

# JCCP

## JOURNAL OF CLINICAL CHIROPRACTIC PEDIATRICS



VOLUME 20 • NO. 1 • JULY 2021

PUBLICATION OF THE COUNCIL ON CHIROPRACTIC PEDIATRICS  
INTERNATIONAL CHIROPRACTORS ASSOCIATION

# JCCP JOURNAL OF CLINICAL CHIROPRACTIC PEDIATRICS

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Publishing Offices:

ICA Council on Chiropractic Pediatrics  
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# GUIDELINES FOR AUTHORS

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# JCCCP JOURNAL OF CLINICAL CHIROPRACTIC PEDIATRICS

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The *Journal of Clinical Chiropractic Pediatrics* welcomes original and scholarly manuscripts for peer-review and consideration for publication. Topics must pertain to the field of pediatrics which includes pregnancy and adolescence. Manuscripts should not have been published before or submitted to another publication.

## The following will be considered:

**Case Reports and Case Series** – presentations of individual or groups of cases deemed to be of interest to the professional and scholarly community.

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**Commentaries** – presentations of opinion on trends within the profession or current events, pertaining to pediatric and adolescent chiropractic care.

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All manuscripts deemed appropriate for publication by the editor will be sent blind to at least two reviewers. If the manuscript is accepted, the author will be notified. If substantive changes are required, the paper will be returned to the author and the author must re-submit a clean copy of the revised manuscript. Author will be given a tentative date for publication if accepted. Manuscripts not accepted for publication will be returned to the author without comment.

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- All submission components must be submitted electronically.
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- Title page
- Abstract
- Manuscript
- Acknowledgements
- References
- Tables
- Figures

### Title page

- Title of article—**ONLY CAPITALIZE FIRST LETTER OF FIRST WORD**
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- Number of tables
- Number of figures
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**Abstract—not to exceed 250 words.** It may be structured or unstructured. Structured abstracts usually include the following sections: Purpose, Methods (include study design in this section), Results, Conclusion. For case reports and case series, see document, "Instructions for Case Reports and Case Series."

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Manuscript length will vary with the type of article; in general, manuscripts are expected to be 1,500-3,000 words in length, excluding references, tables and figures. These may vary with the type of article. For case reports and case series, see, "Instructions for Case Reports and Case Series." In general, for manuscripts reporting research studies, the order of components is:

- Introduction: succinctly describe the relevant literature supporting the need for the study.
- Methods: describe the methods used to accomplish the study, in detail sufficient to allow the informed reader to evaluate their appropriateness.
- Results: present the results of the study, without interpretation.
- Discussion: describe limitations of the study; interpret results; compare results to those of other relevant studies; discuss value and implications of the study.
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# Instructions to Authors – Summary

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- Use “table” function in Word to construct tables; do NOT use tab or space keys to form columns and rows. Use table “normal” style to construct table. Do not insert vertical lines between columns; do not use grids. Place horizontal line under table title and at end of table, separating the table from any footnotes. You may place horizontal lines under headings in the table for clarity.
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- Place figure title and legend on page with the figure.
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## Reference format—examples

- *Journal article*: Jefferies LJ, Milanese SF, Grimmer-Somers KA. Epidemiology of adolescent spinal pain: A systematic overview. *Spine* 2007;32:2630-2637.
- *Book*: Task Force on Community Preventive Services. Guide to Community Preventive Services. New York: Oxford University Press; 2005.
- *Website/webpages*: Author. Title. Name of website. URL. Date of publication. Updated date (if applicable). Date accessed. Example: Fox F. Promoting and sustaining collaborative networks in pediatrics. Pew Research Center. <http://www.pewinternet.org/2013/06/14/promoting-and-sustaining-collaborative-networks-in-pediatrics/>. Published June 14, 2013. Accessed September 3, 2017.

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# Instructions for Case Reports and Case Series

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## Abstract

The abstract should be 250 words or fewer. It may be either structured or unstructured. If structured, use the same sections as described below for the components of the report (Introduction, Case Presentation, Intervention and Outcomes, Discussion).

## Case Report Components

- **Introduction:** State why this case is unusual or important.
- **Methods:** describe the search engine and key words used to review previously published literature on the subject
- **Case presentation:** Provide a brief summary of the pa-

tient's presenting demographics, other relevant characteristics, complaint(s) and related symptomatology.

- **Intervention and outcomes:** Describe the course of treatment, including frequency and duration, and summarize the patient's clinical outcomes, using recognized outcome measures if possible. Include whether informed consent was obtained and if there were any adverse events reported.

- **Discussion:** Succinctly state the important aspects of the case, in terms of its implications for patient care in general, or for specific patient populations or conditions. You may also compare/contrast the case to other cases in the published literature. Be cautious about overstating the importance/implications of your case.

## Evidence-based Case Report Instructions

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An Evidence-based Case Report (EBCR) is NOT the same as a traditional case report. The EBCR focuses on an answerable clinical question, how it was explored in the search, appraising the results and how it applies to the case, along with the integration of this information with the patient interaction. The final stage in this process is to audit the results.

These are the steps to include:<sup>1,2</sup>

- Brief summary of the chief complaint: 50-100 words
- Briefly describe the clinical case: 250-400 words
- Explain how you developed the clinical question: 200-300 words
- Explain your search for evidence (key words, databases used, number of articles retrieved): 50-100 words
- Evaluate the articles retrieved: critically appraise the evidence for validity and relevance: 200-300 words
- Describe how you made your clinical decision by applying these findings to the case, including how you considered and integrated the patient's preferences and values: 250-400 words
- Evaluate your performance: 50-100 words

1. Heneghan C, Badenoch D. *Evidence-based Medicine Toolkit*, 2nd ed. Oxford, UK: Blackwell Publishing, 2006.

<http://onlinelibrary.wiley.com/doi/10.1002/9780470750605.index/summary> (download pdf of "all chapters" for free copy of the publication)

2. Jones-Harris AR. The evidence-based case report: a resource pack for chiropractors. *Clin Chiropr* 2003;6 73-84. (download for free from [www.chiro.org/cases/FULL/Evidence-based\\_Case\\_Report.pdf](http://www.chiro.org/cases/FULL/Evidence-based_Case_Report.pdf))

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Iran J Pediatr. 2010 Sep; 20(3): 261—268. Evidence Based Medicine in Pediatric Practice: Brief Review

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3446038/>

J Can Chiropr Assoc. 2014 March; 58(1): 6—7. **Evidence-based case reports**

<http://pubmedcentralcanada.ca/pmcc/articles/PMC3924510/>

3 BMJ. Vol 7, Issue 3, 2002, **Evidence-Based Medicine in Practice: EBM Notebook**

<http://ebm.bmj.com/content/7/3/68>

# Is chiropractic care for children being sabotaged by its own research elite?

By Joyce Miller DC, Ph.D.

Children are a significant part of many chiropractor's practices. There is even a scientific journal dedicated to their practice. According to the International research,<sup>1</sup> 94% of chiropractors treat children who comprise from 5-32% of their practice. There were 103,469 chiropractors in the world in 2017.<sup>2</sup> If the average chiropractor treats 110 patients per week, then 6-35 patients per week x 50 weeks of the year, the extrapolated number of children patients range from 30 million to 170 million/year world-wide, not insignificant numbers. In large outcome studies, parents report excellent clinical outcomes,<sup>3,4</sup> and high rates of parent satisfaction.<sup>3,4,5</sup> There is even some modest evidence of cost-effectiveness.<sup>3</sup>

It is clear that parents often seek chiropractic care for their children.<sup>6,7</sup> The safety of this care has likewise been well documented.<sup>8</sup> There is also no question that research regarding the effectiveness of this care is limited, not least because health care research into the pediatric patient is complex, costly and rare. These simple truths leave chiropractors in the arena of moderate demand and insufficient evidence. It might be expected in this environment that experienced researchers, familiar with the professional issues, might use their expertise to provide more and better research to support the needs of this unique, vulnerable and needy patient group. Instead, it almost seems as there is an impetus to attack the service provided and reiterate all of its weaknesses, already well recorded.

A case in point is the recent publication of the article produced by 50 researchers from 8 countries on a "jolly meetup" (my term) called a "global summit" (their term) designed to critique non-MSK chiropractic research for pediatrics.<sup>9</sup> Their inevitable conclusion was insufficient evidence. The summit authors actually stated that these conclusions had been reported six times before, and thus, the outcome inevitable. They seemed to be setting up a straw man in order to knock it down. One wonders why it took a team of approximately 50 prominent researchers to review and state the same conclusion that has been held for more than a decade. The evidence-base for chiropractic care for children is inconclusive and more evidence is needed. In an article specifically discussing the lack of evidence for non-MSK childhood conditions, I myself, a chiropractor, along with Dr. Randy Ferrance, a Medical Director of Hospital Based Quality stated that specific lack of evidence in 2010, understanding we were not the first or the last to make that statement.<sup>10</sup> There simply and clearly is insufficient evidence for non-MSK disorders (and one may as well include MSK disorders) in the pediatric population. That

conclusion did not differ or advance or serve any credible purpose that thinking and working students and clinicians have not stated multiple times before. Their goal seems to have been to destroy the clinical profession. It is not news that more research is needed. The same can be said for virtually all aspects of chiropractic care and in fact, much of medical care. The *British Medical Journal* recently reported that a mere 18% of medical decisions were based on high quality evidence base.<sup>11</sup>

In the real world of health care, workers must commit to giving the best and safest health care possible with an insufficient evidence base. Providing safe and effective care in gray areas with insufficient evidence should be applauded, not denigrated. And those with the connections and expertise to do the high-quality research should perform the necessary research rather than simply review and find wanting the past research. It is easy to complain and less easy to provide the research.

Intriguingly, it had previously been suggested by one of the same prominent researchers that child health cannot be ignored, that it may impact long-term quality of life and that chiropractors are well placed to assume the responsibility for the MSK health of children.<sup>12</sup> Although there are a wide range of childhood complaints presented to chiropractors, finding the MSK component has been the goal of chiropractors for time immemorial as the MSK system is the point of entry for manual therapy. In short, chiropractors are musculoskeletalists. This is a term that I coined years ago to help my students understand our entrée to the human body. Chiropractic is a health profession concerned with the diagnosis, treatment and prevention of mechanical disorders of the musculoskeletal system.<sup>2</sup> There is an emphasis on manual therapy including spinal adjustment and other joint and soft-tissue manual treatment.

The process that the researchers chose was to lump all non-MSK conditions together, a non-sensical thing to do from a clinical perspective. Some conditions (often mis-named because no one knows the real etiology, such as infant colic) can be seen as a soft tissue condition, or as a result of autonomic dysregulation. When treated by chiropractors, it is treated through the MSK system. The same is true for the other conditions reviewed. Much of the time, the treatment was not intended to target the complaint (perhaps constipation or enuresis), but to normalize the human body around the complaint. Even the authors in question concede that "Alleviating pain and discomfort originating from the

musculoskeletal system can be an important contribution to the care of people with multiple co-morbidities.”<sup>9</sup> There is medical evidence that touch alleviates infant’s pain.<sup>13</sup> Parents do understand that chiropractors are musculoskeletalists. They do bring MSK conditions to chiropractors. They also understand that chiropractors are doctors and when not helped by medical doctors, they try the chiropractor. As a pediatrician once told me after presenting her neonate for treatment, “what you guys [chiropractors] do is so helpful because it normalizes and creates comfort throughout the body so that all the systems can improve function. In a baby, when one thing works better, (e.g., sleep) everything works better.”

One must wonder why there was an expensive and concerted effort of knowledgeable colleagues of the profession to pointedly and in a repetitive move negate the work and efforts made by the profession to slowly advance the knowledge base and evidence base for chiropractic care for the pediatric population. The need for further damnation of the professional work was not explained by the authors, except that the previous times (and they named six) that this same research was done, it had, “not had an obvious impact on health care and clinical policies.”

At best, the work was unnecessary as it has all been said before; at worst, the work was meant to be divisive and filled with condemnation and soul-destroying for the work of the practitioner. Even the authors agreed that the previous consensus in the profession was a lack of evidence for non-MSK treatment for children. It remains unclear why the effort and expense were made to repeat what has been known all along: More and better research is needed! More and better condemnation of the research that has been done and previously reviewed and found insufficient is not needed.

Further, one wonders how well these esteemed and respected researchers understand their own field of study. For example, they noted that there were no RCTs in the area of chiropractic care for sub-optimal breastfeeding. Certainly, since they are all active in the arena of chiropractic research, they would understand that babies with this condition cannot be randomized to a non-treatment (control) group because the life-long loss of the benefits of breastfeeding would be too great. Thus, allocating newborns to a non-

treatment arm of the trial would be totally unethical. This comment made me wonder if they even understood some of the real issues that plague pediatric research. Were they even in the position to make such a comment?

Is it acceptable for the elite researchers in any profession to take a cheap shot at their colleagues? What are the benefits? What are the risks? What were the costs? What are the real costs? A loss of reputation for those involved? A loss of reputation for the entire profession?

After I began this editorial comment, I came upon an article that I recommend to all practitioners, written by dissenting members of the “summit.”<sup>14</sup> Their thoughtful discussion will give you the scientific realities behind the issues brought up in the “Summiteers” original work. As always, don’t take my word for what these articles state; read both of them yourself and make your own conclusions. I am merely giving you my opinion with this editorial and it is not the opinion of the other editors or the *Journal* itself.

With the difficulty and expense of RCTs, it is unlikely that we will be able to target all the specific sub-groups that present for care in order to unequivocally declare effectiveness. This doesn’t make chiropractic care for the problems of infants and children any less needed. It doesn’t take away parental requests to obtain help with the routine problems of infants and children. It simply means that we must perform high quality risk/benefit analyses before taking the cases, rule out any potential pathology and enroll all cases into outcome studies so that the parents can state any benefits (or not) that accrue, along with satisfaction levels and opinions on cost-effectiveness (and continue to support high level research as well). This is patient-centered care required by all practitioners and collection of outcomes is known as Real World Data, a practical method to develop research with external validity.<sup>15</sup>

One wonders why the researchers, instead of doing practical work to support the profession, spent time and money re-hashing work already widely accepted. Why not do something with that investment to be helpful and give guidance on what can be done to assist professionals, parents and patients? Simple condemnation is undermining of the caring and concern of a real-world professional practice.

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# Parent reports of chiropractic care for children: A preliminary report from 22,043 parents in Australia

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By Dr Genevieve M Keating, PhD in Infant and early childhood development  
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Keywords: chiropractic care, consent, evidence-based practice, evidence-based medicine, satisfaction, colic, crying, musculoskeletal, posture, torticollis, patient-centered care, person-centered care.

**Editor's Note:** We found the following "Short Report" by Dr. Genevieve Keating sufficiently important to provide an abstract for clinicians ahead of full publication.

## Introduction

This short report is an extended abstract from a major study done in Victoria, Australia in 2020. This preliminary report is an introduction to the full report, which is in process. However, the information is so important for the profession that those on the front lines daily deserve an early warning. Watch for the full paper coming soon.

## Background

The government of the state of Victoria in Australia conducted a review of chiropractic care for children under 12 years of age. Part of the review included a public survey of parents who had accessed chiropractic care for their child under 12 years of age in the last ten years. A second survey was for the public who had not accessed chiropractic care for a child under 12 years of age but had an opinion regarding the appropriateness of chiropractic care. The author was a member of the review panel and was granted permission to analyze the de-identified data for her PhD dissertation to study and report the scope, breadth, and meaning of the large data set. The review was initiated in response to significant political pressure regarding misplaced concerns that chiropractic care was dangerous and harmful. The Victorian health minister opened the survey with the following statement, "Now is the time for parents who have experienced the dangerous practice of child spinal manipulation to have a say and share their story. We won't rest until babies are protected from practices we know to be harmful, and that we can be sure children under 12 are not being exposed to harm. The risks of spinal manipulations on newborn babies outweigh any benefits, but more needs to be known about children under 12. We need a national approach and that may involve changes to the law if necessary."<sup>1</sup>

## Method

This study was a secondary analysis of the de-identified data collected for the review during a four-week period from the 22nd of May to the 21st of June 2019. It was a mixed methods study of parents' experiences of chiropractic care for their

children in Australia. The primary goal of the study was to give voice to the parents regarding their experiences of chiropractic care for their children. The questions addressed were: why do parents seek chiropractic care for their children, what reasons do parents cite as their reasons for seeking chiropractic care, who else do they consult for these concerns, how satisfied were parents (or their children) with the care they received, how satisfied were parents with the information provided about the care they received, what are the themes and experiences embedded in the parent's narrative? The purpose of the secondary analysis of data was to understand parental experiences and perspectives of chiropractic care for their children and to quantify their level of support for chiropractic care for children.

## Results

There were 22,043 responses from parents who had accessed chiropractic care for their children under 12 years of age in the last 10 years. An additional 4,558 responses were from interested community members who had not accessed chiropractic care for a child under 12 years in the last ten years but have an opinion about chiropractic care.

Families who accessed chiropractic care did so for various reasons, the majority for musculoskeletal concerns (48%); and concerns relating to development (40%). Much of this care (77.5%) was provided to children who were also under the care of other health professionals for their presenting concerns. The other health professionals consulted were primarily general practitioners, maternal and child health nurses, and medical specialists. The parents felt well informed and involved in the decisions about the care (99.14%). According to the parents, 98.4 % said they noticed, or their child reported, an improvement after the care was provided. The parents were overwhelmingly (99.6%) of the opinion that chiropractic care benefitted their child.

## Qualitative findings

A thematic analysis of the open text questions was performed. The most common themes within the parent

responses were as follows: there were over 13,000 references regarding an improvement in the child's general health or wellbeing, over 7,000 references to an improvement in pain, and 5,379 references to sleep improvement.

### **Discussion**

A large, well-conducted government survey such as this provides good evidence of the use and results of chiropractic care for children and corroborates other studies that support the safety and effectiveness of chiropractic care for children. Large data sets such as this provide "Real World Data" which has been suggested as the type of evidence most useful for routine clinical settings. Although higher level studies such as randomized controlled trials are ideal in certain circumstances, they provide evidence with internal validity only. A study such as this one provides evidence of external validity, that is; it applies to what occurs in wide

and broad real-world clinical practices, making it applicable to routine practice.

Because of the voluntary nature of parental reports regarding benefits for sleep disorders, further and higher-level studies should be conducted into chiropractic care for childhood sleep issues.

### **Conclusion**

This is the largest known parental response survey regarding chiropractic care for children in the world today. There is good evidence that parents utilize and appreciate chiropractic care for their children and wish to maintain open access to this care. Parents were very satisfied with their involvement in decisions about chiropractic care and reported very high levels of satisfaction with the outcomes of such care.

