to derive such estimates. For example, there is no solicitation of periodic reports of morbidity or mortality statistics from chiropractic practitioners relative to patients under 18 years of age, even though there is a strong interest in chiropractic pediatric care.1 Additionally, there is no mechanism in operation designed to accurately ascertain the number of visits to chiropractors by juveniles, regionally, nationally or globally.

Kent has noted that there exists no current data regarding the total number of cervical adjustments and/or manipulations performed annually, or the total number of complications.2 Both of these figures are necessary to specifically assess risks. Kent has also noted that there have been no scientific studies that adequately control for other risk factors associated with neurological complications and/or vertebrobasilar incidents. It is apparent that this information will have to be forthcoming to most accurately assess the risk of complications occurring in the pediatric population under chiropractic care.
Without a serious effort to characterize the profession relative to these factors, it will remain speculative at best to derive numerical values representing risk. In recognition of the present limitations to such an endeavor, the current study was undertaken as an initial effort to provoke more interest in this issue, and to create a basis for future evaluation of the risks associated with pediatric chiropractic care. Although a number of risk factors could be considered, N/VB risk was selected for the present study due to the potential severity of complications associated with such an incident. Moreover, because of the potential danger to the pediatric patient, it was deemed likely that if this type of complication occurred, it would be readily reported in the scientific/clinical literature.

Since chiropractic often involves cervical adjustments, ranging from very low to moderate force, the concern for N/VB complications must be assessed, especially in the pediatric population. In this regard, most complications following cervical manipulation are due to disturbances of vertebral artery circulation, and the resultant ischemic damage to neurological components supplied by the vertebrobasilar system. Although it has been reported that vertebral artery dissection is an uncommon cause for stroke in children, current statistics reveal that the pediatric population is not exempt from this phenomenon. Reports show the annual incidence of strokes for children under 15 years of age, from all causes, to be 2.7 per 100,000 children. There is a strong correlation between the severity of spinal cord injury and the immaturity of the spine. Thus, it behooves the chiropractic profession to pay special attention to avoiding procedures that could induce stroke or other related complications in the pediatric patient, since the majority of complications attributed to spinal manipulative procedures are related to rotational manipulation of the cervical spine. This is significant when considering that the spine in the first decade of life is characterized by facets with shallow angulations, immature joints of Luschka, osseoligamentous structures that are lax, and cervical musculature that is immature in regard to strength. The essentially wedge-shaped vertebral bodies are prone to slippage between adjacent vertebrae because the facets are aligned horizontally, becoming vertical only with maturity (Figure 1). After the first decade of life, the spine gradually takes on the characteristics of the adult spine.

According to Webster, to minimize risk to the pediatric patient, all spinal adjustments should be of very low force and short amplitude. To this end, Schmitt suggests a change from manipulative methods, including any violent movements, to low force movements, which will help to minimize vascular complications. Webster also states that due to the lack of facet development rotational forces should not be used in pediatric adjusting procedures; all spinal adjustments in the pediatric patient should be performed in straight posterior to anterior or straight lateral to medial lines of correction. Additionally, Webster notes that vertebral contact points should only include primary centers of spinal ossification. In consideration of these complications reported in association with pediatric chiropractic care, it appears evident that adjusting procedures for the pediatric patient should exclude any maneuver that includes rotation, extension, and traction. It is anticipated that chiropractic practitioners, if not already doing so, will heed these cautions.

Risk assessment is also an important issue relative to the increasing utilization of complementary/alternative medicine, into which chiropractic has been grouped in the literature. Eisenberg et al., have suggested that in 1990 as many as 425 million visits were made to providers of “unconventional therapy,” exceeding the estimate of 388 million visits to all U.S. primary care (medical) physicians. Moreover, these authors also estimated that as many as 16,000,000 Americans utilized at least one of the 16 “unconventional therapies” evaluated, which included chiropractic.