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# A chiropractor's dream: the Teen Summit and the Green Hub Project for Teens

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## ABSTRACT

Inspired by a chiropractor and conceived initially as the Teen Summit, the Green Hub Project for Teens is a local community project that focuses on the improvement of teenagers' (13-18 year olds) mental health. It resides in Milford, Surrey, UK, in a tranquil, walled garden, designed to support the wellbeing of teenagers' mental health by providing a safe and welcoming environment in which they can engage in social and therapeutic horticulture.

In partnership with the NHS (National Health Services), the Green Hub Project has been designed to provide a resource for local healthcare providers to refer emotionally challenged teenagers to enjoy nature while gardening alongside and interacting with skilled volunteers and others of their own age.

The design of the project was to achieve positive, measurable goals and outcomes for teens' mental wellbeing including encouraging self-acceptance, active lifestyles, positive social interaction, inclusion and respect for diversity, and the development and application of a range of learned life skills (teamwork, responsibility, planning and follow through, creativity, problem solving, affirming and supporting others and conflict resolution).

**Key words:** Horticulture therapy, Adolescent Mental Health, Teen Summit, Green Hub Project for Teens, Pediatric Chiropractic.

## Introduction

Mental health problems have been shown to be on the rise among children and adolescents (Box 1). In a fast-paced world of constant demands, peer pressure and political chaos (even before the immediate and long-term ramifications of the COVID-19 pandemic lockdown have been calculated), stress has taken a toll on teenagers' mental health and has negatively impacted their lives and in some cases, ended in tragedy.

Key findings of an NHS report looking at the mental health of children and young people in England in July 2020, and changes since 2017.

- Rates of probable mental disorder have increased since 2017. In 2020, one in six (16.0%) children aged 5 to 16 years were identified as having a probable mental disorder, increasing from one in nine (10.8%) in 2017. The increase was evident in both boys and girls
- The likelihood of a probable mental disorder increased with age with a noticeable difference in gender for the older age group (17 to 22 years); 27.2% of young women and 13.3% of young men were identified as having a probable mental disorder in 2020.<sup>1</sup>

Box 1. Mental Health of Children and Young People in England, 2020 Wave 1 follow up to the 2017 survey.<sup>1</sup>

In Great Britain, the NHS mental health services for teenagers and children, despite being staffed by dedicated public servants, students and volunteers, has been strained to provide intervention for all the expressed needs during the pandemic.<sup>2</sup> The waiting lists for services are now months long, leaving struggling teenagers and their parents with nowhere to turn. An interim support solution was critical.

## Where it all began: The Surrey Teen Summit

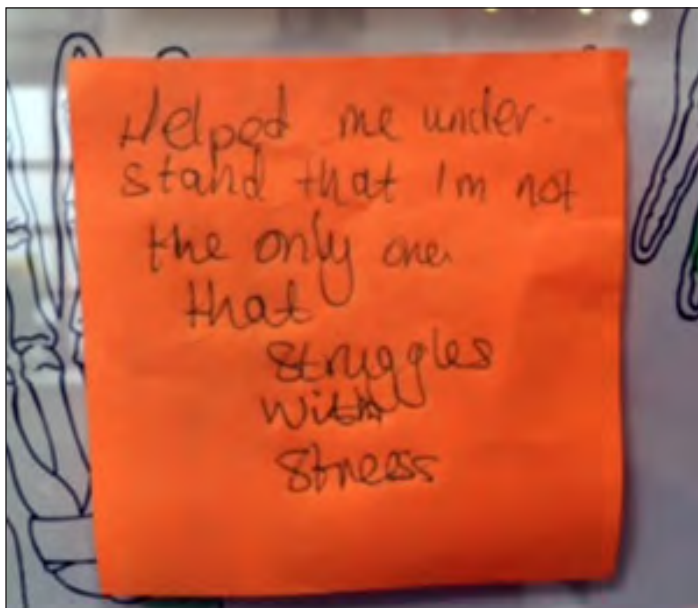
In clinical practice, chiropractors frequently observe how the body-mind connection is intrinsically linked, and that pain, stress and anxiety can translate into tension in the physical body causing familiar symptoms such as headaches, back and neck pain, as well as translating into disrupted sleep, inability to attend or focus on schoolwork or depression.<sup>3,4</sup> Providing chiropractic and other manual therapies to teenagers not only provides physical relief and interrupts the pain cycle<sup>5,6,7</sup> but can support them in building self-awareness ("feeling more in tune with their bodies") and empower them to "take charge" of their health and wellbeing.<sup>8</sup>

These observations and clinical experiences of a chiropractor with an active family practice led to the Surrey Teen Summit in 2015.<sup>9</sup> The Summit was led by a multidisciplinary group of local professionals who together, created and organized

a series of workshops for teenagers. The first session had 22 attendees (one traveling from as far away as Sweden). Through surveying the attendees, they related that the experience was transformative in several ways. Teenagers became more self-assured and confident as they developed independent skills as well as exploring their ability to function as a member of a team. For the next five years, the Summit was convened and workshops conducted as diverse as yoga and mindfulness, craft and creativity, exercising in nature, study strategies and how to create an Olympic mindset.

What is this Olympic mindset? Olympians demonstrate mental dexterity and resilience; these traits are not necessarily inborn but are cultivated over time. Mental dexterity and resilience along with their individual skill sets separate Olympians from their peers in accomplishing their goals.

Each workshop had a different theme promoting reflection and self-awareness, inviting the participants to listen to their bodies, and explore strategies to build resilience. The collective learning experience drew the individual teenager out of their sense of isolation gaining confidence as they learn from each other. They learned, by sharing, that they were not the only ones experiencing challenges.



### Finding tranquility in an anxious world

After several years of developing a network of healthcare professionals, educators, parents and teenagers and holding successful Teen Summits, the Green Hub Project for Teens was the chiropractor's next undertaking. Based on the chiropractor's experience in private practice and her extensive community service with adolescents, she was alarmed by the steadily declining mental health of the nation's teenagers. This concern was echoed by many of her

colleagues, healthcare providers who worked in the field of mental health, specifically with young people in this age group and their perplexed and anxious parents (Tellefsen Hughes 2021).<sup>10</sup>



Photograph by Ángel López on Unsplash: <https://unsplash.com/license>

The growing community eventually organized under the title of The Green Hub Project for Teens. It was designed as a platform for running workshops to help young people, ages 13-18, find the best strategies and resources to overcome life hurdles they may face.



The plan for the Green Hub Project for Teens platform was to offer life skills workshops in the community, for teenagers with an aim to "Empower, Inspire and Engage". A wide range of topic included but were not be limited to:

- Emotional intelligence
- Emotional resilience
- How diet (food and nutrition) may affect mood
- Developing boundaries
- Planning and problem solving
- Teamwork and conflict resolution
- Study strategies
- The physiological benefit of exercise, sleep, water and food.



- How learning can be empowering and improve your self-confidence.
- Dealing with difficult or toxic friendships
- Social media management
- Sleep and settling the brain
- Strategies to manage being overwhelmed or unwanted thoughts.
- Relationship of posture and self-worth
- How to find your coping strategies in unprecedented times

### Life skills workshops from the Green Hub Project for Teens

**Size and structure:** Mentored workshops were designed to consist of 15-20 students with the curriculum built around the aforementioned subjects to stimulate group conversation, reflection and feedback in a respectful and organized manner. The group agreement would be to create a safe environment for everyone within which to learn and share.



In the previously held Surrey Teen Summit, when given the opportunity to give feedback, the teenagers expressed appreciation that they were each given space and time to give feedback. The feedback mechanism was deemed invaluable to the organizers and mentors to critically evaluate the needs and interests of the attendees. The sessions were then adapted accordingly. Within each session, opportunities were crafted to encourage the attendees to identify their own goals to work on after each session was completed

**Workshop leaders:** The session leaders would be professionals who worked with teenagers on a daily basis in their professional practices. They would include, but not be limited to, a diverse assortment of both physical and mental health practitioners, educators, life coaches, business professionals and horticulture specialists. They would be chosen for their ability to engage and inspire others as well as connecting with this unique population.

Feedback previously elicited from the attendees of the Surrey Teen Summit that had been shared with the workshop leaders over the past five years would help them assess what had been effective and implement additional ways to communicate. As with the Surrey Teen Summit, all leaders would be volunteers and any profits accrued after expenses from the tuition for the workshops would be applied towards the community project to further the Green Hub Project for Teens.

**Young Ambassadors:** Young ambassadors, previous attendees from the Surrey Teen Summits, had been invited to share their own unique experience in life. These have been some of the most popular and powerful of the sessions. Listening to someone's story about how adversity affected them personally or how they had overcome a challenge had been a powerful and supportive tool in reaching other teens. One of the goals was to highlight young peoples' stories in TED-style-talks. Videoing these presentations also had the potential for further positive outreach through social media. Continued inclusion of the Young Ambassadors in future seminars was planned.

### The Garden Phase

The next or "garden phase" of the Green Hub Project for Teens was implemented to provide a resource for families using horticultural therapy (also known as 'social and therapeutic horticulture') to encourage and sustain personal development that are associated with horticulture. These activities include cultivating and caring for plants, gardening and landscaping or visiting and exploring natural environments like gardens, parks or forests to engender a feeling of well-being, improve physical health and encourage social interaction.<sup>11</sup>

A meta-analysis of research examining the effects of gardening, including horticultural therapy, on health, provided robust evidence for the positive effects of gardening on health. They concluded that in order to achieve optimal health outcomes, further research is needed to determine the frequency and duration of gardening which is sufficient to attain particular outcomes. To quote the authors, "A regular dose of gardening can improve public health."<sup>12</sup>

The Green Hub Project for Teens would provide a safe haven of peace and tranquility where anxious, stressed, overwhelmed teenagers could retreat. Being outdoors in a natural setting has been shown to support recovery of stress and mental fatigue.<sup>13</sup> Working in the garden could potentially support structural health by changing the chronic posture of teenagers looking down at cell phones or computers slouched on the couch to building muscle strength, developing new large and small motor skills and increasing flexibility. At the same time, the teenagers who

participate could be part of a worthwhile project which would promote a sense of accomplishment.

### **Non-judgmental, compassionate listening**

The volunteers (many of whom already work with teenagers in some capacity) are on hand to provide gardening advice and, when needed, non-judgmental, compassionate listening. Being outdoors in a natural environment is therapy in itself and entering the gate of this walled garden where teenagers and volunteers work side by side has a great deal to offer.

The Green Hub Project for Teens is designed to be a place for teenagers to gather to learn gardening, how to cultivate flowers and vegetables, orchard management or to work on a landscaping project. Teens will have places to sit, reflect or meditate to ground and calm themselves. They will be outdoors and will be encouraged to “turn off” the ever-present technology of today’s world and to leave their worries at the gate.

The Green Hub Project for Teens was not designed to offer targeted therapy sessions or medical solutions. Its sole mission was to hold the space for teenagers to take a break from life, give them a chance to be present to themselves to breathe and engage them in the present moment. To provide somewhere positive and supportive to retreat was one of the goals. The strategy was and is to provide additional support to promote the mental health of the teenagers who arrive at the garden, creating an oasis where they can find peace and hope and be empowered in the understanding that being outdoors can be a potent form of self-care to help modulate their moods and lower their anxiety. The focus was and will continue to be on creative ways to alleviate, reframe or shift stress, even if momentarily. A practice can create a habit and a habit may become a life skill.

### **Nature, gardening and young people’s health and wellbeing**

Engaging with nature benefits human health and wellbeing. Walking in nature, gardening, sitting on a park bench and even watching nature through a window have all been shown to be beneficial.<sup>14</sup> Engaging with nature can help reduce stress and anxiety, improve cognitive functioning, build self-esteem and confidence and improve physical health.<sup>15,16</sup>

### **Young people and nature**

Engaging with nature benefits adults as well as children and young people. Young people who spent more time in and near natural environments have been shown to be in better mental health. For instance, Li and colleagues (2018) tracked the movements and mood of 155 adolescents using GPS systems and found a significant positive correlation between the amount of green space the adolescents were



*Photo by Melissa Askew on Unsplash.*

exposed to and the extent to which they reported being in a positive mood. These effects were independent of socio-economic status and gender.<sup>17</sup>

In a similar way Wells et al (2003) found that children (aged 8 to 12) coped better with stressful life events when they lived near natural spaces.<sup>18</sup> Other studies have demonstrated that moving to greener urban areas is associated with sustained mental health improvements,<sup>19</sup> suggesting that environmental policies to increase urban green space may have sustainable public health benefits.

Even short-term exposure to nature can benefit young people’s wellbeing. Greenwood & Gatersleben (2016) asked 120 late teens, 16-18 year old individuals, to conduct a range of stressor tasks and then randomly allocated them to rest (either alone, with their phone or with a friend) in a classroom (indoors) or in a green courtyard. Stress recovery was significantly greater outdoors than indoors, especially when young people were with a friend.<sup>20</sup>

### **Walking in nature**

Active engagement with nature such as walking through natural environments or gardening are particularly beneficial. Olafsdottir et al (2020) randomly allocated University students to either walk in nature, walk indoors (in a gym) or passively view a nature film on television and found that walking in nature resulted in significantly greater improvements in physiological and mental wellbeing than walking indoors or watching a nature film. These benefits were particularly prominent during stressful times (exam periods).<sup>21</sup>

The benefits of walking in nature have been shown to benefit healthy populations as well as people suffering from a range of mental health issues. For example, Berman and colleagues (2012) asked 20 adults suffering from major depressive disorders to take a 50-minute walk either in a natural or a landscaped environment and found that a walk in nature was significantly more beneficial in supporting

improvements in working memory and positive affect.<sup>13</sup> These observed results may extrapolate into the teenage population and can be potentially studied in the garden environment utilizing questionnaires filled out by the participants who are visiting the garden. An example of a questionnaire would be the WHO-5 Well Being Index. The WHO-5 is a short questionnaire consisting of five simple and non-invasive questions assessing the subjective well-being of the respondents. The scale has demonstrated adequate validity both as a screening tool for depression and as an outcome measure in other clinical trials across a wide range of study fields.<sup>22</sup>

### Gardening

Soga, et al (2017) and Cipriani et al (2017) wrote about the benefits of gardening including reducing depression and anxiety, promoting recovery from stress and helping people to develop social relationships.<sup>12,23</sup> Gardening can offer these benefits by providing a distraction from everyday stressors and demands, by immersing people in nature, promoting physical activity, encouraging social interactions, and providing a sense of purpose and meaning. Therapeutic gardening activities exercise the body and the mind encouraging not only neuromuscular development through activity and repetitive exercise but by engaging the brain in problem solving, learning and increasing sensory awareness as the hands touch and “play” in the earth. The engagement of all their senses in their endeavors promotes a sense of calm by modulating the autonomic nervous system. This outdoor environment provides a rich sensory diet: the nose smells the dirt and the flowers, the eyes see the broad palate of nature’s colorful transformation of the world around them, the ears hear the wind rustling the leaves of the trees and sounds of birds and bees, their hands play in the dirt, make mudpies, gently place the young plants or pick the tender fruits, and ultimately, they can taste the bountiful harvest of their efforts.<sup>24</sup>

Van Lier et al (2016) conducted a survey among 8,500 secondary school children in New Zealand and found that those involved in gardening at home were of better physical and mental health and had more positive family relationships.<sup>25</sup> Frequent gardening is clearly beneficial but even relatively short gardening sessions have a positive impact. Van den Berg et al (2011), randomly allocated 30 gardeners to either spend 30 minutes attending to their allotments or to 30 minutes of reading on their own allotment plot. Continuous monitoring of cortisol levels and self-reported mood showed that gardening was significantly more effective in improving mood and reducing stress than reading.<sup>26</sup>

Longer term gardening interventions have been shown to benefit health and wellbeing well after the intervention has finished. Gonzales et al (2010), for instance, found significant improvements in mental wellbeing among 29 participants with clinical depression who participated in a 12-week horticultural intervention. These positive effects were still present 3 months after the intervention.<sup>27</sup>

Researchers from Bristol University and University College London discovered using laboratory mice, that a “friendly” bacteria commonly found in soil activated brain cells to produce the brain chemical, serotonin, and altered the mice’s behavior in a similar way to antidepressants. Teenagers inhaling deeply in this natural environment holds the promise of improving mood by stimulating the release of this “happy hormone,” serotonin.<sup>28</sup> Therapeutic gardening activities exercise your body and mind. It keeps your mind active because it uses different brain functions such as problem solving, learning and sensory awareness. And the potential of eliciting other supportive neurotransmitters is hypothesized, like eliciting the release of dopamine (seeking and reward behavior) to motivate teenagers to participate and accomplish their goal of harvesting a basket of fruit or a bouquet of flowers.<sup>29</sup>

### A garden to support the mental health of young people

Mental health can broadly be defined as “the capacity of each of us to feel, think, and act in ways that enhance our



ability to enjoy life and deal with the challenges we face.” Being in good mental health means that people thrive and fulfill their potential. In the UK, around a quarter of adults experience at least one mental health problem in any given year.<sup>30</sup> Almost half of these mental health problems have been established by the age of 14 and three quarters before adulthood.<sup>31</sup>

Mental health problems among young people are associated with a range of problems including bullying, social and exam pressure, obesity, substance abuse, inequality as well as worries about global issues such as Covid-19 or climate change. Providing young people with a break from these pressures, allowing them to temporarily escape, boosting their resilience and supporting stress recovery is extremely important. The opportunity to actively engage with gardening activities either alone or with others or to simply sit in garden and watch the flowers or listen to the birds may hugely benefit their mental wellbeing.

### Goals for the Future

The Green Hub Project for Teens will continue to build on these existing experiences, structure and set of activities. It will expand on the natural environment experiences and will include additional planned focused talks and workshops to empower teens to take control of their own wellbeing as well as a variety of other offerings to educate and support their parents, teaching them skills to better understand and communicate with and guide their teenage children.

These programs could eventually provide an outreach to a wider audience than those participating in the Green Hub Project for Teens but at this time the teenagers and their parents are the focus. This venue would also allow for the design of the collection of data pertaining to this population through field research utilizing an appropriately validated assessment tool.

Over time the vision is to enable this project to be emulated in the UK. The organization has thus been structured to include business plan and curriculum, software and CRM system so that it can easily be reproduced creating the potential and the groundwork to support and mentor similar charities interested in using the Green Hub Project for Teens as the blueprint to expand the services available or our youth.

### Conclusion

Mental health problems have been shown to be on the rise among children and adolescents. The stress of the current state of affairs in the world has taken a toll on teenagers' mental health and has negatively impacted their lives. The Green Hub Project for Teens is a creative template for a community project of willing and able adult volunteers to fill the void of available mental health care services for teens in an overtaxed national health care system.