While these numbers relate to adults (18 years or older), a 1994 study by Speigelblatt, et al., evaluated 1,911 responses from a self-administered questionnaire to parents of children visiting a university outpatient clinic in Quebec, Canada, relative to pediatric use of alternative medicine. Questionnaire analysis revealed that respondents matched the ethnic origin and level of

**Figure 1.** This drawing illustrates the relative angulations of facets, and development of joints of Luschka during various stages of maturation.
education of Montreal. The respondents also reflected similar sociodemographics of previous studies by the Quebec Government (OPQ survey)\textsuperscript{30} designed to evaluate the use of alternative medicine, suggesting that the results could be extrapolated to represent the overall population. Notable among the findings by Speigelblatt et al. was that 11\% of children of respondents had previously visited “alternative medicine practitioners.” Of the 11\%, the largest number (37\%) visited chiropractors. Based on the 1991 census of Quebec,\textsuperscript{27} there were 1,157,112 children in Quebec. This suggests that possibly as many as 47,094 children were likely to be visiting chiropractors at the time of the study. Based on a conservative estimate of five visits/child/year, it is reasonable to presume that approximately 235,470 pediatric visits could have occurred in Quebec, as a reflection of the Speigelblatt, et al. study. Although the present study is restricted to evaluating the potential N/VB risk relative to pediatric chiropractic visits in the United States, it is apparent from the information available from other countries such as Great Britain, Australia, and New Zealand, that a considerable number of children annually visit a chiropractor.

It is also important to recognize that the benefits arising from chiropractic care must be weighed against any potential risk. For example, in one study, 73\% of the parents of “sick” children reported that chiropractic care had been of benefit to their child.\textsuperscript{18} As well, children under chiropractic care have also been shown to demonstrate measurable improvement in conditions ranging from respiratory dysfunction\textsuperscript{19-21}, enuresis\textsuperscript{22-24}, and other problems.\textsuperscript{25-27} Consequently, based on the substantial numbers of visits to chiropractors by pediatric patients, as well as the benefits reported in the literature, it is necessary to estimate the potential risk of complications to pediatric patients presenting for chiropractic care, in assessing the risk/benefit ratio.

**Methods**

**Sources**

This investigation has utilized information primarily from three sources in a quasi meta-analysis format, which lacks the statistical comparisons suggested by Wolf.\textsuperscript{28} Statistical assessment was not possible due to the nature of the studies from which the data was drawn. For example, surveys by the Department of Health and Human Resources, and the American Chiropractic Association, as of 1990, did not consider the ramifications of response rate, reporting the actual number of survey instruments mailed, sociodemographics of the respondents versus nonrespondents, validation of the questionnaire itself, and other factors, all of which impact on the validity of the results. However, these surveys represented the only forms of data collection at those particular times. In spite of the limitations, this approach was chosen in order to obtain sufficient data to construct a conservative estimate of the number of pediatric visits to chiropractors in the U.S. The estimate was constructed over the same time period as the literature search (1966 through the first quarter of 1998). The three sources included (a) the 1990 Seventh Report to the President and Congress on the Status of Health Personnel in the United States,\textsuperscript{30} (b) the Summary of 1994 American Chiropractic Association’s (ACA) Annual Statistical Study,\textsuperscript{31} and (c) the 1994 Job Analysis of Chiropractic by State conducted by the National Board of Chiropractic Examiners.\textsuperscript{32} Although a 1995 ACA statistical survey\textsuperscript{33} has been published, it was not utilized as the methodology departed considerably from previous years by including non-members as well, which eliminated the ability to compare the data with previous years. Thus, while the approach to encompass non-members will ultimately yield a clearer statistical profile of chiropractic practice variables, the 1995 ACA survey lacked the specificity regarding important distinctions such as number of licensed chiropractors versus active chiropractors, differentiation of patient profiles by age (pediatric, as in previous ACA surveys limited this group to age 16 rather than through age 17) and average number of visits per week. Thus, the three sources described, collectively represented the best composite of information sufficient to meet the information requirements for this study.

Additionally, while information relative to chiropractic practice characteristics in other countries has been mentioned, it was not utilized in the calculation of N/VB risk to pediatric patients under chiropractic care in the U.S. Also, for comparative purposes, risk factors associated with certain medical procedures and other phenomena have also been considered (Table 1). While the present study is directed toward the pediatric patient, some relevant information dealing with the adult population under chiropractic care has been presented as well. The intention for providing this information has been to elaborate distinctions that must be made in evaluating the literature for reports of various types of complications attributed to chiropractic care.

**Categorization**

From the sources utilized, seven categories were developed to estimate the number of pediatric visits per annum (Table 2). These included: (1) The year in which the study was conducted (generally in survey format), (2) Interval between studies, (3) Number of chiropractors estimated to be in active practice, (4) Number of practicing weeks per year, (5) Total number of visits per year, (6) Percentage of visits reflecting pediatric patients (usually 17 years or younger), and (7) Number of visits at each study interval(s). During periods for which there was no reported data sufficient to derive information relative to the seven categories above, data from the previous year’s report were substituted.

Categories (1) and (2) were a composite of data available from the three sources. Category (3) was derived from information in the 1990 Seventh Report to the President and Congress. In regard to category (4), the working values were derived by averaging the years 1984–1994 from the ACA Summaries, and the 1990 Seventh Report to the President and Congress. Category (5) was derived by averaging data from the 1990 Seventh Report to the President and Congress\textsuperscript{33}, and the ACA annual statistical evaluation for the years 1984–1994. Category (6) was determined by averaging ACA survey estimates for the years 1984,\textsuperscript{34} 1986,\textsuperscript{35} 1988,\textsuperscript{36} 1990,\textsuperscript{37} 1991,\textsuperscript{38} 1992,\textsuperscript{39} 1993,\textsuperscript{40} and 1994\textsuperscript{41}; values from the Seventh Report to the President and Congress (1990), and values from the 1994 report from the National Board of Chiropractic Examiners.\textsuperscript{42}
<table>
<thead>
<tr>
<th>Risk (%)</th>
<th>Event</th>
<th>Type of Estimate</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>Incidence of adverse drug event in hospitalized patients in the U.S.</td>
<td>Estimated for the U.S. population.</td>
<td>Anderson, 1992</td>
</tr>
<tr>
<td>10</td>
<td>Incidence of psychosis due to corticosteroid therapy.</td>
<td>Estimated for all individuals taking steroids.</td>
<td>Havey, 1984</td>
</tr>
<tr>
<td>7-10</td>
<td>Incidence of hepatitis due to blood transfusion.</td>
<td>Estimated for the U.S. population.</td>
<td>Stehling, 1986</td>
</tr>
<tr>
<td>3.76</td>
<td>Incidence of nosocomial infection in hospitalized patients in the U.S.</td>
<td>Based on records compiled by NCHS.†</td>
<td>C.D.C., 1991</td>
</tr>
<tr>
<td>0.7</td>
<td>Incidence of esophageal perforation during anterior approach to cervical spine surgery.</td>
<td>Estimate based on literature review.</td>
<td>van Berge, Henegouwan et al., 1991</td>
</tr>
<tr>
<td>0.3-0.9</td>
<td>Incidence of death due to cervical spine surgery.</td>
<td>Estimate based on 5 years survey data from the Spine Research Society</td>
<td>Graham, 1989</td>
</tr>
<tr>
<td>0.057</td>
<td>Incidence of seizure due to DPT Vaccine.</td>
<td>Estimated based on U.S. records compiled by VAERS. ‡</td>
<td>C.D.C., 1994</td>
</tr>
<tr>
<td>0.012</td>
<td>Incidence of breast cancer due to mammography.</td>
<td>Calculation based on absolute risks. ‡</td>
<td>Bushong, 1984</td>
</tr>
<tr>
<td>0.005-0.015</td>
<td>Incidence of death from radiation-induced malignancy due to x-ray exposure of 1-RAD.</td>
<td>Calculated based on absolute risks. ‡</td>
<td>Bushong, 1984</td>
</tr>
<tr>
<td>0.0025-0.01</td>
<td>Incidence of death due to radiocontrast media.</td>
<td>Estimate based on data from 10 mil. Injections given in the U.S.</td>
<td>Atkinson &amp; Kaliner, 199</td>
</tr>
<tr>
<td>0.001-0.0008</td>
<td>Incidence of death due to allergic reaction to anesthetic agents.</td>
<td>Estimate for patients undergoing anesthesia.</td>
<td>Anderson, 1992</td>
</tr>
<tr>
<td>0.00002-0.00008</td>
<td>Incidence of serious neurologic/ vertebrobasilar complications due to spinal manipulations (adults).</td>
<td>Estimated risks.</td>
<td>Gutmann, 1995</td>
</tr>
</tbody>
</table>