### The Teen Garden:



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# The importance of therapeutic presence for the pediatric chiropractor: “getting into right relationship”

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## ABSTRACT

There are essential ethical elements required for a chiropractor to establish an authentic professional relationship in order to maintain the integrity of a healing relationship with their patients. Ethically, chiropractors also have an ongoing responsibility to do their own personal and professional development. Therapeutic presence is the capacity to hold a healing space for another person by developing trust and rapport and providing them with a safe energetic container influenced by one's calm and centered state of being. The Polyvagal Theory provides a neurobiological narrative that focuses on the importance of 'safety' and the adaptive consequences of detecting risk on our physiological state, social behavior, psychological experience and health to achieve presence. To fulfill our biological imperative of connectedness, our personal, professional and ethical agenda needs to be directed toward making patients feel safe in the moment and getting into right-relationship. Recognizing and interpreting the mother/baby dyad's adaptive behaviors provides an insight into their pre & perinatal imprints which reflect the child's Baby Body Language patterns.

**Key words:** ethics, right-relationship, chiropractor, therapeutic presence, Polyvagal Theory, safety, co-regulation, pediatric, birth trauma, pre & perinatal imprints.

## Introduction

Professional relationships, especially in health care, work best when there are two essential ethical elements present.<sup>1</sup> The first is to have the willingness to be in a relationship in which authentic care is offered. The second element considers the motivation and willingness of the practitioner to shift whatever is needed, on both a personal and professional perspective, to bring themselves into “right-relationship” when necessary and to invite the patient (or in the case of the infant, the patient and parents) to be there with them.

Lambert found the therapeutic relationship to be at least 30% of what is healing for a client undergoing therapy.<sup>2</sup> Various studies have shown that in the therapeutic, medical, perinatal care, educational, mentoring or spiritual relationship, it is the relationship itself that is at the heart of healing.

The importance of any chiropractor or health care professional (HCP) establishing and maintaining the optimal standard of ethics and integrity is at the core of any healing relationship. The manner in which one enters into right-relationship in the therapeutic relationship involves how one can work with one's inner ethics, one's own self-discovery and course-correction so that one can consistently adapt to the constantly changing zone of connection with another person.

Ethically, health care professionals, including chiropractors,

have an ongoing responsibility to their patients, colleagues and students to do their own personal and professional development work. Such self-reflective work is essential to prevent their own lack of self-awareness or have potentially unhealed blind spots interfere with the patient's healing trajectory. The role of the practitioner is to do whatever is appropriate to support and assist them. Basically, the chiropractor has a duty of care to show up as the best version of themselves as they apply the biopsychosocial model of care.

Such failure on the part of the HCP can be noticed by patients energetically and is often the issue around the misunderstanding, mishearing and lack of connection with the chiropractic patients (or parents of pediatric chiropractic patients) which may contribute to non-compliance of a treatment plan and less than optimal outcomes. Patients may leave the treatment room feeling dissatisfied and offended. They may perceive that there has been an injustice done to them while relating their experience or their pain and/or their child's lack of progress after that encounter. Such a situation paves the way for the disgruntled patient or parent whose perceived needs have not been met as they may not have been heard in an authentic and relatable way. Such miscommunications are cited as the second most common complaint against a chiropractor in 2020 to the General Chiropractic Council, the statutory regulatory body for chiropractors in the UK. Fortunately, the majority of those result in an admonishment being exercised against the chiropractor rather than a professional negligence case.<sup>3</sup>

Furthermore, as chiropractors are professional caregivers, professional compassion fatigue or burnout is often identified as being related to their own unresolved emotional and psychological issues. These factors, together with the amount of life stress indicators, tend to be the main issues rather than burnout being directly related to the number of patients they have on their caseload.<sup>4</sup> When a path into right-relationship is navigated from a strong ethical and authentic base, practitioners are more capable of achieving full personal mind/body presence which in turn creates the foundation for a strong therapeutic presence.

### **Therapeutic Presence**

Therapeutic presence is defined by Scurlock-Durana (2010) as the capacity to hold a healing space for another person by developing trust and rapport and providing them with a safe energetic container influenced by one's calm and centered state of being.<sup>5</sup> This presence amplifies the effectiveness of whichever skills the chiropractor has at his or her disposal and contributes to healthy treatment outcomes. As a chiropractor's own personal presence is the foundation for a strong, therapeutic presence there are basic skills needed to achieve this.

When a chiropractor is mindful, as in being conscientious and intentional in what they do, this allows them to be more open and creative with possibilities. Being mindful and practicing chiropractic with a conscious state of awareness enables the chiropractor to be more flexible, receptive and to be present. With such practice, they will tend to move toward an approach to a state of regulated neural firing and move toward, rather than away from difficult situations.<sup>6</sup> Cultivating presence and being mindful can provide the chiropractor with the resourcefulness that can help in one's life calling with more resilience and efficiency. Research by Goleman has shown that self-awareness is one of the starting points for both emotional and social intelligence.<sup>7</sup>

Establishing and respecting ethical and healthy relationship boundaries allows chiropractors and other health care professionals (HCPs) to nurture their resources and their own healthy lifestyle while filtering out what is physically, emotionally, energetically and spiritually draining.

Recognizing and tracking disrupted body presence in our patients is an ongoing and intuitive skill facilitating the experienced pediatric chiropractor to track and observe signs and expressions of their patients' internal landscape. One must listen to the patient and "hear" what is not being said. First, however, it is equally important that the chiropractor learn and master how to access and monitor their own inner world for the subtle cues and develop their body's innate intelligence. The impaired ability to sense or feel certain parts of their own body due to physical or emotional trauma; disease, physiological stress and

exhaustion; sensory disorganization, or cultural or religious rules about body awareness can skew their perception and interfere with how the pediatric chiropractor can relate to children and their parents.

The ability of a chiropractor to recognize and interpret sensory information and subtle cues in their body and environment allows for developing energetic awareness. As a chiropractor, or any HCP, this is an integral part of tracking their internal physiological environment and navigational system while being aware of their physiological state in the moment. Developing their body's natural capacity to discern and track what is happening internally and externally allows the chiropractor to make more informed and intelligent decisions. This is a prerequisite to facilitating therapeutic presence in the treatment room.

### **Safety and social engagement**

The Polyvagal Theory (PVT) provides the vehicle for explaining the importance of physiological state. The PVT describes how intervening variables influence behavior and our ability to interact with others. The theory explains how safety is not the removal of threat but that feeling safe is dependent on unique cues in the environment and in our relationships that have an active inhibition on neural defense circuits and promote health and feelings of love, trust and connection.

Porges, in 2017, highlights that current parenting and educational strategies are targeted toward expanding and enhancing cognitive processes while inhibiting bodily feelings and impulses to move. The result is a cortico-centric orientation in which there is a top-down bias emphasizing mental processes and minimizing the bottom-up feelings emanating from our body.<sup>6</sup>

Furthermore, Porges emphasizes that safety is associated with different environmental features defined by bodily responses versus cognitive evaluations. Our cognitive evaluations of risk in the environment, including identifying potentially dangerous relationships, play a secondary role to our visceral reactions to people and places. Porges further identifies that neuroception is the neural process that evaluates this risk in the environment which is without conscious awareness.<sup>7</sup>

The PVT provides a neurobiological narrative that focuses on the importance of 'safety' and the adaptive consequences of detecting risk on our physiological state, social behavior, psychological experience and health.<sup>8</sup> The ability to sense safe states is a prerequisite not only for social behavior but also for accessing the higher brain structures that enable humans to be creative and generative. PVT emphasizes the bidirectional communication between bodily organs and the brain through the vagus and other nerves involved

in the evolutionary adaptation to the regulation of the autonomic nervous system (ANS).

Presence depends upon a sense of safety as the brain continually monitors the external and internal environments for signs of danger. This neuroceptive evaluation involves prefrontal, limbic and brainstem processes and is shaped by ongoing appraisal of the significance of an event while referencing it to historical events of a similar type from the past. Knowing one's own neuroceptive tendencies is a necessary first step in creating presence as a chiropractor.

When a situation is perceived as threatening, the chiropractor, like any other human, will tend to move from the open state of receptive presence to the reactive physiological state of fight, flight, freeze or dissociation. Here the plateaus and peaks are on survival mode and drive the inner experience and neural firing patterns in engrained and limited ways. Siegel further highlights that the therapist, in this case the chiropractor, then disengages and shuts down the options with clients and limits presence.<sup>9</sup> As for patients becoming similarly physiologically reactive, this restricts their capacity to be open to the therapist's presence and their therapeutic interventions. Presence requires a tolerance for uncertainty and vulnerability as the therapist or chiropractor monitors their internal physical and mental world in order to create an integrated state of being. Siegel states that integration creates an openness for possibility and is at the heart of presence.

From a PVT perspective, the clinical interactions as a chiropractor in facilitating a meaningful therapeutic experience is by looking, listening and witnessing the patient in the present moment. This social engagement system experiences bodily feelings and is a portal for changing these feelings along a continuum extending from a calm, safe state that would promote trust and love to a vulnerable state that would promote defensive reactions. This shift involves the dynamic bidirectional communication between bodily state and emotional processes during a social interaction between both the chiropractor and patient, as in the therapeutic setting.

For this social interaction to be mutually supportive and enable a co-regulation of physiological state, the expressed cues from the dyad's social engagement systems need to communicate mutual safety and support. When this occurs, the active participants as for example, the pediatric chiropractor and child/mother dyad, will then have a sense of feeling safe with each other.

Furthermore, the bidirectional system linking physiological bodily states with facial expressions and vocalizations provides the portal for social communication that involves requests for neural co-regulation and mechanisms to calm

and repair co-regulation following neural disruptions.

For example, how we look and see each other is a critical feature of this capacity to connect. Subtle cues of understanding, of shared feelings, and of intent are therefore conveyed. These cues which often covary with the intonations or prosody of vocalization, are also communicating the physiological state. A portal to change our physiology can be both through the breath and through listening as vocalizations, are important cues of safety which can create contexts to enable people to feel safer.<sup>10</sup> As such, a chiropractor can therefore facilitate a change in physiological state for their patient by using and reading these cues proficiently.

Understanding and applying the PVT is pivotal for connection and co-regulation with others which is one's basic biological imperative. To fulfill the chiropractor's biological imperative of connectedness, the personal, professional and ethical agenda needs to be directed toward making individuals, (the patients) feel safe. It is not really what you say – it is how you say it that makes the nervous system feel safe. This is the essence of creating a platform for therapeutic presence.

#### **Birth trauma**

The human ANS responds to danger and life threat with a common stress reaction that is associated with the sympathetic nervous system (NS) and the hypothalamus-pituitary-adrenal (HPA) axis. PVT emphasizes that danger and life threat elicit different defensive response profiles. According to the theory, danger reactions are associated with the accepted notions of a stress response expressed which increases in autonomic activation through the sympathetic NS and adrenals. However, PVT also identifies a second defense system related to life threat that is characterized by a massive down-regulation of autonomic function by an ancient pathway of the parasympathetic NS.<sup>11</sup>

The 'classic' stress response of mobilization is manifested in fight/flight reactions. The second defense system as proposed by PVT is one of immobilization, behavioral shutdown and dissociation. Although the fight/flight reaction is functionally adaptive in response to danger cues, the behaviors associated with immobilization are less adaptive when there is an inability to escape or physically defend. When the body immobilizes in defense, it goes into a unique physiological state that is potentially lethal which is not a conscious or voluntary response. It is an adaptive biological reaction to the inability to utilize fight/flight mechanisms to defend or to escape. This reflexive response is displayed, for example, when someone passes out in fear. The human NS is continuously evaluating risk in the environment, making judgements and setting priorities for behaviors that are adaptive. As the process occurs without



our awareness and without the conscious mental processes that we attribute to the prefrontal cortex, executive brain functions involved in decision-making.

Chiropractors who are working unknowingly with a patient who has a history of trauma, need to be familiar with the immobilization defense system. For example, the birthing experience can be viewed as a traumatic event for many women and could impede her anticipated response to treatment for her reported chief complaint. The root of her problem could be left unaddressed if the chiropractor only views the postpartum patient from a purely biomechanical perspective. Similarly, if a baby is evaluated as a separate entity from their biological mother and from the mother's birthing narrative then a vital neurophysiological and somato-emotional piece could potentially be missed. This could be perceived as a disservice to the baby or child as their birth history, a once in a lifetime event, would be skipped over.

Developing that scenario further, consider the woman whose NS was adapting to the long, intense pain of labor and as a result the physiological shift triggered the ANS towards the parasympathetic NS and to a dissociated adaptive state. The woman then receives an epidural for pain relief which would help her to regulate back to a social engagement state which then would allow her the emotional space to resource herself in preparation for delivery.

Now consider the baby's experience during this scenario given the raised cortisol levels in the maternal blood supply together with the awareness of her mother's NS dissociating and losing connection with the baby within. The intended pain relief from the epidural will assist the mother's NS in the short term. However, the baby will still be experiencing the compressional forces of labor within the birth canal but will experience them without the supportive connectedness of mother who now has disengaged from her "felt sense" and connection with her baby.

This is one of the many points during the gestational timeline when the neurological, physiological and emotional connection between the baby/mother dyad can be interrupted. As such, a mother's "felt sense" and in-the-moment presence is not in sync with her baby. In turn, the baby's NS will also adapt and may dissociate into parasympathetic survival mode. Such adaptive behaviors are displayed as in their pre & perinatal imprints described as their Baby Body Language patterns. These are important cues for the chiropractor who wants to be in right-relationship with both the mother and baby separately, while recognizing the autonomic state of the mother/baby dyad in order to be able to navigate a path towards achieving therapeutic presence within the treatment session.

For some people, traumatic events are just events, while for others these same events trigger life-threatening responses. Their bodies respond as if they are going to die. For example, the father observing the delivery of his baby or a mother delivering her own baby, can trigger their own individual early pre and perinatal imprints and past experience neural response patterns which may appear to have been life threatening. For some people, specific physical characteristics of an environmental challenge will trigger a fight/flight behavior, while others may totally shutdown in response to the same physical features. For example, the overhead bright lights in a delivery room could be a traumatizing trigger, for example under the lights in the dentist's chair. Understanding the response, not the association to a traumatic event, is more critical to the successful treatment of trauma.<sup>12</sup>

### Neuroception and PTSD

Neuroception is a term coined by Porges which he uses to describe the process that evaluates environmental features of risk which trigger the neural circuits to shift autonomic states. This is different from perception which requires awareness and conscious intention while neuroception occurs reflexively.

Within the PVT, neuroception was postulated as a mechanism to shift the ANS into three broad states defined by the PVT (i.e. safety, danger, life threat) and to emphasize the potent role of the mammalian social engagement system, including the face, heart, and myelinated vagus, in down-regulating both the fight/flight and shutdown defense systems.

For example, the touching of a patient's head while rotating their neck, as in setting up for a gentle cervical adjustment can trigger a reflexive defensive pattern related to how that person may have had an assisted forceps delivery. These are the cues that the NS is detecting from a tissue memory of a past experience.

As per the PVT, when the social engagement system is engaged and working, it down-regulates defenses and people will feel calm, hug each other, and observers will look at them and feel good for them. However, when evaluated risk increases, the two defense systems take priority. For example, in response to danger, our sympathetic NS takes control and increases metabolic resources to support motor activity for fight/flight behavior. If, however, that doesn't help the individual to have a sense of feeling safe, they then will recruit the ancient unmyelinated vagal circuit of the parasympathetic NS and shut down or dissociate.

It would be clinically relevant for the chiropractor who seeks to be in right-relationship to develop protocols for neural regulation to assist patients in down-regulating defense

strategies in order to move optimally towards achieving therapeutic presence. When the social engagement system is triggered through the felt sense through neuroception, the social interaction calms the physiology which supports overall health, growth and restoration.

One such pediatric management protocol recommended by the author, would be for the chiropractor to avoid physically separating a mother/baby dyad while carrying out any intervention and instead to work with the newborn or baby while remaining on the mother’s lap. This would assist the chiropractor in tracking any physiological state change between the mother or baby and them, and between the dyad. The chiropractor could then track and readily facilitate an optimal state change towards social engagement for either the mum or baby. Separating a baby or young child from a parent can trigger both their own individual defense mechanisms and has the potential to escalate into a non optimal therapy situation. Interventions administered with positive intentions that may involve restraint may also trigger trauma responses unintentionally, including PTSD.<sup>14</sup>

As an example, chiropractic upper thoracic and cervical adjustments could potentially trigger cues of danger in both children and adults that were related to early imprints from the interventions in forcefully assisted delivery at birth.

### **Societal bias**

In our society there is a bias against discussing the birth experience, a once in a lifetime experience for the baby, and which also can be an intense transformational experience for a mother. However, the manner in which this discussion is facilitated is of paramount importance as trauma resolution needs to be the negotiable factor between the patient and chiropractor.

Unresolved birth trauma for both a mother and a child can result in a lifelong narrative in which the recall of the event triggers an identification. For example, consider the example of a mother in a social setting talking about her 20 year old son’s birth as an event that “made her never have another baby.” A mother’s narrative such as this has the potential for having an ongoing impact on her relationship with her son as a young adult because of her early issues with bonding and attachment as a result of her trauma. Equally, the son’s emotional perspective from this narrative could be that he was the causative factor in his mother’s trauma. Trauma resolution is about taking ownership and the chiropractor has a responsibility to lead by example and model behavior that is conducive to evolving a patient’s somato-emotional intelligence. Taylor simply refers to the ethical dilemma, ‘as do no harm and know thyself because what one does not know about oneself can unintentionally cause another harm.’<sup>11</sup>

Many of the defensive behaviors we observe in the

chiropractic office are adaptive behaviors that are triggered by a patient’s unconscious neuroception which can lead to misinterpreting the intentions of the chiropractor’s cues. As a chiropractor, it is important to recognize and track the patient’s apparent sense of feeling safe as portrayed by the PVT in order to moderate their ability to develop secure attachments. This in turn provides the patient with an understanding of the important role of one’s physiological state in both prosocial behaviors and in response to trauma.

This understanding reduces the shame associated with assuming that the patient’s behavior or reaction to a chiropractor’s intervention is related to a voluntary decision, which is often a stigma that a patient can experience. For example, one chiropractor declared their patient “the worst patient I’ve ever had” as he roughly and insensitively pushed his finger into the patient’s mouth to perform a pterygoid muscle trigger point release as the patient audibly gagged and struggled to move away and she felt ashamed and responsible for her perceived lack of cooperation.

According to Porges, as our NS likes predictability, then a vital treatment goal would be to provide the patient with the ability to access a physiological state that enables social engagement, rather than perpetuating a defensive state that has the potential to interfere with recovery. Explaining to a new mother that her unsettled baby is displaying a defensive pattern has the potential to educate, reassure and build her confidence and empower her to manage her newborn’s physiological and emotional needs.