† NCHS is the National Center for Health Care Statistics of the C.D.C.
‡ VAERS is the Vaccine Adverse Event Reporting System of the C.D.C.
‡ (Number of incidents /106 persons/rad/ yrs) * (Number of procedures performed/rad/ yrs)
The following formula was used to derive each periodic estimate of pediatric visits:

\[
\text{Category (2) x (3) x (4) x (5) x (6) = (7)}
\]

The total number of periodic estimates was then summed (Table 2). In order to construct the most meaningful estimate of pediatric chiropractic visits, it was necessary to construct an estimate which covered approximately the same time span over which the literature search was conducted; i.e., between the years 1966-first quarter of 1998. In that regard, essentially no survey data, representative of the chiropractic profession as a whole, was available between 1966 - 1977 (approximately one decade). Thus, data for this period was, for the most part, carried over from data derived from the three sources covering the period of 1978 through the first quarter of 1998. However, it was deemed appropriate to reduce category 3 (No. of active chiropractors) by 66.7%, as this change closely approximated the average increase in this category for the decade between 1978 and 1988 (Table 2).

### Literature Search

A Medline search of the literature from years 1966–first quarter of 1998, using the Medical Subject Heading (MeSH) keywords: chiropractic, adjustment, manipulation, complication and child /children was performed to find any reports of adverse events following chiropractic care in the pediatric population. Additionally, the database of Mantis was searched using the same subject headings from 1970, representing the origin date of the database, through the first quarter of 1998 (32.25 yrs). References provided by the articles found were also searched by citation index for other studies reporting pertinent information regarding risk assessment relative to the pediatric population. Reports of injury to children as a result of treatments not performed by chiropractors were not considered.

### Results

The literature search between 1966 and the first quarter of 1998 included only two reports of N/VB complications. These were found in the Medline and Mantis databases of scientific and clinical literature, one in 1978 and the other in 1992.

In the first of the two studies involving pediatric patients, Zimmerman et al.,\(^4\) reported a case of a seven year old boy suffering from headaches and transient cranial nerve deficits after vigorous gymnastics and repeated manipulations of the cervical spine by a chiropractor. The author goes on to hypothesize that passive stretching of the cervical spine during chiropractic maneuvers may have lead to vertebral artery thrombosis. However this theory is speculative, lacking any evidence to support the claim. Additionally, it cannot be determined what role, if any, “vigorous gymnastics” played in the child’s condition. It is noteworthy, however, that trauma induced by athletic injuries has been reported to cause occlusive vertebral arterial flow.\(^4\)

In the second of the two studies involving pediatric patients, Shafrir and Kaufman (1992)\(^4\) discussed the case of a child with a spinal cord tumor (astrocytoma) who presented to a chiropractor complaining of torticollis (Wry Neck). However, reports

### Table 2. Estimated Number of Chiropractic Visits made by Pediatric Patients in the United States from 1966 to 1998. †

<table>
<thead>
<tr>
<th>Year of Estimate(^a)</th>
<th>Interval (Yrs)(^a)</th>
<th>No. of Active Chiropractors</th>
<th>Practice Activity(^b) (Wks)</th>
<th>Visits (Wk)(^b)</th>
<th>Pediatric Patients(^c) (%)</th>
<th>Total Visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>1.0</td>
<td>23,400</td>
<td>50.4</td>
<td>127.0</td>
<td>9.0</td>
<td>13,480,085</td>
</tr>
<tr>
<td>1979</td>
<td>1.0</td>
<td>23,400</td>
<td>50.4</td>
<td>127.0</td>
<td>9.0</td>
<td>13,480,085</td>
</tr>
<tr>
<td>1980</td>
<td>4.0</td>
<td>25,600</td>
<td>50.4</td>
<td>127.0</td>
<td>9.0</td>
<td>58,989,772</td>
</tr>
<tr>
<td>1984</td>
<td>4.0</td>
<td>31,500</td>
<td>50.4</td>
<td>120.1</td>
<td>9.0</td>
<td>68,641,474</td>
</tr>
<tr>
<td>1988</td>
<td>2.0</td>
<td>39,000</td>
<td>50.4</td>
<td>120.1</td>
<td>9.0</td>
<td>42,492,341</td>
</tr>
<tr>
<td>1990</td>
<td>4.0</td>
<td>41,500</td>
<td>50.4</td>
<td>125.7</td>
<td>9.0</td>
<td>94,649,083</td>
</tr>
<tr>
<td>1994</td>
<td>1.0</td>
<td>41,500</td>
<td>50.4</td>
<td>125.7</td>
<td>9.0</td>
<td>23,662,271</td>
</tr>
<tr>
<td>1995-1998</td>
<td>3.3</td>
<td>41,500</td>
<td>50.4</td>
<td>127.0</td>
<td>9.0</td>
<td>78,893,064</td>
</tr>
</tbody>
</table>