Guiding and assisting a distressed mother to change her physiological state from fear and shame, to feeling empowered so that she can understand and interpret her child’s “Baby Body Language” is what can be achieved by the chiropractor being in right-relationship and in therapeutic presence. For example, in the treatment room when engaged with a child, the chiropractor could explain to the child that they want to show their parents how clever the child’s nervous system has been at adapting to the situation that made them feel unsafe. This allows the practitioner to model a narrative of viewing the child’s behaviors in the positive rather than in the conventional way of listing the negatives relating to the child’s perceived dysfunctional behavior. The chiropractor can then assist both the parent and child to celebrate the child’s adaptive behaviors as it was these responses that enabled them to survive.

This approach creates a bridge of understanding and promotes navigating a path for change rather than causing a mother to feel guilty or responsible for their child’s past or cause a child to feel that their body has let them down in some misguided way. The author seeks to emphasize to

the parent the profound importance the adaptive response of the child's nervous system plays, even if the child experiences profound physiological and behavioral states that limit their ability to function in a social world. This approach allows for more realistic expectations for a child's development by having a sound and balanced starting point.

It would be imperative from a PVT perspective to reiterate that there is no such thing as a bad response, just an adaptive response. This is the basic premise in which a child's NS is trying to do the right thing for them to survive. As a chiropractor we need to facilitate a parent's understanding and recognition of this fact. Equally, a parent's NS is also experiencing their own adaptive reaction to the situation which has triggered their NS responses.<sup>13</sup>

It is the authors' view that for a chiropractor to achieve and maintain therapeutic presence they need to track the changing cues of the child and/or the mother/baby dyad's changing physiological states to social engagement. The application of the ongoing evaluation of these states functionally contributes to the treatment and healing process and facilitates a sound basis for the ongoing connectedness of the mother/child dyad.<sup>14</sup>

Such an inclusion in the chiropractors' management style will facilitate an ongoing ethical permission-based practice for executing any therapeutic interventions. By the pediatric chiropractor focusing their intention and attention to tracking the child or the dyad in a session would translate into the chiropractor knowing 95% more about the dyad, than the dyad knows about them at the end of each session. (Caution should be exercised in sharing unnecessarily one's

personal narratives in the session, in order to stay focused in remaining in therapeutic presence with the dyad.)

### Conclusion

Practicing the principles of therapeutic presence requires patience, experience and ongoing commitment as it is an invaluable model or paradigm of conscious awareness for helping others. A chiropractor who chooses the path of self-development to help them be more present for others in each moment, in a space of caring and compassion, would enable them to receive as well as give. The ability to serve in presence for someone else's healing brings the professional into a deeper state of grace and resonance.

When both the chiropractor and mother/child dyad respect their own individual body's physiological responses, they move towards a more evaluative state in which they become more respectful of themselves and the treatment outcomes. The PVT provides the neuroscience in understanding the continuum between the physiological states of fight, flight, freeze and dissociation. The application of the ongoing evaluation of these states functionally contributes to the treatment and healing process and facilitates a sound basis for the ongoing connectedness of the mother/child dyad.

The way in which practitioners are grounded in themselves, open to others (while holding appropriate boundaries) and participate fully in the life of the mind and body, are important aspects of practicing therapeutic presence which is at the heart of relationships that help others to grow. This inside-out view helps chiropractors to see the ongoing personal development work they need to do as professionals to develop the essential receptive starting place of therapeutic presence for all clinical encounters.

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# Headaches in children: Part 1. The changing phenotypes of migraine headache in infants, children and adolescents

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## ABSTRACT

Headaches in children are common and the prevalence is increasing worldwide. The phenotype of migraine headache changes with continuing development of the nervous system. Children of all ages experience headaches but these are typically difficult to recognize and diagnose in the younger ages. Early intervention addressing the chemical, mechanical and psychological factors contributing to an individual's headache is essential. This reduces the risk for central sensitization associated with chronicity and disability including reducing the risk for headache in adulthood.

**Key words:** migraine headache, children, headache, periodic syndrome, abdominal migraine, cyclical vomiting, aura.

### Introduction

Headaches are a primary cause of disability worldwide and are highly disabling in adults and children.<sup>1</sup> Headaches occur commonly in children and can be a source of significant disability affecting activities of daily living and quality of life. Headaches occur in children of all ages and commonly progress into adulthood. Symptoms vary from infancy to adolescence and can be difficult to differentially diagnose in children delaying appropriate management. Early intervention can change the trajectory of headaches reducing chronicity and disability.

### Incidence/Prevalence of Pediatric Headache

The prevalence of headaches in children is increasing worldwide<sup>2</sup> and they increase with age, particularly after the age of 5.<sup>3</sup> It is thought that the stress of starting school is related to this clear increase.<sup>4</sup> Frequent headache prevalence has increased significantly as well<sup>5</sup> and is accompanied by an earlier debut in children.<sup>6</sup> They are more prevalent among children in a lower socioeconomic class<sup>7</sup> with consequences of lower grades<sup>8</sup> and for some, lower educational achievement<sup>9</sup>, a self-perpetuating negative spiral.

Chronic headaches negatively affect the quality of life of the child and their families.<sup>10,11</sup> Looking at the trajectory of headaches, children with recurrent headaches are more likely to develop central sensitization and suffer from chronic headaches as adults.<sup>4</sup>

The diagnostic criteria for headache in children have been based on adult criteria for many years. The first edition of the international headache criteria was published in 1988. Since then, it has been updated in two versions and most

recently, 30 years later, modified to better include children in the ICDH-3 beta version.<sup>12</sup> An expert group within pediatrics has evaluated these criteria and are in agreement that they lack sensitivity for children under 6 years of age.<sup>13</sup> Therefore, prevalence estimates in younger children and infants are likely under-estimated and under-reported increasing the risk for inadequate management<sup>14,15,16</sup> and central sensitization.

### Co-Morbidities and Trajectories

The World Health Organization recognizes headaches as a common disorder of the nervous system. Headache sufferers commonly have other somatic complaints and emotional disturbances<sup>17,18</sup> which change with increasing age. There is a high degree of co-morbidity with asthma, respiratory disorders, hay fever, frequent ear infections,<sup>18</sup> depression and anxiety,<sup>19</sup> as well as other musculoskeletal pain syndromes<sup>20</sup> such as low back pain, neck and shoulder pain.<sup>21,22</sup> There is co-relationship with physical inactivity; it acts as both a risk factor and a consequence of headaches.<sup>2,19,23</sup> There is a higher prevalence of headache in the population of obese children.<sup>24</sup>

Neuropsychiatric disorders occur commonly in childhood.<sup>18</sup> Emotional problems and behavioral disorders in preschool are over-represented in the headache population. Children often display features of hyperactivity, impulsivity, inattentiveness and have the diagnosis ADHD.<sup>25</sup>

Anxiety/depression and headache are bi-directional and present concurrently in children and adolescents.<sup>19</sup> Sleep disorders occur commonly in children with headache in all age groups<sup>26</sup> and both provoke and relieve headache. There is a relationship as well with the primary headache

disorders and the regulation of sleep<sup>27</sup> involving vitamin D and neurotransmitters.

**Diagnosis**

The phenotype of headaches differs between adults and children due the differences in myelination and cerebral maturation.<sup>28</sup> The most common types of headaches seen in practice reflect the triad of health. The major headache categories involve chemical, psychological and mechanical factors which activate the trigeminovascular system resulting in a neuroinflammatory cascade causing and exacerbating headaches. One primary headache form is a result of a complex neurochemical, neurovascular disorder.<sup>29</sup> Another primary headache form has more of a psychological profile<sup>30,25</sup> and a common secondary headache form is due to biomechanical dysfunction.<sup>31</sup> The threshold for headache decreases when more than one of these factors is present simultaneously.

Red flags that indicate neuroimaging for headaches should always be ruled out and are listed in Table 1.<sup>32</sup>

Cerebellar dysfunction
Features of increased intracranial pressure
New neurological deficits
Possible brain tumor
Night epilepsy
Waking up due to a severe headache
Personality changes

Table 1. Red Flags for headaches in children.

Secondary headaches that need to be ruled out are several. This list is not meant to be exhaustive, more so, a list of common problems that show up in a non-medical practice. A more detailed description will follow in the next issue where tension-type headache and cervicogenic headache will also be described and compared.

Ocular headache
Tension-type headache
Cervicogenic headache
Medication overuse headache
Nutritional deficits
Neuroborrelia
Sleep apnea
Hypertension

Table 2. List of common headaches in children to rule out.

**Migraine Headaches**

In adults, migraine headaches are a result of neuronal dysfunction with a critical imbalance between excitatory and inhibitory neurotransmission. There is a bioelectric phenomenon which activates the trigeminovascular system by releasing inflammatory neurotransmitters and causing vasodilation. There is a stimulation of C1-C3 nerve roots afferent as well as craniofacial afferents. Sensory overload and lowered energy reserve are thought to ignite the major pain signaling system of the brain, the trigeminovascular system. This abnormal cortical responsivity and sensory processing may constitute the fingerprint of the migraine brain.<sup>33</sup> More simply said, there is a dysfunction of the pain modulating system. This system is easily triggered by other inflammatory states, mechanical noxious input<sup>31</sup> and stress.<sup>30</sup>

Migraine headache has two major subgroups in adults according to the ICHD headache criteria.<sup>16</sup> Migraine headache without aura and migraine headache with aura. These headaches have a genetic predisposition.<sup>34</sup> Migraine without aura is a recurrent headache that in adults lasts from 2-72 hours.<sup>35</sup> It is a moderate to severe pulsating headache which is accompanied by nausea, vomiting, photo and/or phonophobia. The headache changes sides, it is aggravated by physical activity and is relieved by sleep. Once headaches become chronic the risk for central sensitization<sup>36</sup> and cutaneous allodynia increases. The extracranial pain sensitive structures include the skin, muscles, arteries, periosteum and joints, particularly of the head and neck.<sup>13</sup>

Migraine with aura is distinguished by the presence of transient, focal neurological symptoms that usually precede or accompany the migraine headache.<sup>37</sup> It is a reversible neurological disturbance affecting different senses, often vision, sensation and speech function. In children, these usually occur unilaterally, while adults experience them bilaterally. Visual disturbances, in the form of scintillating crescents<sup>38</sup> occur most often, followed by, a sensation of pins and needles migrating in the body, numbness and aphasia.<sup>39</sup> Metamorphopsia, micropsia and macropsia are other visual disturbances which alter how things appear, either changing shape, becoming smaller or bigger.<sup>40</sup> Some children also experience things changing colors. Olfactory and auditory hallucinations may also be experienced.<sup>41</sup>

Migraine headaches in children differ from those in adults in symptomatology, duration and location. Headache duration in young children can be from minutes to one hour, falling short of the required time listed in the ICDH guidelines. This is the most common reason why children do not fit into the present diagnostic guidelines.<sup>13</sup> Headaches regardless of type are classically bilateral, frontal or supraorbital in children. Syndromes occurring in children are not

necessarily accompanied by headache pain, are common and recognized as an expression of migraine headache.<sup>12</sup> Migraine headaches may be accompanied by vegetative symptoms of pallor, nausea and vomiting.<sup>28</sup> Young children may exhibit behavior indicating they are light and noise sensitive.<sup>42,43</sup> With increasing age, photo and phonophobia usually accompany a migraine headache. Children with migraine headache are more often home from school with other illnesses. There are different expressions of migraine, episodic syndromes, which occur during growth and development, with some continuing on into adulthood.

### **Age group headache presentations:**

#### **Infant**

Headaches not uncommonly present already in infancy<sup>44</sup> and are diagnosed based on the history of a difficult, assisted or traumatic delivery and/or suboptimal positioning in-utero.<sup>45</sup> Clinical exam findings include behavioral and palpatory abnormalities. Post-delivery pictures can provide evidence of trauma or non-neutral positioning in-utero. The infants behave like they have a headache, holding their heads, scratching and pulling at the face and head. They are difficult to console and are not uncommonly diagnosed with infantile colic. Infants having had a complicated or prolonged delivery can have a headache due to the trauma.<sup>46</sup> Infants that suffer from pain due to a traumatic delivery are more likely to develop central sensitization<sup>47</sup> and go on to later develop migraine headaches.<sup>48</sup>

One of the most common periodic syndrome associated with migraine is infantile colic.<sup>49</sup> Several studies have focused on a subgroup of irritable infants, describing them as having a periodic syndrome which later develops into a migraine headache without aura.<sup>49,50,51</sup> Gelfand discusses reasons why the baby cries and suggests that it may be due to having a headache, being overly sensitive to stimulus or perhaps having abdominal pain analogous to abdominal migraine.<sup>51</sup> A small study focusing on reducing sensory stimulus has shown effect in calming the irritable infant.<sup>52</sup> There appears to be a genetic component involved where mothers suffering from migraine have greater than double the risk of having a colicky baby.<sup>51</sup> The gut and the nervous system are derived from the same embryologic tissues.<sup>53</sup> The enteric nervous system and the central nervous system (CNS) are interconnected and strongly influence each other.<sup>53</sup> This bi-directional relationship, in predisposed individuals, is thought to be involved in the mechanism of a subgroup of infants with colic, and other gastrointestinal syndromes which appear during growth and development.<sup>28</sup> There seems to be an increased arousal in the CNS to triggers leading to a release of inflammatory neurochemicals resulting in gastrointestinal dysregulation.<sup>28</sup>

Long term studies on infants with colic reveal more often than expected, sleep disorders, temper tantrums,

recurrent abdominal pain, allergic manifestations and aggressiveness.<sup>54,55</sup> Romanello's study showed that school age children presenting with a new onset of migraine headache have greater than a 6-fold increased prevalence of having had infantile colic.<sup>56</sup> Guidetti's study from nearly 40 years ago showed that infants that were classified as hyper-reactive were more likely to suffer from migraine headache later in childhood.<sup>42</sup>

The other periodic syndromes which occur in order of age may exist by themselves or change into other episodic syndromes. Paroxysmal torticollis appears later in infancy, not following birth or traumatic delivery. During the first year of life the infant presents with torticollis which alternates sides. This disorder occurs periodically and regularly lasting from minutes to days resolving first in toddlerhood. This is the most uncommon periodic syndrome. Vegetative symptoms co-occur commonly with irritability, drowsiness, pallor, vomiting, ataxia, or tortipelvis.<sup>57,58</sup>

#### **Preschool to early school age**

Benign paroxysmal vertigo presents in the preschool period with recurrent episodes of dizziness, lasting frequently just a few minutes, but may extend to a few days.<sup>59</sup> The episode begins suddenly and may be accompanied by nystagmus, ataxia, nausea/vomiting or pallor, even headache.<sup>60</sup> The child often appears unsteady and may be frightened by the episode. This condition commonly resolves around the age of school start (5-6 years of age), but may continue on through childhood into young adulthood. Motion sickness is common as well. The risk for developing migraine headache was significantly greater among those who experienced vertigo for a longer time period.<sup>61</sup>

In the preschool years, some children experience recurring episodes of vegetative symptoms which negatively affect their ability to participate in activities. They suffer from pallor, nausea, anorexia, and less commonly, episodes of joint pain and fever.<sup>62,5</sup>

A variety of sleep disturbances begin in preschool and can progress and change with age. Early on, apnea,<sup>63</sup> sleep disordered breathing and night terrors<sup>64</sup> may be expressions of migraine headache. Bedtime resistance with sleep anxiety,<sup>42</sup> bruxism,<sup>65</sup> sleep talking<sup>66</sup> and sleep walking<sup>62</sup> are also common.

Cyclical vomiting in childhood commonly starts around five years old and occurs regularly with bouts of frequent vomiting lasting up to several days.<sup>67</sup> This involves the enteric nervous system resulting in gastrointestinal dysregulation.<sup>28</sup> It is common with a family history of migraine.

Abdominal migraine is the most common periodic

syndrome<sup>67</sup> which begins around seven years of age.<sup>69</sup> It is commonly disabling, negatively affecting quality of life and participation in school and other activities.<sup>70</sup> There is an increased arousal in the CNS triggering a release of inflammatory neurochemicals resulting in gastrointestinal dysregulation.<sup>28</sup>

Aura often appears in school-age children but may occur at any age.<sup>71</sup>

Besides periodic syndromes, children and adults may experience premonitory symptoms prior to the onset of a migraine headache. These include: yawning, mood change, fatigue, neck stiffness, visual blurring and light headedness but exclude photophobia, phonophobia, osmophobia and nausea.<sup>4</sup> It is common with more than one symptom, but there does not seem to be any correlation with age.

**Adolescence**

Migraine headache in adolescence is the most common severe recurrent headache. The disability of migraine headache in adolescence is significant resulting in school absences, difficulties concentrating,<sup>1</sup> and lower academic performance.<sup>8</sup> There is an increase in prevalence of migraine headache in boys in the childhood years.<sup>71</sup> The prevalence of headaches in boys’ levels off while the prevalence among females increases into young adulthood. During puberty there is a clear shift in gender predominance with girls much more commonly suffering from headaches. Headaches are commonly experienced in the temporal region and the duration of headaches increase with age.<sup>48</sup> The phenotype of headache is similar to that in adults presenting as a unilateral pulsating headache of moderate to severe intensity. Nausea, vomiting, photo and phonophobia are often concurrent. This headache may change sides and is relieved with sleep, with stress being a primary risk factor.<sup>73</sup>

Other more prevalent modifiable risk factors in this age group are lack of regular physical activity, smoking, alcohol, caffeine ingestion, obesity and abuse.<sup>2,10,23</sup> Being bullied creates an inflammatory process in the body and can contribute to the neurovascular and neurochemical insult affecting the frequency and intensity of headaches<sup>73</sup> as well as increasing the risk for obesity.<sup>75</sup> Obesity results in systemic inflammation which may be a possible trigger to the inflammatory cascade seen in headaches.

Among adolescents, headache, back pain and stomach pain coexist more commonly than each disorder existing by itself.<sup>20</sup> Neck pain is commonly associated with migraine in adolescents<sup>76</sup> as well as cranial autonomic symptoms such as runny nose and tearing of the eyes.<sup>70</sup> It is not uncommon for the juvenile migraine headache to remit, improve and change forms with increasing age.<sup>77</sup> But the frequency of chronic migraine headaches doubles in adolescence

particularly among girls.<sup>78</sup> Most disturbing is that the risk for suicide is elevated in teens with chronic headaches.<sup>79</sup>

Triggers for migraine include light, sounds, odors, emotional, and/or endogenous factors. Individual triggers seem to have an additive effect, leading to an attack only when a threshold has been reached. This observation suggests that trigger factors act on common pathways provoking the neuroinflammatory cascade.<sup>38</sup>

The commonly described triggers in childhood and adolescence include impaired sleep, stress, skipping meals, physical overexertion, fatigue and bright flickering lights.<sup>38</sup> Later in adolescence, hormones, odors, anxiety and depression play a bigger role.<sup>38</sup>

There is a host of foods and chemicals which for some individuals can contribute to an ongoing inflammatory response listed below in Table 3.<sup>80</sup>

Allergenic proteins
Sulfites
Nitrites
Artificial sweeteners, Aspartamine
Food additives and dyes
Tyramine
Phenylethylamine (ADHD medication)
MSG
Histamine
Stress hormones
Caffeine
Citrus fruits
Dairy products

Table 3. Triggers for migraine headache.

Factors that have been found to be relieving for migraine headaches are listed in Table 4.<sup>81,82</sup>

Sleep
Magnesium
Vitamin D
Rest
Good Posture
Massage
Chiropractic manipulation

Table 4. Factors that are relieving for migraine headache.



### **Treatment: Manual therapy, Pharmaceuticals and Nutraceuticals**

Despite the suffering and economic consequences, the majority of headache sufferers do not seek medical care. Manual therapy is the most common non-medical treatment requested by patients<sup>83</sup> and pediatric guidelines dictate manual therapy and other non-medical care as a first line intervention for children.<sup>84</sup> Appropriate early intervention is highly recommended to reduce the frequency and disability of headaches.<sup>31,85,86</sup>

Identifying and addressing mechanical, chemical and psychological triggers may reduce the disability and chronicity associated with migraine headache. For the inconsolable infant with a history of a traumatic delivery, mechanical dysfunction should be assessed and addressed. This reduces nociception from mechanoreceptors overloading the trigeminocervical nucleus.

Infants should be assessed for signs of allergy/intolerance and the status of the developing microbiome (antibiotic or pharmaceutical exposure, mother's microbiome, immune status).<sup>87</sup> These factors may result in irritation or inflammation in the gut which may act to perpetuate the nociception in the enteric nervous system.

The clinician should note how well the parents have bonded with the infant. Depression during pregnancy and the postnatal period is associated with bonding impairment<sup>88</sup> which may be expressed by excessive crying in the infant.

The threshold for pain decreases with multiple contributing factors, highlighting the importance of recognizing and addressing triggers in the three primary areas (mechanical, chemical and psychological) mentioned. Proper treatment early on can reduce and interrupt the disability and chronicity associated with pain sensitization.<sup>89</sup>

Medication use for headaches is common in adolescence and is related to medication use in the family.<sup>90</sup> Regular medication use is associated with developing a medication overuse headache.<sup>21</sup> Education of teenagers is important to avoid this secondary headache by restricting medication to at most 2-3 times a week.<sup>91</sup>

Vitamin D deficiency is a global problem and highly over-represented in the headache population of both children and adults.<sup>92</sup> Vitamin D controls over 200 genes and has an important role in reducing inflammation.<sup>93</sup> D vitamin deficiency is directly coupled to headaches and musculoskeletal pain syndromes by propelling the body into an inflammatory state.<sup>94</sup> Vitamin D and magnesium are cofactors which when working together reduce an inflammatory state reducing pain and headaches.<sup>95</sup> Vitamin D also influences the release of neurotransmitters and

neurochemicals directly involved in migraine headache pathology, anxiety and depression.<sup>96,97</sup>

There are nutraceuticals which have been shown to be effective in treating migraine headache without associated adverse effects. Besides vitamin D, these include magnesium, L-tryptophan, niacin and vitamin B2. Another recommended combination is magnesium with partenium, andrographis paniculate and coenzyme Q10.<sup>98</sup> The current pediatric guidelines recommend non-medical alternative treatment for pediatric headache.<sup>84</sup> The role of diet is important before initiating long term pharmaceutical therapy.<sup>98</sup> Treatment with prophylactic and/or acute migraine with drugs is often unsatisfactory and counterproductive with a potential for toxicity.<sup>99,100</sup>

The neuromusculoskeletal result of spinal dysfunction can initiate or perpetuate a migraine headache. Noxious input from the cervical spine can activate the trigeminovascular system resulting in a neuroinflammatory cascade<sup>101,102</sup> potentiating the process occurring in a migraine headache. Chiropractic manipulation for children has been shown to be effective in reducing the disability of migraine headache.<sup>103</sup> The duration, intensity, frequency is reduced as well as medication use.<sup>102,104</sup> The reactive tension in the cervical paraspinal and suboccipital muscles contribute as well to the ongoing pain cycle and is important to address in treatment.<sup>81</sup>

Management of headaches should be multimodal addressing the central and peripheral pain sensitization generators.<sup>105</sup> Manual therapy has been shown to be effective in reducing headaches in children and is an example of managing the peripheral pain generator, or the bottom-up strategy.<sup>82</sup> The top-down strategy, or addressing the central mechanism is needed with central sensitization, changing how the brain interprets afferent input. Different modalities may be used, but stress, sleep and exercise are the main top-down interventions used for the management of chronic pain.<sup>106</sup>

Besides skills in manual therapy, holistic management is important for success in treatment. This includes educating families in the area of sleep hygiene, stress management, regular mealtimes, adequate nutrition, sensitivities to certain foods and chemicals, regular physical activity and in appropriate cases, addressing the consequences of obesity.

### **Conclusion**

Migraine headache is the most common headache in the pediatric population. The phenotype of this headache changes with age and development which can make it difficult to interpret. Recognizing it early, addressing the peripheral and central mechanisms which activate the headache are important in avoiding central sensitization and chronic headache. This headache is particularly

sensitive to cervical spine dysfunction, chemical imbalance, and psychosocial stress. Addressing inflammatory states associated with vitamin D deficiency, obesity and abuse will be critical in management. Identifying and treating

psychological and biomechanical stressors will reduce the frequency, intensity and medication use associated with this headache. Finally helping families to understand and avoid the specific triggers for their child will reduce the disability of this headache and improve the quality of for the family.

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# What role does the microbiome play in the immune function of the pregnant patient during the COVID-19 pandemic? Can probiotics help?

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## ABSTRACT

The COVID-19 pandemic has upended life and has left the world facing an uncertain future. It is thought that a global approach needs to be the focus before life can “return to normal.” COVID-19, first identified as a geographically localized viral infection, rapidly spread to become a global pandemic. Eighteen months later, the prediction is that it will recur in waves due to its many mutations. This suggests its recurrence will be similar to the influenza virus. This is of particular concern for the more vulnerable population like pregnant women. In pregnancy the immune response is altered and many pharmaceuticals are contraindicated. Vaccination of pregnant women is still a subject of investigation with trials being carried out in many countries. But in the pregnant population many are vaccine hesitant because of unknown longterm effects for them and for their offspring. Ongoing strategies and alternative methods of preventing the disease need to be investigated. In COVID-19 patients, an alteration of the microbiome composition has been identified, which points towards a related decrease in the integrity of the immune system. Additionally, disease severity has been related to the amount of dysbiosis in the gut flora. Utilizing a therapeutic protocol of prebiotics and probiotics might be a viable alternative in preventing infection or decreasing the risk of severe outcomes when infected with COVID-19.

**Key words:** Pregnancy, Immune System, COVID-19, SarsCoV-2, Microbiome, Gut flora, Pregnancy Immune system, Th1 Immune system, Th2 Immune system.

## Introduction

The repercussions of the COVID-19 pandemic have continued since the winter of 2019-2020. People have been under the strain of lockdowns with public health and governmental restrictions and they long for it to end. Some have begun to rebel and are refusing to comply with governmental restrictions. Others are questioning how effective those restrictions and recommendations have been.

The vaccination program seems to be showing evidence of success. According to the Center for Disease Control (CDC), the COVID-19 vaccines currently authorized in the United States are demonstrating effectiveness against Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), including asymptomatic infection, symptomatic disease, severe disease, and death. Study findings, along with the early evidence for reduced viral load in vaccinated people who develop COVID-19, suggest that any associated transmission risk is likely to be substantially reduced in vaccinated people. Additionally, available evidence suggests that the COVID-19 vaccines presently authorized in the United States offers protection against known emerging variants as well.<sup>1</sup>

A study done in Israel by Haas et al. has shown, that in all age groups, as vaccine coverage increased, the incidence of SARS-CoV-2 negative outcomes declined.<sup>2</sup> And a NIH

pre-print found that the numbers of overall rates of infection with COVID-19 have decreased to 4.6% from the previous 9.0 % without vaccination, over 300 days.<sup>3</sup> This reported progress has raised hopes for a return to normal life. However, critical monitoring and data collection concerning any potential side effects of the vaccination should not be ignored and its health benefit ratio needs to be continuously evaluated.

Based on current available evidence, should vulnerable populations, like pregnant women, be vaccinated? And if not, what other means of protecting them is available to us with a known risk/benefit ratio? Does resistance in the general population to follow recommended protective measures, vaccine hesitancy or outright refusal increase the risk for vulnerable individuals to contract COVID-19? And despite the preliminary reported success of the current vaccines, with new mutations continuing to be reported, is there sufficient protection for our vulnerable populations?

A recent study by Egeren et al.<sup>4</sup> found that the overall size of the pandemic in terms of number of active infections will play a significant role in whether the virus can be brought under control with neutralizing antibody prophylactics or vaccines. The speed at which mutations develop in the population increases substantially as the number of infected individuals increases. This suggests that strategies to prevent stress on the coronavirus (e.g. antiviral prophylactics, high-

efficiency air filtration, masking, ultraviolet air purification) are key to reduce the risk of new mutations.<sup>4</sup>

As a result, it is important to protect the vulnerable subset of pregnant women and to empower them to protect themselves. Pregnant women have been at greater risk of complications with prior coronaviruses (Severe Acute Respiratory Syndrome (SARS) and Middle Eastern Respiratory Syndrome (MERS)).<sup>5</sup> They were identified as a vulnerable subset in the early stages of the COVID-19 pandemic.<sup>5,6</sup> In general preventative measures and treatment options for women in pregnancy are limited. However, the CDC recommendations published in April 2021 were that pregnant women should also receive the COVID-19 vaccine. New CDC research suggests that Pfizer/BioNTech and Moderna are safe for expectant mothers.<sup>7</sup> The COVID-19 Treatment Guidelines Panel of the NIH recommends that potentially effective treatments for COVID-19 should not be withheld from pregnant women because of theoretical concerns related to the safety of therapeutic agents in pregnancy. However, drugs need to be administered on an individually assessed basis.<sup>8</sup>

Before the pandemic, news of a pregnancy was usually a joyous event, but during this pandemic, joyful anticipation and celebration of new life is overshadowed with worry. Pregnant women agonize over how to protect their growing child and themselves from this disease. There is not enough data available to fully understand the effects of the virus or the vaccine on the pregnant patient and her unborn child. This is complicated by the changes that occur in immune function during pregnancy outlined in this paper. Does the pregnancy shift of the T-Helper (Th) cells reduce immunity to SARS-CoV-2? Would preventative measures be the appropriate path to take? And if yes, which one?

A connection between the gut and the COVID-19 virus has been found in recent studies.<sup>9</sup> There appears to be a deficit of certain strains of beneficial gut bacteria that serve as important immune modulators while other “bad” or pathogenic bacteria overpopulate the gut. This leads to the hypothesis, that when the microbiome’s population is less immune enhancing, the individual may be more susceptible to an invading pathogen like the coronavirus. This also leads to the assumption that it might serve a pregnant woman to enhance the stability and healthy diversity of her microbiome to support the immune system. The pregnant patient may benefit from the use of a probiotic. But is this hypotheses supported by evidence?

### **Impact of COVID-19 on maternal health in pregnancy**

According to the CDC, pregnant woman are at increased risk of developing more severe or complex symptoms when contracting SARS-CoV-2 compared to non-pregnant women. In a cohort study the CDC found that pregnant

women were at higher risk for hospitalization, mechanical ventilation and ICU admission as well as mortality versus non-pregnant women with SARS-CoV-2.<sup>10,11</sup> Additionally, pregnant women with COVID-19 might have an increased risk for adverse pregnancy outcomes, such as preterm birth.<sup>12</sup>

Results of a large systematic review and meta-analysis involving 1,100 patients from China, North America and Europe show that in the majority of cases the clinical course of infection in pregnant women was not complicated. Most common symptoms were fever and cough followed by anosmia, ageusia, myalgia, fatigue, sore throat, malaise, rigor, headache and poor appetite.<sup>13</sup> The most common laboratory abnormalities were elevated C-reactive protein and reduced lymphocyte count, which are consistent with infected non-pregnant adults from COVID-19.<sup>13</sup> Viral RNA was found to be absent in amniotic fluid, placenta, vaginal secretion and blood, suggesting that intrauterine/intrapartum transmission is unlikely.<sup>14</sup> But it had been found that there was a high frequency of preterm births.<sup>14</sup>

A multi-center retrospective cohort study<sup>15</sup> of facilities in Washington State, with 240 pregnant patients infected, found 10% hospitalizations and 1.25% maternal deaths. They calculated a case fatality rate in pregnant women to be 13.6-fold higher compared to non-pregnant, similarly aged individuals. Interestingly, some of the maternal deaths occurred postpartum, which makes the postpartum period a time of important surveillance. Overall, mild COVID-19 disease occurred in 90.8% of the pregnant patients (including 55 asymptomatic) and 9.2% developed severe and critical disease.<sup>15</sup>

In the same study<sup>15</sup> they also looked at pregnancy outcomes in SARS-CoV-2 infected pregnant women and found two spontaneous abortions in the first trimester. In the second and third trimester, nearly all had live births. Preterm births, however, were significantly higher among women with severe or critical COVID-19 at delivery, than for women who had recovered. Furthermore, neonates born to mothers with severe or critical COVID-19 at the time of delivery, were more likely to be low birth weight (<2500g) as well as more likely to be admitted to the NICU for fetal indications than those born to women with mild or recovered symptoms at the time of delivery. Most common diagnoses of the neonate were respiratory distress, hyperbilirubinemia and possible sepsis.<sup>15</sup> Therefore, the findings suggest that the first trimester and before delivery are times where the pregnant woman needs more protection. And as it will be explained in this paper, this time coincides with the times where the immune system is in a pro-inflammatory state.

Even so, long-term sequelae of a mothers COVID-19 infection at the time of pregnancy or delivery have not been



studied to determine adverse outcomes on a child's health. They might become an important part in neuropsychiatric disease diagnosis, such as autism spectrum disorder<sup>15</sup> as time goes by. Long-term sequelae of viral infections like influenza have been associated with congenital abnormalities, such as cleft palate, neuronal tube and congenital heart defects.<sup>16</sup>

### **Immune system during pregnancy and with COVID-19 infection**

The immune system in pregnancy faces the ultimate challenge. On one hand, the immune system needs to downregulate its activity towards foreign (fetal) tissue. Conversely, it needs to be able to defend against infectious agents. In other words, the immune system adapts to allow growth of the fetus as well as counteracts spontaneous abortion, which in turn, alters the immune response to viral infections.<sup>17</sup> The altered inflammatory response to viruses is mediated in part by a shift in cellular (Th-1) towards humoral (Th-2) immune response.<sup>18</sup> This causes a decrease of circulating natural killer (NK) as well as circulating plasmacytoid dendritic cells.<sup>17</sup>

The balance between the innate and adaptive immunity shifts in favor of the innate mechanisms, particularly in the first trimester. Whether maternal susceptibility to RNA viral infections is due to over- or under-activity of the innate immune system is not yet clear; it is likely that some effector mechanisms are upregulated while others are suppressed.<sup>19</sup>

In addition to this change in immune system function, a hormonal shift occurs and progesterone production is increased.<sup>17</sup> Progesterone is a steroid hormone, which plays an essential role in the establishment and maintenance of pregnancy as well as the onset of parturition.<sup>20</sup> In the myometrium, progesterone hinders a pro-inflammatory cytokine production.<sup>21</sup> Progesterone can decrease local and systemic inflammation, which consequently reduces Th cell function. Th cells play an important role in the adaptive immune system.<sup>22</sup> Therefore, it suggests that a decrease of Th cells causes a downregulated immune response to potential pathogens, like the coronavirus, and a decreased production of neutralizing antibodies to fight off the infection.

Mor and Cardenas<sup>23</sup> found that the immunology of pregnancy is the result of the combination of signals and responses originating from the maternal and fetal-placental immune system. They argue against the notion that the immune system shifts into a state of Th-2 (humoral) immunity or anti-inflammatory state during the entire pregnancy.<sup>23</sup> In fact, they propose that there are three immunological phases, characterized by distinct biological processes, which can be symbolized by how the pregnant woman feels.<sup>23-25</sup> The first and early second trimester, requires a strong pro-inflammatory response<sup>26</sup>

in order for the blastocyst to break through the epithelial lining of the uterus to implant. Subsequently, the mother feels unwell and experiences "morning sickness." The second phase happens, when the baby rapidly grows. It is an anti-inflammatory state and the mother feels at her best. Finally, during the third phase containing delivery, the body goes through a renewed inflammation and is in a pro-inflammatory state.<sup>23-26</sup>

These shifts from the pro- to anti- to pro-inflammatory phases, and the respective shifts in the diversity of cytokines, may also be reflected in the sensitivity to infectious disease.<sup>23-26</sup> For example, an exacerbated Th2 immunity shift has been found to induce uncontrolled viral infections, like with the fetal ZIKA virus, which results in microcephaly.<sup>27</sup> This suggests that with the now known overreactive inflammatory response (cytokine storm)<sup>28</sup> in COVID-19, there might be negative pregnancy outcomes as well. Therefore, an adequate balance between Th1 and Th2 immune responses during pregnancy is critical for a successful outcome. Additionally, failure to achieve a proper balance during pregnancy is associated with obstetrical complications,<sup>29</sup> like pregnancy loss<sup>30</sup> and preeclampsia.<sup>31</sup>

In addition to the systemic immune changes, there are anatomical alterations, like the chest shape and elevation of the diaphragm, which causes a reduction in total lung capacity and inability to clear secretions.<sup>32</sup> This further puts the pregnant mother at a disadvantage when fighting a respiratory viral infection, like SARS-CoV-2. SARS-CoV-2 can cause lung complications such as pneumonia and, in the most severe cases, acute respiratory distress syndrome (ARDS).<sup>33</sup>

Lwt's look at COVID-19 infection in terms of progression stages. There are three chronologic pathological stages, which define severity of the disease:<sup>28</sup>

- 1) Pulmonary stage with interstitial pneumonia and acute respiratory distress syndrome. In the pulmonary stage the epithelial cells of the upper and lower respiratory tracts are infected. Therefore, the person suffers from cold like symptoms, like a dry cough. The mucus epithelial cells, lining the respiratory and the digestive tracts, contain their very own immune system, the secretory Immunoglobulin A antibody (sIgAa) defense mechanism. A proficient sIgAa immune system neutralizes the coronavirus before the disease enters its second phase and becomes more severe and systemic.<sup>28</sup>

Historically, pneumonia during pregnancy has been associated with increased morbidity and mortality compared with non-pregnant women. Additionally, coexisting maternal disease, like asthma and anemia, increase the risk of contracting pneumonia in pregnancy.<sup>32</sup> And because

COVID-19 is a respiratory disease, it is fair to say that the risk of developing pneumonia with preexisting conditions, like asthma and anemia, is increased when contracting COVID-19 in pregnancy as well. Furthermore, developing pneumonia during pregnancy from COVID-19, is also associated with higher morbidity and mortality compared to non-pregnant women.