a. Data derived in part from Seventh Report to the President and Congress.\(^1\)
b. Data derived in part from Summary of 1994 ACA Annual Statistical Study.\(^2\)
c. Data derived in part from Job Analysis of Chiropractic by State.\(^3\)

† See Methods for estimation calculations.
of torticollis associated with astrocytoma tumor are rare.\textsuperscript{46,47} Following chiropractic care, the child became quadriplegic, allegedly as a result of cervical manipulation. While astrocytoma has been reported to be a congenital condition in numerous medical publications,\textsuperscript{64-65} there exists no evidence to support the claim of a complication arising as a result of chiropractic care. Once again, this report is speculative at best lacking any scientific evidence to support the claim.

Risk Assessment

Table 1 depicts risk assessments from the scientific/clinical literature reporting a range of topics common to the western medical model. Risk assessment for N/VB complications in the pediatric chiropractic population was derived by dividing the total reported cases by the total number of visits that could be conservatively constructed over the same time period during which the literature was searched. In that time period a total of 502,184,156 visits were estimated (Table 2). In the scientific/clinical literature, two reports of pediatric neurological complications were reported to be associated with chiropractic "manipulations." Thus, the risk associated with chiropractic care, is at best estimate (number of reported complications/total number of visits), calculated to be 4.0 x 10\textsuperscript{-7} % per visit. Stated otherwise, there would be a chance of about 1 in 250 million pediatric visits that a N/VB complication would result.

Discussion

Based on studies of associated risks in the adult population under chiropractic care by Dabbs & Larette,\textsuperscript{39} Dorak,\textsuperscript{40} Gutmann,\textsuperscript{64} Cyriax\textsuperscript{65} and others,\textsuperscript{64-66} the incidence of stroke from cervical manipulation has been estimated to be in the range of 1-3 per million cervical manipulations and/or adjustments. Terrett has determined from the literature spanning 1934 - 1998, that only fifty reports of vertebrobasilar stroke can be attributed to chiropractors.\textsuperscript{64} Considering all reports of vertebrobasilar complications from Terrett, as well as reports by Shafrir and Kaufman, and Zimmerman et al., there are a total of 52 reports of neurological and/or vertebrobasilar complication, of which two are related to the pediatric patient.

In regard to the adult patient population, Terrett's review of the literature found that among 78 cases of vertebrobasilar stroke following putative "chiropractic" manipulation, that 35.89% were not performed by chiropractors. These other "spinal manipulators" included a kung-fu practitioner,\textsuperscript{44} an Indian barber,\textsuperscript{47} a blind masseur,\textsuperscript{68} assorted medical doctors,\textsuperscript{48-84} nurses,\textsuperscript{48-86} osteopaths,\textsuperscript{48-86} various physiotherapists,\textsuperscript{48-102} wives,\textsuperscript{101,102} and people doing self-manipulation.\textsuperscript{103-107} It is unfortunate that such inaccurate reporting occurs as it misleads the scientific community, and the general public, as to the risks associated with chiropractic care.

The low number of published reports concerning N/VB complications in regard to the pediatric population requires comment. As mentioned, the search covering 32.25 years of scientific/clinical literature resulted in only two reported cases of childhood injury attributed to chiropractic care. There are several possible reasons for this. First, research contributions to the scientific/clinical literature concerning pediatric chiropractic care are in the fledgling stage, as the profession has only recently celebrated its first centennial.\textsuperscript{108} Secondly, perhaps the incidences of complications in the areas addressed in this study are indeed rare. Third, perhaps reports have been published in journals, or periodicals, not indexed. If this were the case, it would be possible to overlook such reports. Moreover, it may be that such complications occur, but are not reported in any form of publication, but may be archived in hospital, or other records.