2) Proinflammatory stage with an overproduction of pro-inflammatory cytokines, which results in acute lung injury and systemic inflammation (cytokine storm).<sup>28</sup>

3) Prothrombic stage with widespread thrombosis, resulting in multiorgan failure or death respectively.<sup>28</sup>

All these stages suggest that the combination of the coronavirus disease in its second stage with a pregnancy pro-inflammatory phase (according to Mor and Cardenas, at the beginning and end of pregnancy<sup>23</sup>) could lead to a super pro-inflammatory cytokine storm. This means that it is possible, that the various pro-inflammatory cytokines and chemokines already released in abundance by the COVID-19 disease<sup>28</sup> could be facilitated or enhanced by the pro-inflammatory mechanisms of pregnancy. This then could cause a self-elicited and fatal systemic immunological reaction, which adversely affects every key organ in the body and may result in multiorgan failure.<sup>34</sup> If this premise holds true it would make the first and third immunological phases of pregnancy especially worrisome.

Because the phases of pro-inflammation in pregnancy coincides with a decrease in important immune cells, like lymphocytes, macrophages, Th-18 and NK-cells<sup>36</sup> as well as an increase in pro-inflammatory cytokines,<sup>23</sup> it might explain why the ability of the immune system to fight off an infection greatly decreases.

The second immunological phase, on the other hand, is considered anti-inflammatory. This includes the second trimester to before birth, where the immune response is no longer a predominant endocrine feature.<sup>23</sup> This might explain why negative pregnancy interference and outcomes with a COVID-19 infection<sup>5,6,10-12,15</sup> are seen less in mid-term pregnancy and may therefore reflect the sensitivity to infectious diseases in the other immunological phases of pregnancy.<sup>23</sup> Pregnant women in malaria-endemic regions are more susceptible to malaria infection during the first half of pregnancy than later on.<sup>37</sup> Lassa fever, caused by infection with an adenovirus, showed a higher rate of case-fatality in pregnant women particularly in the third trimester.<sup>38</sup>

### **The gut-COVID connection with pregnancy**

A paper written by Yeoh et al. found<sup>9</sup> that the microbiome composition was significantly altered in patients with

COVID-19 disease compared with non-COVID-19 individuals. Relating this significant finding to pregnancy immunologic changes requires further investigations, such as:

- SARS-CoV-2 pathophysiology can be attributed to aberrant immune responses in clearing the coronavirus.<sup>9</sup> In pregnancy with the aforementioned decreased adaptive immune system or a decrease in numbers of Th cells and antibodies respectively as well as an increase of pro-inflammatory cytokines,<sup>23-25</sup> there could be an even greater aberrant immune response.

- The detection of a viral load in fecal samples and the altered gut microbiota composition in COVID-19 infected people has been shown to correlate with disease severity. Additionally, disease severity correlates with the magnitude of plasma concentrations of several inflammatory cytokines, chemokines and blood markers such as C-reactive protein, lactate dehydrogenase, aspartate aminotransferase and gamma-glutamyltransferase.<sup>5,9</sup> This suggests that the depletion of immunomodulatory gut microorganisms and increase of pro-inflammatory messenger substances contribute to severe COVID-19 disease.<sup>9</sup>

In pregnancy (at conception, early second trimester and shortly before delivery) the immune system shifts towards a pro-inflammatory immunity.<sup>23-25</sup> This normal pro-inflammatory state coupled with severe dysbiosis of the microbiome composition<sup>9</sup> could potentially result in a rapid progression of a coronavirus infection to severe COVID-19 disease.

- Patients with COVID-19 were depleted in gut bacteria with known immunomodulatory potential, such as *Faecalibacterium (F) prausnitzii*, *Eubacterium (E) rectale* and several bifidobacterial species.<sup>9</sup> Replacing deficient gut bacteria with a probiotic supplement could be a viable and safe treatment option as a preventative measure or for mitigation of severe disease progression<sup>9</sup> in the pregnant patient.

- The dysbiotic gut microbiota composition in patients with COVID-19 persisted after clearance of the virus. This could explain persistent symptoms and/or multisystem inflammatory syndrome, that occurs in some patients after they tested negative to the coronavirus.<sup>9</sup> Recovered patients have experienced persistent symptoms such as fatigue, dyspnea and joint pains, some over 80 days after initial onset of symptoms.<sup>39-41</sup>

This makes postnatal care for mothers who recovered from COVID-19 infection very important.<sup>15</sup> Therefore it could be beneficial to take probiotic supplements for a minimum of three months after the corona test has been negative to rebalance the dysbiotic microbiome<sup>9</sup> and counteract long

COVID disease.<sup>39-41</sup>

Microbiome compositional differences were found in the gut microbiota of COVID-19 patients compared with healthy individuals. The main differences in species in COVID-19 patients was found to be an enrichment of *Ruminococcus* (R) *gnavus*, *R. torques* as well as *Bacteroides dorei* and depletion of *Bifidobacterium* (B) *adolescentis*, *F. prausnitzii* and *E. rectale*.<sup>9</sup> All of these depleted species play a positive immunomodulatory role in the human GI tract.<sup>42-44</sup> For example *F. prausnitzii* has been shown to cause secretion of the anti-inflammatory cytokine Interleukin (IL)-10.<sup>45</sup> Therefore, it appears, that the compositional differences, increase or decrease, of certain species in the gut microbiota of a COVID-19 patient, seem to reduce the functionality of the immune response to the disease.<sup>9</sup>

When identifying microbial species associated with disease severity, *F. prausnitzii* and *B. bifidum* were found to be decreased more in severe disease. This finding suggests that the amount of depletion correlates with an increased disease severity.<sup>9</sup> Furthermore, gut microbiota of recovered patients were still depleted in some species, which support immune system function, including *E. rectale*, *R. bromii*, *F. prausnitzii* and *B. longum*.<sup>9</sup>

Based on the observation that the gut microbiota is altered in patients with COVID-19, Yeoh et al. hypothesized that these compositional changes play a role in exacerbating the disease by contributing to dysregulation of the immune response.<sup>9</sup> In this study they were looking at the non-pregnant person. When adding the pregnancy altered immune response into consideration, an increased risk for complications or death with COVID-19 in the pregnant women becomes probable. And therefore, gut health could play an important role in prevention and/or inhibition of severe COVID-19 disease,<sup>9</sup> especially in pregnancy.

### **Potential beneficial role of probiotics on the outcome of COVID-19 in pregnancy**

The microbiome interacts with the host and performs many viable functions. It plays a major role in immunity, which is especially important when the immune system is challenged with a new virus. There are several axes known, such as the gut/lung axis or gut/brain axis. For example, through the mesenteric lymphatic system, intact beneficial gut bacteria and their metabolites enter the systemic circulation and exert positive influence on the pulmonary immune response (gut/lung axis). Through this pathway intestinal metabolites such as short chain fatty acids (SCFA) or anti-inflammatory cytokines (eg., IL-10) influence the immune status of the gut and other distant organs.<sup>46</sup> SCFA derived from gut therefore suppress lung inflammation.<sup>47,48</sup> And in the case of an ongoing airway infection, Th-cells that produce regulatory cytokines travel from the gut through

the lymphatic system to the respiratory system, providing support for the immune response via stimulation of an anti-inflammatory action.<sup>46</sup>

Non-COVID-19 individual stool samples were collected before COVID-19 disease.<sup>49</sup> Their microbiome was compared with individuals who had COVID-19 disease between February and May 2020. In the case of COVID-19 infection, the microbiome composition was altered. And Yeoh et al. (2021) found that the microbiome of patients with COVID-19 was immunologically impaired.<sup>9</sup> They concluded that without the appropriate bacteria, communication between the gut and the lung is decreased, which in turn causes an increase in inflammatory activity in the lungs.<sup>9</sup>

Additionally, in the setting of COVID-19, it is important to consider that antibiotics and antivirals are often administered resulting in further gut microbiota dysbiosis.<sup>46</sup> Dysbiosis triggers an increase in pro-inflammatory cytokines. This results in further disruption of the intestinal microbiome and results in damage to the mucous membrane barrier. A damaged barrier or increased permeability of the intestinal wall may lead to or enhance an already existing low-grade systemic inflammation. This causes further dysregulation of the human immune system and impairs the individual's ability to fight a viral infection. This has been called by the authors, Santacroce et al. (2021), as the «immunity dysregulation dysbiosis cycle» (IDDC).<sup>46</sup>

Evidence has demonstrated significant effects of probiotics in strengthening and modulating the immune system against disease.<sup>50-53</sup> *Lactobacillus* spp. and *Bifidobacterium* spp. are the main conventional probiotics that are available for use to balance or diversify the intestinal ecosystem in the fight against infections. Probiotics, such as *Lactobacillus* and *Bifidobacteria* can lead through an antiviral action to a balanced intestinal microbiome and thus contribute to an anti-inflammatory effect, which could potentially prevent an infection or even super-infection of COVID-19.<sup>47</sup>

### **Summary**

In summary, research has shown, that not only the viral infection of COVID-19, but also the host immune response defines disease evolution. A depleted gut microbiota taxa may play a role in overaggressive inflammation and disease outcome.<sup>9</sup> Gut bacteria such as *B. adolescentis*, *F. prausnitzii* and *E. rectale* have been linked to reducing host inflammatory response in other inflammatory related diseases.<sup>9,42-44</sup> And because they are available as an oral probiotic supplement, it might be beneficial to take a multispecies probiotic supplement before, during and for at least 3 months after pregnancy, with or without COVID-19 infection.

Early therapeutic approaches might be key in battling COVID-19 disease. Pharmaceutical administration in pregnancy is very limited, especially when drugs are still in the investigatory stage and whose mechanisms may be very aggressive with deleterious side effects for the patient. Data has yet to be accumulated and published on the effects of some of the current pharmaceutical therapeutics employed for COVID-19 on the pregnant patient and the fetus. Vaccination in pregnant women has been recommended by the CDC.<sup>6</sup> Pregnant women may be hesitant to receive it because of unknown longterm outcomes for them and their offspring.

This paper was written to provide a possible additional alternative. It has been demonstrated that probiotics can effectively counteract some immune dysregulations caused by viral infections.<sup>54</sup> Therefore, it may be a viable therapeutic approach to target first and second-stage pathogenesis of COVID-19 with probiotics. Potentially hindering the coronavirus from progressing to the third and final stage of the disease or decrease an exaggerated inflammatory response by counterproducing anti-inflammatory cytokines and chemokines as well as SCFA's.<sup>50-53</sup> This is especially important at the beginning and end of pregnancy (pro-

inflammatory phases).<sup>23</sup>

Probiotics have been used in pregnancy and are proven to be safe by the FDA.<sup>55</sup> They have been shown to protect against infectious disease by immunomodulatory regulation and antiviral activity.<sup>54</sup> Therefore it's recommendation for use as an additional strategy against COVID-19 infection or it's progression and ensuing complications is warranted. The metabolic actions of the beneficial gut bacteria in producing SCFAs and other anti-inflammatory properties reinforce the modified immune system of pregnancy. They also regulate the naturally occurring immune system shift and counteract dysbiosis in the case of COVID-19 disease.

### Conclusion

The challenging circumstances in combatting Covid-19 during pregnancy requires exceptional immune support. There is mounting evidence that probiotics modulate gut health. They are safe and effective in improving immunity and fighting viral activity. Disease severity has been moderated with a healthy microbiota, which could lessen the course of disease severity during pregnancy. This approach might be considered by clinicians caring for these patients.

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# Metarsus adductus in infants and toddlers: a literature review of clinical measurement tools

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## ABSTRACT

**Background:** Metatarsus adductus (MA) is a common lower limb torsional abnormality that affects 1/1000 births and is one of the reasons for in-toeing in children. This condition has a good prognosis as it commonly spontaneously recovers around the school-age years, with 10-15% of cases persisting. At present there is a lack of agreement in terms of definition, standard approach of measurement and documentation criteria and robust evidence for the validity of intra- or inter-examiner reliability. This creates a barrier in monitoring and referring cases appropriately between clinicians as well as providing prognosis and reassuring parents. The aim of this study was to align the clinical needs of documentation and observation in these common clinical cases. **Method:** Literature search of the Cochrane library, Pubmed and ScienceDirect was undertaken. Keywords used: 'MA', 'Intoeing', 'measurements/classification', in English language, 1-3 years, excluding congenital abnormalities and neurological causes. Articles identified were screened for relevance and references were further assessed. **Results:** 173 articles were identified of which 18 fulfilled the requirements. Out of the 8 relevant articles, only 3 were fully compatible with the age in question. Techniques to measure metatarsus adductus included the heel bisector method, photocopies, ultrasound, footprints, dynamic foot pressure and radiographs. Radiographs are considered inappropriate for the toddler age group. Lack of robust evidence was an issue with identifying inter- and intra-rater reliability with both radiographic and non-radiographic findings, especially in relation to the pediatric population. **Conclusion:** Clinicians can use history and physical examination to rule out 'red flag' findings and other pathologies and monitor the progress using non radiographic methods. Given the lack of skeletal maturity, as well as the radiosensitivity in the toddler age group, x-rays should be avoided unless indicated for intervention.

**Keywords:** Pediatrics, metatarsus adductus, intoeing, toddlers/infants, classification, measuring tools, inter/intra reliability

**Conflict of Interest:** The authors declare no conflict of interest. No funding was obtained for this study.

## Introduction

Metatarsus adductus (MA) is a common lower limb torsional abnormality that affects 1/1000 births and is one of the reasons for the common presentation of in-toeing in children. This condition has a fairly good prognosis as it spontaneously recovers around the school-age years, with 10-15% of cases persisting.<sup>1</sup> However, the clinician must be able to determine when the condition is benign and when further investigation is required. This is a grey area where reviewing the literature may have value. It is thought that untreated MA as a child may be implicated in adult hallux valgus, hammer toes, fifth metatarsal stress fractures, difficulty in shoe fitting and can contribute to increased trips and falls later in life.

The term metatarsus adductus was first used by Carmer in 1909, and since then the term has been used to describe a 'uniplanar transverse deformity of the metatarsal bone at the tarsometatarsal joint (Lisfranc joint).<sup>2</sup> Additional observational findings associated with the presence of metatarsus adductus is the prominent fibula due to the

convexity of the lateral border of the foot.<sup>3</sup> In spite of the term being used in the last 111 years and this finding being one of the most common congenital lower limb deformities in infants, the etiology and epidemiology of this condition are still unclear.<sup>4</sup> A number of theories suggest the primary cause of MA is due to intrauterine constraint,<sup>5</sup> oligohydramnios (a disorder of amniotic fluid resulting in decreased amniotic fluid volume for gestational age) and or poor muscle activation. None of these theories have been proven.<sup>5</sup>

At birth the walls of metatarsal shafts along with calcaneus, talus and occasionally cuboid are the only points that can be used as landmarks<sup>6</sup> in pediatric radiographs, as the other bones have not yet ossified.<sup>7</sup>

Therefore, the questions are, first, what are the currently available tools used to identify/quantify the presence of MA in infants and children? How accurate are they? Second, is there a legitimate challenge to the hypothesis that

radiographic measurements prove to be more accurate than non-radiographic measuring techniques in the pediatric population?

Tests for the condition are important as they drive the need for treatment and may be implicated if unnecessary treatment is initiated.

### Method

For the purpose of this study, toddler age was based on the Center for Disease Control and Prevention 2020 definition which has determined the toddler age as 1-3 years. Keywords used to explore the literature included: 'Metatarsus adductus', 'in-toeing', 'toddlers/infants', 'Classification', 'Measuring tools', 'inter/intra reliability'. The inclusion criteria defined included literature in English language, with no time restriction in years, healthy 1-3 year olds, in developed countries. Exclusion criteria eliminated neurological conditions (i.e. spasticity, cerebral palsy), other causes of in-toeing (tibial torsion and hip anteversion) as well as congenital abnormalities such as clubfoot, syndactyly, agenesis of foot bones, metatarsus varus.

Literature search commenced by examining The Cochrane Library for systematic reviews and trials around identification/measuring and quantification of MA and in-toeing in infant and children. Five trials were identified with 0 relevance. A collective of 173 articles were initially identified via Pubmed using both MeSH and advanced search terms. Of these, 11 relevant articles were identified and used in this study. A further 7 studies were identified by assessment of their reference list. A total of 18 articles were sourced and a total of eight proved to be relevant.

### Results

The diagnostic process to identify MA is primarily conducted by observation and bedside physical examination.<sup>8</sup> The two most common types of assessment tools are radiographic and non-radiographic methods. Some of the more commonly used classification tools for MA are Bleck's heel bisector method,<sup>2</sup> Foot Progression Angle, 'V' finger classification test and Ganley and Ganley MA flexibility test.<sup>9</sup> The radiographic methods are x-rays, foot scans and ultrasonography.<sup>10</sup> The simplest tool is to place the child in standing position onto a copy machine and push "print."

The 'V' finger test is a simple bedside examination tool where the heel of the child is placed between the examiner's index and 3rd finger. This allows observation of forefoot deviation and alerts the clinician to thoroughly examine for metatarsus adductus.<sup>3</sup> The Ganley and Ganley MA flexibility test is also a simple bedside exam tool that can follow the 'V finger test'. This test requires the examiner to manually correct the deformity using very low force to encourage the in-toeing deformity to be eliminated.<sup>11</sup> If the

foot is flexible, the clinician is able to assess that this is a moderate and non-progressive case of MA.

Berg's classification of MA appears to be the most commonly referenced type of classification tool. This classification combines findings from Bleck's 'heel bisector method' and serves two purposes: firstly to differentiate severity of each case into mild, moderate and severe cases and also to identify flexible, partially flexible and fixed MA cases.<sup>11,12</sup> In the normal foot, the heel bisector line starts at the calcaneus and should cross between the 2nd and the 3rd toes, whereas in severe cases, this line crosses between 4th and 5th toes.<sup>13</sup> However, this classification has been modified by different authors who have tried to improve the reliability of the test. 'Lateral border heel line' is one of the adjunct suggestions proposed by Karami et al. (2017) in an attempt to challenge and improve the validity of this tool.<sup>14</sup> Karami compared the MA severity index and Berg's classification and found a good rho (coefficient) between the two tests; hence, the two variables are similar and can be used interchangeably.<sup>14</sup> Despite the novel approach, not much was done in terms of assessing the intra- and inter-examiner reliability of this tool. This should be taken into consideration when evaluating the results.