Because this possibility exists, a thorough search of non-disseminated, but public, records will eventually have to be conducted, preferably on a continuous basis. For example, where possible, medical records of pediatric patients sustaining N/VB complications should be studied to ascertain if any link could be established to prior chiropractic care. Studies of this type should be conducted on a periodic basis. Moreover, the necessity to ascertain the number of visits, adjustments, and/or manipulations must also be documented to calculate risk factors. As revealed in the present study, it was necessary to be eclectic in deriving the information necessary to estimate the number of pediatric visits. Because different surveys have unique objectives, it is apparent that the results are not directly comparable. This study makes it apparent that some concentrated effort must be exercised to gather the data required for risk assessment in one survey format, either by one organization, or shared by several following the same methods.

This level of professional inquiry is not only the responsibility of the chiropractic discipline which views itself as extremely safe, but it is essential in terms of advising patients, or guardians, of the potential for harm (even if it is remarkably small). It is encouraging to recognize that so few reports of complications (concerning adults or pediatric patients) associated with chiropractic care exist in the scientific/clinical literature. However, as described above, that level of reporting alone cannot be taken as the only index of verifying the safety of chiropractic care for the pediatric patient. Alternative to this viewpoint is the logical assumption that if indeed N/VB complications represented a frequent pattern, reports of such incidents would be expected to be found in the widely disseminated literature.

Regardless of the reasons which account for the few reports of N/VB complications in the pediatric population under chiropractic care, epidemiological studies will be required to document practice statistics concerning the number of pediatric visits, adjustments, and complications. To date, these have yet to be performed by those in the chiropractic profession, or by others studying the chiropractic profession in particular. Nevertheless, given the limitations of the literature pertaining to chiropractic care, specifically in regard to pediatric patients, the objective of the present study was to provide an initial estimate of risk of the occurrence of N/VB complications based upon what data is available. This has been done in full recognition that this first published estimate will require further studies by the research community to document its accuracy.

In this regard, it is suggested that organizations interested in reporting the most accurate estimates of risk begin the process by developing questionnaires that provide the necessary information relative to accurately arrive at such estimates. To date, this has not been the case. Most reports have lacked methodological
sophistication, including government surveys and those conducted by chiropractic organizations.

Although other risk factors were presented in the present study for comparative purposes (Table 1), caution must be exercised in either criticizing the higher risks associated with other disciplines, or boasting the safety of chiropractic pedi-
atric care. In fact, it will be necessary through future data gath-
ering efforts to demonstrate more conclusively that the con-
cept of safety espoused by chiropractic is not an illusion creat-
ed by the lack of proper reporting of incidents, if and when they do occur.

Equally important to risk is the concept of risk/benefit ratio. As previously mentioned, when considering the use of any health care procedure, the expected benefit must be weighed against the inherent risks as well as the consequences of foregoing said procedure. Based on this axiom, chiropractic care relative to neurological and/or vertebrobasilar complications appears to present little risk to the pediatric patient when compared to cited reports related to benefits of chiropractic care. While some pre-existing conditions such as Down’s syndrome, cardiac diseases, arteritis, meningitis, clotting abnormalities, various arthritic conditions as well as symptoms of vertebrobasilar insufficiency may predispose the pediatric patient to a higher probability of neurological and/or vertebrobasilar complication, the estimate provided is considered applicable to the general pediatric population. It will be necessary, and of interest, to re-evaluate this estimate as more data is acquired within larger groups of patients, measured under conditions of appropriate methodology applicable to survey research.

Summary and Conclusions

1. Based on the prevalent scientific/clinical literature spanning the last 32.25 years, there are only two reported cases related to pediatric complications and chiropractic care, which fit into the category of N/VB complications.

2. Based on an eclectic summation of data derived from three sources, a conservative estimate of the number of pediatric visits to chiropractors in the U.S. over the same time span amount to 502,184,156.

3. This information provides and estimate of the risk of a N/VB complication occurring in one out of approximately every 250,000,000 visits, or 4.0 x 10^-7 %.

4. There is a need for serious efforts from the chiropractic profession, and related disciplines to solicit ongoing information generating sufficient data to derive more definitive estimates of risk, especially in regard to the pediatric chiropractic population.

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