Technology affords us the identification/quantification of MA with the radiographic examination. Using radiographic measurements, the clinician needs to anticipate if the risk outweighs the benefit in each case, given that toddlers are more radiosensitive than adults. The FDA's Center for Devices and Radiological Health (CDRH) states that despite the use of minimal dosage in children's radiographs,<sup>5,15</sup> these should be prescribed with caution and used only in cases that are essential for diagnosis or preoperative determination.

Numerous types of measurements are available in the radiographic field to assess the presence of MA.<sup>16</sup> However, the validity and reliability of most of these measurements is currently being questioned as the age group in question has insufficient ossification of important foot landmarks due to their skeletal maturity.<sup>7</sup> A number of articles commented on the validity of what is considered the traditional angle and most commonly used radiographic angles.<sup>6</sup> These included: Kite's angle (talo-first metatarsal angle), Calcaneal — 5th metatarsal angle, calcaneus and 2nd metatarsal angle as traditional measurements for MA evaluation. Engel's angle (middle cuneiform and 2nd metatarsal angle), heel bisector variability and talus/1st metatarsal angles have more recently been advocated.<sup>9</sup>

Within the field of imagery studies, 'foot scans' are also advocated. The use of 'static weight bearing foot scan' appears to be the method most commonly used within this category to assess the pediatric MA. This position allows



the foot to get into the plantigrade position and reduces the flexibility component allowing a true measurement of the resting weight bearing position.<sup>14</sup> However, the limited number of studies describing this method does not allow for much comparison of technique nor examination of limitations and human error involved in these tests. Positioning and supporting a dependent child with standing can easily introduce some variables that can skew the results. Human errors in positioning and bias in holding are some potential issues.

A more recent technique that has attracted the interest of researchers is the use of ultrasound techniques as it allows the visualization of cartilaginous regions in the tarsal bones.<sup>14</sup> The dynamic component of ultrasound means that it can be combined with the standard bedside examinations such as the Ganley and Ganley flexibility test. This allows observing the ability of the foot to correct along with assessing the integrity of all the cartilaginous structures.<sup>10</sup>

In summary, there is a lack of agreement in terms of definition, standard approach of measurement and robust evidence for validity or intra- and inter-rated reliability.<sup>6,9,14</sup> Inter-rater reliability refers to degree of agreement among raters. Intra-rater reliability refers to the ability of the same examiner to reproduce the results in different cases. No studies have been identified where intra/inter-rater reliability was examined in the pediatric population. No clear gender comparisons were made in the samples tested in the studies.

### Discussion

The goal of this paper was to determine the most credible clinical/scientific methods to diagnose metatarsus adductus and predict its prognosis in the infant and toddler population. None of the studies found were devised to do more than describe the methods used to determine the degree of metatarsus adductus so the predictability question was not answered.

If metatarsus adductus persists beyond the preschool age, radiographic findings can provide a more robust answer as to the reason and inform both the clinician who can recommend interventions and give the parents a prognosis given the high inter- and intra-rater reliability in the older age groups. In the infant/toddler group, an observational approach i.e., Berg's classification<sup>11</sup> can be the most appropriate starting point. Despite this, the findings provide no answers to whether spontaneous recovery will be achieved. Checking flexibility of the foot can have clinical utility in this regard. Further, the clinician can combine the visual observation of the heel bisector to the case history and growth chart of each child and make appropriate recommendations. In all cases of evidence-based practice, it is important to examine the available literature, use

clinician's expertise and patient's or parent's needs and preferences. MA can be documented and observed in this way.

A lack of uniform evaluation was observed in the research literature. In quantification tools, radiographs in weight bearing were most commonly done in the older age group. Foot prints and visual bisectors were also used as quantification tools. However, among non-invasive methods, The Berg classification is one of the more commonly used non-invasive identification/quantification techniques in studies. Foot scans and ultrasonography were the alternative non-invasive methods and have been observed more commonly the last 5 years.<sup>14</sup> However paucity of evidence for intra- and inter-reliability is observed in the research creating a discrepancy in comparing results and drawing conclusions at this point in time.

Appreciating the lack of ossification in foot structures of this population and utilising the FDA advice on radiosensitivity, radiographic interventions must be avoided at this age group unless indicated by history.<sup>15,16</sup>

In summary, there is a lack of agreement in terms of definition, standard approach of measurement and robust evidence for the validity of intra- and inter-rated reliability. More research is required to meet these milestones.

There are both non-invasive measuring tools and invasive (radiographic) tools to evaluate a toddler for MA. There is insufficient robust evidence for the quality, reliability and validity for any of the methods. Because parents commonly consult chiropractors for the condition of MA in their infant or toddler, it is essential that each chiropractor determine the best method to determine degree of the problem along with prognosis. Further, an understanding of the methods will potentially improve interprofessional communication and monitoring.

The articles identified in this study are few and the age category proves very difficult to identify sufficient research for consideration.

### Conclusion

A universally used/accepted tool to assess the MA in toddlers could not only improve inter-professional management and intervention but also be able to reassure parents and manage their expectations.

Considering best evidence, the clinician is left to determine what works best in their own clinical setting. Certainly, chiropractors are able to determine the flexibility of the deformity, which indicates it is a short-term rather than long-term issue. More meaningful conclusions can be made if longitudinal cross-sectional studies are available in the

future for assessing progression of metatarsus adductus. Considering the 1/1000 prevalence of this finding, more work needs to be carried out to narrow the gap in identifying

for appropriate referral of the 10-15% cases with persistent MA. Based on these findings, there is a good indication that perhaps literature is not saturated in this domain.

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## Plant-Based Beverages in the Diets of Infants and Young Children

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*JAMA Pediatr.* Published online February 22, 2021.  
[doi: 10.1001/jamapediatrics.2020.5840](https://doi.org/10.1001/jamapediatrics.2020.5840)

### ABSTRACT

Plant-based beverage intake in the US increased 61% from 2012 to 2017 owing to interest in vegetarian and vegan diets and plant-based options, environmental and ethical concerns, perceived health benefits, cow's milk allergy and intolerance, and taste preferences. In 2016, 5% of children aged 2 to 4 years enrolled in the Feeding Infants and Toddlers Study, one of the largest dietary intake studies in the US, consumed plant-based milk on the day of the survey, an increase from past years. However, little is known about patterns of plant-based beverage intake among children aged 12 to 24 months, for which a nutrient-dense diet is particularly important for optimal growth and development. A recent National Academies of Sciences, Engineering, and Medicine committee report summarized the recommendations from authoritative bodies in high-income countries on plant-based beverage intake for young children. Overall, most of the authoritative bodies recommended against the provision of plant-based beverages to young children, with some nuances in the guidance provided. Across the guideline documents reviewed, however, the National Academies committee identified a range of methodological approaches, which has implications for both the consistency and quality of guideline documents. In the future, it is important for organizations to collaborate on the planning and development of guidelines, including the process of conducting systematic evidence reviews, the report concluded.

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## Effect of Collaborative Care on Persistent Postconcussive Symptoms in Adolescents: A Randomized Clinical Trial

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*JAMA Netw Open.* 2021;4(2):e210207.  
[doi:10.1001/jamanetworkopen.2021.0207](https://doi.org/10.1001/jamanetworkopen.2021.0207)

### ABSTRACT

**Key Points:** Question What is the effectiveness of collaborative care with cognitive behavioral therapy for treating adolescents with persistent postconcussive symptoms? **Findings:** In this randomized clinical trial of 200 adolescents, those who received collaborative care reported fewer postconcussive symptoms at 3 and 12 months and higher health-related quality of life at 12 months compared with a control group receiving usual care. **Meaning:** These findings suggest that collaborative care with cognitive behavioral therapy is a promising treatment to alleviate symptoms and improve functioning for adolescents with persistent postconcussive symptoms. **Abstract:** Importance Despite the high level of impairment for adolescents with persistent postconcussive symptoms, few studies have tested whether such problems can be remediated. **Objective:** To examine whether collaborative care treatment is associated with improvements in postconcussive, quality of life, anxiety, and depressive symptoms over 1 year, compared with usual care. **Design, Setting, and Participants:** The Collaborative Care Model for Treatment of Persistent Symptoms After Concussion Among Youth II Trial was a randomized clinical trial conducted from March 2017 to May 2020 with follow-up assessments at 3, 6, and 12 months. Participants were recruited from pediatric primary care, sports medicine, neurology, and rehabilitation clinics in western Washington. Adolescents aged 11 to 18 years with a diagnosed sports-related or recreational-related concussion within the past 9 months and with at least 3 symptoms persisting at least 1 month after injury were eligible. Data analysis was performed from June to September 2020. **Interventions:** The collaborative care intervention included cognitive behavioral therapy and care management, delivered mostly through telehealth, throughout the 6-month treatment period, with enhanced medication consultation when warranted. The comparator group was usual care provided in specialty clinics. **Main Outcomes and Measures:** Primary outcomes were adolescents' reports of postconcussive, quality of life, anxiety, and depressive symptoms. Secondary outcomes were parent-reported symptoms. **Results:** Of the 390 eligible adolescents, 201 (51.5%) agreed to participate, and 200 were enrolled (mean [SD] age, 14.7 [1.7] years; 124 girls [62.0%]), with 96% to 98% 3- to 12-month retention. Ninety-nine participants were randomized to usual care, and 101 were randomized to collaborative care. Adolescents who received collaborative care reported significant improvements in Health Behavior Inventory scores compared with usual care at 3 months (3.4 point decrease; 95% CI, -6.6 to -0.1 point decrease) and 12 months (4.1 point decrease; 95% CI, -7.7 to -0.4 point decrease). In addition, youth-reported Pediatric Quality of Life Inventory scores at 12 months improved by a mean of 4.7 points (95% CI, 0.05 to 9.3 points) in the intervention group compared with the control group. No differences emerged by group over time for adolescent depressive or anxiety symptoms or for parent-reported outcomes. **Conclusions and Relevance:** Although both groups improved over time, youth receiving the collaborative care intervention had fewer symptoms and better quality of life over 1 year. Intervention delivery through telehealth broadens the reach of this treatment.

## Complementary and Alternative Medicine Used by Children in Military Pediatric Clinics

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May 2011 *Journal of alternative and complementary medicine* (New York, N.Y.) 17(6):531-7 Follow journal

DOI: [10.1089/acm.2010.0339](https://doi.org/10.1089/acm.2010.0339)

### ABSTRACT

The objective of this study was to evaluate the prevalence, types, perceived effects, and factors that influence the use of complementary and alternative medicine (CAM) by military children. A parent survey was administered in two military general pediatric clinics from June to September 2009. Parents completed surveys about their children including the following items: demographic information, a list of specific CAM therapies, family CAM use, and child health status. Caregivers completed 278 surveys. The overall use of CAM was 23%. The most common type of CAM used was herbal therapy (34%). The CAM therapies most commonly reported to be very helpful were special diets (67%), melatonin (57%), vitamins and minerals used at doses higher than the recommended daily allowance (50%), and massage therapy (50%). The majority of users reported no side-effects (96%). Among CAM users, 53% had discussed their CAM use with a physician and 47% had seen a CAM practitioner. Factors associated with CAM use in multiple regression analysis included chronic conditions ( $p=0.001$ ), parent/sibling use of CAM ( $p<0.001$ ), and parent age over 30 years ( $p=0.02$ ). Primary sources of CAM information were friends and family (68%) and doctors (44%). Common reasons for using CAM were to promote general health (70%), to relieve symptoms (56%), and to improve quality of life (48%). Eighty percent (80%) of all respondents indicated they would use CAM if recommended by a physician. In this military population with access to universal health care, CAM use is higher than the U.S. national average and nearly double that of the 2007 National Health Interview Survey study. Patients with chronic conditions, family members using CAM, and parental age over 30 years are more likely to use CAM. CAM is perceived as helpful with minimal to no side-effects. Pediatricians should inquire about CAM use and be prepared to provide guidance on this topic.

## Association Between Epidural Analgesia During Labor and Risk of Autism Spectrum Disorders in Offspring

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*JAMA Pediatr.* 2020;174(12):1168-1175.

doi:[10.1001/jamapediatrics.2020.3231](https://doi.org/10.1001/jamapediatrics.2020.3231)

### ABSTRACT

**Key Points:** Question: Is there an association between maternal labor epidural analgesia given for vaginal delivery and risk of autism spectrum disorders in children? **Findings:** In this multiethnic population-based clinical birth cohort that included 147,895 children, autism spectrum disorders were diagnosed in 1.9% of the children delivered vaginally with epidural analgesia vs 1.3% of the children delivered vaginally without the exposure, a 37% relative increase in risk that was significant after adjusting for potential confounders. **Meaning:** This study suggests that exposure to epidural analgesia for vaginal delivery may be associated with increased risk of autism in children; further research is warranted to confirm the study findings and understand the potential mechanisms. **Importance:** Although the safety of labor epidural analgesia (LEA) for neonates has been well documented, the long-term health effects of LEA on offspring remain to be investigated. **Objective:** To assess the association between maternal LEA exposure and risk of autism spectrum disorders (ASDs) in offspring. **Design, Setting, and Participants:** Data for this retrospective longitudinal birth cohort study were derived from electronic medical records from a population-based clinical birth cohort. A total of 147 895 singleton children delivered vaginally between January 1, 2008, and December 31, 2015, in a single integrated health care system were included. Children were followed up from the age of 1 year until the first date of the following occurrences: clinical diagnosis of ASD, last date of health plan enrollment, death, or the study end date of December 31, 2018. **Exposures:** Use and duration of LEA. **Main Outcomes and Measures:** The main outcome was clinical diagnosis of ASD. Cox proportional hazards regression analysis was used to estimate the hazard ratio (HR) of ASD associated with LEA exposure. Results Among the cohort of 147 895 singleton children (74 425 boys [50.3%]; mean [SD] gestational age at delivery, 38.9 [1.5] weeks), 109 719 (74.2%) were exposed to maternal LEA. Fever during labor was observed in 13 055 mothers (11.9%) in the LEA group and 510 of 38 176 mothers (1.3%) in the non-LEA group. Autism spectrum disorders were diagnosed in 2039 children (1.9%) in the LEA group and 485 children (1.3%) in the non-LEA group. After adjusting for potential confounders, including birth year, medical center, maternal age at delivery, parity, race/ethnicity, educational level, household income, history of comorbidity, diabetes during pregnancy, smoking during pregnancy, preeclampsia or eclampsia, prepregnancy body mass index, gestational weight gain, gestational age at delivery, and birth weight, the HR associated with LEA vs non-LEA exposure was 1.37 (95% CI, 1.23-1.53). Relative to the unexposed group, the adjusted HR associated with LEA exposure of less than 4 hours was 1.33 (95% CI, 1.17-1.53), with LEA exposure of 4 to 8 hours was 1.35 (95% CI, 1.20-1.53), and with LEA exposure of more than 8 hours was 1.46 (95% CI, 1.27-1.69). Within the LEA group, there was a significant trend of ASD risk associated with increasing duration of LEA exposure after adjusting for covariates (HR for linear trend, 1.05 [95% CI, 1.01-1.09] per 4 hours). Adding fever to the model did not change the HR estimate associated with LEA exposure (adjusted HR for LEA vs non-LEA, 1.37 [95% CI, 1.22-1.53]). **Conclusions and Relevance:** This study suggests that maternal LEA may be associated with increased ASD risk in children. The risk appears to not be directly associated with epidural-related maternal fever.

## Pediatric Osteopathic Manipulative Medicine: A Scoping Review

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 January 2021 *Pediatrics* 147(2):e2020016162 Follow journal  
[DOI: 10.1542/peds.2020-016162](https://doi.org/10.1542/peds.2020-016162)

### ABSTRACT

**Context:** A common reproach precluding the use of osteopathic manipulative medicine (OMM) in pediatrics is a lack of evidence regarding its safety, feasibility, and effectiveness. **Objective:** We conducted a systematic, scoping review of pediatric osteopathic medicine to identify gaps in the literature and make recommendations for future research. **Data sources:** We searched 10 databases using 6 key words and medical subject heading terms for any primary articles reporting OMM use in children published from database inception until initiation of the study. **Study selection:** Articles were selected if they reported primary data on OMM conducted in the United States on patient(s) 0 to 18 years old. **Data extraction:** Baseline study characteristics were collected from each article and the Grading of Recommendations, Assessment, Development, and Evaluations system was used to critically appraise each study. **Results:** Database search yielded 315 unique articles with 30 studies fulfilling inclusion and exclusion criteria. Of these, 13 reported the data required to demonstrate statistically significant results, and no significant adverse events were reported. The majority of studies were graded as providing weak clinical evidence because of significant methodologic flaws and biases. **Limitations:** The review was limited to US-based studies and reports. Minimal discrepancies between reviewers were resolved via an objective third reviewer. **Conclusions:** There is little strong, scientific, evidence-based literature demonstrating the therapeutic benefit of OMM for pediatric care. No strong clinical recommendations can be made, but it can be medically tolerated given its low risk profile. High-quality, scientifically rigorous OMM research is required to evaluate safety, feasibility, and efficacy in pediatrics.

## Association Between Disturbed Sleep and Depression in Children and Youths: A Systematic Review and Meta-analysis of Cohort Studies

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*JAMA Netw Open.* 2021;4(3):e212373. March 22, 2021  
[doi:10.1001/jamanetworkopen.2021.2373](https://doi.org/10.1001/jamanetworkopen.2021.2373)

### ABSTRACT

**Key Points:** Question Is disturbed sleep associated with depression in children and youths? **Findings:** In this meta-analysis of 16 studies including 27 073 patients, pooled estimates supported the role of disturbed sleep as a risk factor for depression in children and youths. Effect size estimates were small but statistically significant. **Meaning:** This study suggests that disturbed sleep is a component of the multifaceted risk profile of depression and should be included in prevention programs as early as childhood. **Importance:** Disturbed sleep represents a potentially modifiable risk factor for depression in children and youths that can be targeted in prevention programs. **Objective:** To evaluate the association between disturbed sleep and depression in children and youths using meta-analytic methods. **Data Sources:** Embase, MEDLINE, PsycINFO, Scopus, Web of Science, and ProQuest Dissertations & Theses Global were searched for articles published from 1980 to August 2019. **Study Selection:** Prospective cohort studies reporting estimates, adjusted for baseline depression, of the association between disturbed sleep and depression in 5- to 24-year-old participants from community and clinical-based samples with any comorbid diagnosis. Case series and reports, systematic reviews, meta-analyses, and treatment, theoretical, and position studies were excluded. A total of 8700 studies met the selection criteria. This study adhered to the guidelines of the Preferred Reporting Items for Systematic Reviews (PRISMA) and Meta-analyses and the Meta-analysis of Observational Studies in Epidemiology (MOOSE) statements. **Data Extraction and Synthesis:** Study screening and data extraction were conducted by 2 authors at all stages. To pool effect estimates, a fixed-effect model was used if  $I^2 < 50\%$ ; otherwise, a random-effects model was used. The  $I^2$  statistic was used to assess heterogeneity. The risk of bias was assessed using the Research Triangle Institute Item Bank tool. Metaregression analyses were used to explore the heterogeneity associated with type of ascertainment, type of and assessment tool for disturbed sleep and depression, follow-up duration, disturbed sleep at follow-up, and age at baseline. **Main Outcome and Measures:** Disturbed sleep included sleep disturbances or insomnia. Depression included depressive disorders or dimensional constructs of depression. Covariates included age, sex, and sociodemographic variables. **Results:** A total of 22 studies (including 28 895 patients) were included in the study, of which 16 (including 27 073 patients) were included in the meta-analysis. The pooled  $\beta$  coefficient of the association between disturbed sleep and depression was 0.11 (95% CI, 0.06-0.15;  $P < .001$ ;  $n = 14\ 067$ ;  $I^2 = 50.8\%$ ), and the pooled odds ratio of depression in those with vs without disturbed sleep was 1.50 (95% CI, 1.13-2.00;  $P = .005$ ;  $n = 13\ 006$ ;  $I^2 = 87.7\%$ ). Metaregression and sensitivity analyses showed no evidence that pooled estimates differed across any covariate. Substantial publication bias was found. **Conclusions and Relevance:** This meta-analysis found a small but statistically significant effect size indicating an association between sleep disruption and depressive symptoms in children and youths. The high prevalence of disturbed sleep implies a large cohort of vulnerable children and youths who could develop depression. Disrupted sleep should be included in multifaceted prevention programs starting in childhood.

## Quantitative imaging of tongue kinematics during infant feeding and adult swallowing reveals highly conserved patterns

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*Physiological Reports* Volume 9, Issue 3 ee14685 First published: 06 February 2021

<https://doi.org/10.14814/phy2.14685>

### ABSTRACT

Tongue motility is an essential physiological component of human feeding from infancy through adulthood. At present, it is a challenge to distinguish among the many pathologies of swallowing due to the absence of quantitative tools. We objectively quantified tongue kinematics from ultrasound imaging during infant and adult feeding. The functional advantage of this method is presented in several subjects with swallowing difficulties. We demonstrated for the first time the differences in tongue kinematics during breast- and bottle-feeding, showing the arrhythmic sucking pattern during bottle-feeding as compared with breastfeeding in the same infant with torticollis. The method clearly displayed the improvement of tongue motility after frenotomy in infants with either tongue-tie or restrictive labial frenulum. The analysis also revealed the absence of posterior tongue peristalsis required for safe swallowing in an infant with dysphagia. We also analyzed for the first time the tongue kinematics in an adult during water bolus swallowing demonstrating tongue peristaltic-like movements in both anterior and posterior segments. First, the anterior segment undulates to close off the oral cavity and the posterior segment held the bolus, and then, the posterior tongue propelled the bolus to the pharynx. The present methodology of quantitative imaging revealed highly conserved patterns of tongue kinematics that can differentiate between swallowing pathologies and evaluate treatment interventions. The method is novel and objective and has the potential to advance knowledge about the normal swallowing and management of feeding disorders.

OPEN ACCESS: <https://physoc.onlinelibrary.wiley.com/doi/10.14814/phy2.14685>

## Association of the Timing of School Closings and Behavioral Changes With the Evolution of the Coronavirus Disease 2019 Pandemic in the US

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*JAMA Pediatr.* Published online February 22, 2021.

[doi:10.1001/jamapediatrics.2020.6371](https://doi.org/10.1001/jamapediatrics.2020.6371)

### ABSTRACT

**Key Points:** Question: What are the independent associations of voluntary behavioral change and legal restrictions, such as state-mandated school closings, with the subsequent spread of the coronavirus disease 2019 (COVID-19) pandemic in the US? **Findings:** In this cross-sectional study of US COVID-19 data, voluntary behavioral changes, such as reductions in time spent at work, had an association with COVID-19 incidence and mortality that was 3 times stronger than that of school closures. **Meaning:** These findings suggest that less harmful ways of preventing severe acute respiratory syndrome coronavirus 2 transmission are available than mandatory school closures. **Importance:** The consequences of school closures for children's health are profound, but existing evidence on their effectiveness in limiting severe acute respiratory syndrome coronavirus 2 transmission is unsettled. **Objective:** To determine the independent associations of voluntary behavioral change, school closures, and bans on large gatherings with the incidence and mortality due to coronavirus disease 2019 (COVID-19). **Design, Setting, and Participants:** This population-based, interrupted-time-series analysis of lagged independent variables used publicly available observational data from US states during a 60-day period from March 8 to May 18, 2020. The behavioral measures were collected from anonymized cell phone or internet data for individuals in the US and compared with a baseline of January 3 to February 6, 2020. Estimates were also controlled for several state-level characteristics. **Exposures:** Days since school closure, days since a ban on gatherings of 10 or more people, and days since residents voluntarily conducted a 15% or more decline in time spent at work via Google Mobility data. **Main Outcomes and Measures:** The natural log of 7-day mean COVID-19 incidence and mortality. **Results:** During the study period, the rate of restaurant dining declined from 1 year earlier by a mean (SD) of 98.3% (5.2%) during the study period. Time at work declined by a mean (SD) of 40.0% (7.9%); time at home increased by a mean (SD) of 15.4% (3.7%). In fully adjusted models, a delay of 1 day in implementing mandatory school closures was associated with a 3.5% reduction (incidence rate ratio [IRR], 0.965; 95% CI, 0.946-0.984) in incidence, whereas each day of delay in behavioral change was associated with a 9.3% reduction (IRR, 0.907; 95% CI, 0.890-0.925) in incidence. For mortality, each day of delay in school closures was associated with a subsequent 3.8% reduction (IRR, 0.962; 95% CI, 0.926-0.998), and each day of delay in behavioral change was associated with a 9.8% reduction (IRR, 0.902; 95% CI, 0.869-0.936). Simulations suggest that a 2-week delay in school closures alone would have been associated with an additional 23 000 (95% CI, 2000-62 000) deaths, whereas a 2-week delay in voluntary behavioral change with school closures remaining the same would have been associated with an additional 140 000 (95% CI, 65 000-294 000) deaths. **Conclusions and Relevance:** In light of the harm to children of closing schools, these findings suggest that policy makers should consider better leveraging the public's willingness to protect itself through voluntary behavioral change.

## Harnessing the Web: How Chiropractic Education Survives and Thrives During the COVID-19 Pandemic: Chiropractic Educators Research Forum (CERF), December 5, 2020

Conference Proceedings: Chiropractic Educators Research Forum

*J Chiropr Educ* (2021) ABSTRACT | FEBRUARY 25 2021

<https://doi.org/10.7899/JCE-20-27>

### ABSTRACT

This conference was convened by the Chiropractic Educators Research Forum (CERF) on December 5, 2020. This meeting provided a forum for the presentation of scholarly works in chiropractic education theory and practice. This conference specifically focused on research related to chiropractic education during the COVID-19 pandemic. During the December 2020 CERF meeting, presenters and panelists took an in depth look at how programs worked to meet program objectives, graduation requirements, accreditation, and other activities during the COVID-19 pandemic.

**Keywords:** Chiropractic, Education, Congress [Publication Type], COVID-19 [Supplementary Concept]

## Family-Centered Prevention Effects on the Association Between Racial Discrimination and Mental Health in Black Adolescents: Secondary Analysis of 2 Randomized Clinical Trials

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*JAMA Netw Open*. 2021;4(3):e211964. March 24, 2021

[doi:10.1001/jamanetworkopen.2021.1964](https://doi.org/10.1001/jamanetworkopen.2021.1964)

### ABSTRACT

**Key Points:** Question Is participation in a family-centered prevention program, designed to enhance caregiving practices, associated with protection of Black adolescents from the effects of racial discrimination on their mental health? **Findings:** This secondary analyses of data from 2 randomized clinical trials found that participation in a family-centered prevention program was associated with protection of Black adolescents from the effects of racial discrimination on conduct problems (in both trials) and on depression/anxiety symptoms (in 1 trial). These associations were partially explained by intervention-induced changes in protective parenting. **Meaning:** These findings suggest that family-centered prevention programs reduce the effects of racial discrimination on subsequent increases in mental health problems among Black adolescents. **Importance:** Some Black adolescents who frequently experience racial discrimination develop mental health problems. Protective caregiving may buffer adolescents from the negative mental health outcomes associated with experiencing racial discrimination. **Objective:** To examine if participation in programs that enhance protective caregiving will attenuate the positive association between Black adolescents' encounters with discrimination and subsequent increases in mental health problems. **Design, Setting, and Participants:** This secondary analysis used data from 2 randomized clinical trials testing family-centered prevention programs: the Strong African American Families—Teen (SAAF—T) program and the Adults in the Making (AIM) program. The programs were implemented in community locations convenient for participants in 12 rural Georgia counties. For the SAAF—T trial, Black adolescents and their primary caregivers were recruited from 2007 to 2008. In the AIM trial Black adolescents and their primary caregivers were recruited from 2006 to 2007. Data for this study were analyzed from June to August 2020. **Exposures:** Adolescents provided data at baseline on the frequency of their encounters with racial discrimination. Treatment group participants in each trial took part in a family-centered prevention program designed to prevent substance use and mental health problems. SAAF—T is a 5-session, 10-hour psychosocial intervention for families with a Black adolescent aged 14 to 16 years. AIM is a 6-session, 12-hour psychosocial intervention for families with a Black youth who is a high school senior. **Main Outcomes and Measures:** The primary outcomes were mental health problems, including conduct problems and depression or anxiety symptoms. **Results:** The SAAF—T study included 502 Black adolescents (mean [SD] age, 16.0 [0.6] years; 281 [56.0%] girls), including 252 randomized to the intervention and 250 randomized to the control, and the AIM trial included 367 Black adolescents (mean [SD] age, 17.7 [0.8] years; 217 [59.1%] girls and women), including 187 randomized to the intervention and 180 randomized to the control. Adolescents assigned to the SAAF—T intervention group who frequently experienced discrimination at baseline evinced fewer subsequent increases in conduct problems (incident risk ratio, 0.530 [95% CI, 0.340 to 0.783]). Adolescents assigned to the AIM intervention group who frequently experienced discrimination at baseline evinced fewer subsequent increases in conduct problems (mean difference, -0.361 [95% CI, -0.577 to -0.144]) and fewer subsequent increases in depression or anxiety symptoms (mean difference, -0.220 [95% CI -0.402 to -0.038]). Moderated mediation analyses suggested that enhanced protective caregiving was partially responsible for all observed interaction effects (indirect effect: SAAF-T conduct problems, -0.063 [95% CI, -0.127 to -0.001]; AIM conduct problems, -0.048 [95% CI, -0.095 to -0.001]; AIM depression or anxious symptoms, -0.036 [95% CI, -0.074 to 0]). **Conclusions and Relevance:** This secondary analysis of 2 randomized clinical trials found that participation in family-centered preventive interventions attenuated the association between frequent exposure to discriminatory behaviors and subsequent mental health problems. Notably, all but 1 of the treatment and moderated-mediation findings were reproduced across the SAAF—T and AIM trials.

**Trial Registrations:** ClinicalTrials.gov Identifiers: SAAF—T, NCT04501471; AIM, NCT04510116

## Shedding light on excessive crying in babies

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*Pediatric Research* 2020 Jul 6. Online ahead of print.

PMID: 32629458 DOI: [10.1038/s41390-020-1048-6](https://doi.org/10.1038/s41390-020-1048-6)

### ABSTRACT

**Background:** Excessive and inconsolable crying behavior in otherwise healthy infants (a condition called infant colic (IC)) is very distressing to parents, may lead to maternal depression, and in extreme cases, may result in shaken baby syndrome. Despite the high prevalence of this condition (20% of healthy infants), the underlying neural mechanisms of IC are still unknown. **Methods:** By employing the latest magnetic resonance imaging (MRI) techniques in newborns, we prospectively investigated whether newborns' early brain responses to a sensory stimulus (smell) is associated with a subsequent crying behavior. **Results:** In our sample population of 21 healthy breastfed newborns, those who developed IC at 6 weeks exhibited brain activation and functional connectivity in primary and secondary olfactory brain areas that were distinct from those in babies that did not develop IC. Different activation in brain regions known to be involved in sensory integration was also observed in colicky babies. These responses measured shortly after birth were highly correlated with the mean crying time at 6 weeks of age. **Conclusions:** Our results offer novel insights into IC pathophysiology by demonstrating that, shortly after birth, the central nervous system of babies developing IC has already greater reactivity to sensory stimuli than that of their noncolicky peers. **Impact:** Shortly after birth, the central nervous system of colicky infants has a greater sensitivity to olfactory stimuli than that of their noncolicky peers. This early sensitivity explains as much as 48% of their subsequent crying behavior at 6 weeks of life. Brain activation patterns to olfactory stimuli in colicky infants include not only primary olfactory areas but also brain regions involved in pain processing, emotional valence attribution, and self-regulation. This study links earlier findings in fields as diverse as gastroenterology and behavioral psychology and has the potential of helping healthcare professionals to define strategies to advise families.

## Preterm Birth and the Development of Visual Attention During the First 2 Years of Life: A Systematic Review and Meta-analysis

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March 30, 2021. *JAMA Netw Open*. 2021;4(3):e213687.

doi:[10.1001/jamanetworkopen.2021.3687](https://doi.org/10.1001/jamanetworkopen.2021.3687)

### ABSTRACT

**Key Points:** Question: Is preterm birth associated with visual attention impairments in early life, and if so, in which attention functions? Findings: This systematic review and meta-analysis of 53 studies including 2047 preterm-born and 1951 full-term—born neonates and infants found that preterm birth was significantly associated with impairments in visual attention functioning. Despite a short-term advantage in visual-following in preterm infants, deficits cascaded from basic orienting responses to focused attention during the first 2 years of life. **Meaning:** The findings suggest that preterm birth is associated with challenges in the development of visual attention beginning in the early stages of life. **Importance:** Preterm birth is associated with an increased risk for long-lasting attention deficits. Early-life markers of attention abnormalities have not been established to date but could provide insights into the pathogenesis of attention abnormalities and could help identify susceptible individuals. **Objective:** To examine whether preterm birth is associated with visual attention impairments in early life, and if so, in which attention functions and at which developmental period during the first 2 years of life. **Data Sources:** PubMed and PsycINFO were searched on November 17, 2019, to identify studies involving visual attention outcomes in infants born preterm vs full term. **Study Selection:** Peer-reviewed studies from the past 50 years met the eligibility criteria if they directly assessed visual attention outcomes until the age of 2 years in generally healthy infants born preterm or full term. The selection process was conducted by 2 independent reviewers. **Data Extraction and Synthesis:** The Meta-analysis of Observational Studies in Epidemiology (MOOSE) reporting guideline was followed. Random-effects models were used to determine standardized mean differences. The risk of bias was assessed both within and between studies. **Main Outcomes and Measures:** Five nascent indices of visual attention were analyzed, including very basic functions—namely, the abilities to follow and fixate on visual targets—and more complex functions, such as visual processing (ie, habituation), recognition memory (ie, novelty preference), and the ability to effortfully focus attention for learning. **Results:** A total of 53 studies were included, with 69 effect sizes and assessing a total of 3998 infants (2047 born preterm and 1951 born full term; of the 3376 for whom sex was reported, 1693 [50.1%] were girls). Preterm birth was associated with impairments in various attention indices, including visual-following in infancy (Cohen d, -0.77; 95% CI, -1.23 to -0.31), latency to fixate (Cohen d, -0.18; 95% CI, -0.33 to -0.02), novelty preference (Cohen d, -0.20; 95% CI, -0.32 to -0.08), and focused attention (Cohen d, -0.28; 95% CI, -0.45 to -0.11). In the neonatal period, preterm birth was associated with superior visual-following (Cohen d, 0.22; 95% CI, 0.03 to 0.40), possibly owing to the additional extrauterine exposure to sensory stimulation. However, this early association waned rapidly in infancy (Cohen d, -0.77; 95% CI, -1.23 to -0.31). **Conclusions and Relevance:** The findings suggest that preterm birth is associated with impingements to visual attention development in early life, as manifested in basic and then complex forms of attention. Advancements in neonatal care may underlie improvements found in the current era and accentuate several early protective factors.



## Association of Race/Ethnicity and Social Disadvantage With Autism Prevalence in 7 Million School Children in England

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*JAMA Pediatr*. Published online March 29, 2021.

[doi:10.1001/jamapediatrics.2021.0054](https://doi.org/10.1001/jamapediatrics.2021.0054)

### ABSTRACT

**Importance:** The global prevalence of autism spectrum disorder (ASD) has been reported to be between 1% and 2% of the population, with little research in Black, Asian, and other racial/ethnic minority groups. Accurate estimates of ASD prevalence are vital to planning diagnostic, educational, health, and social care services and may detect possible access barriers to diagnostic pathways and services and inequalities based on social determinants of health. **Objective:** To evaluate whether socioeconomic disadvantage is associated with ASD prevalence and the likelihood of accessing ASD services in racial/ethnic minority and disadvantaged groups in England. **Design, Setting, and Participants:** This case-control prevalence cohort study used the Spring School Census 2017 from the Pupil Level Annual Schools Census of the National Pupil Database, which is a total population sample that includes all English children, adolescents, and young adults aged 2 to 21 years in state-funded education. Data were collected on January 17, 2017, and analyzed from August 2, 2018, to January 28, 2020. **Exposures:** Age and sex were treated as a priori confounders while assessing correlates of ASD status according to (1) race/ethnicity, (2) social disadvantage, (3) first language spoken, (4) Education, Health and Care Plan or ASD Special Educational Needs and Disability support status, and (5) mediation analysis to assess how social disadvantage and language might affect ASD status. **Main Outcomes and Measures:** Sex- and age-standardized ASD prevalence by race/ethnicity and 326 English local authority districts in pupils aged 5 to 19 years. **Results:** The final population sample consisted of 7 047 238 pupils (50.99% male; mean [SD] age, 10.18 [3.47] years) and included 119 821 pupils with ASD, of whom 21 660 also had learning difficulties (18.08%). The standardized prevalence of ASD was 1.76% (95% CI, 1.75%-1.77%), with male pupils showing a prevalence of 2.81% (95% CI, 2.79%-2.83%) and female pupils a prevalence of 0.65% (95% CI, 0.64%-0.66%), for a male-to-female ratio (MFR) of 4.32:1. Standardized prevalence was highest in Black pupils (2.11% [95% CI, 2.06%-2.16%]; MFR, 4.68:1) and lowest in Roma/Irish Travelers (0.85% [95% CI, 0.67%-1.03%]; MFR, 2.84:1). Pupils with ASD were more likely to face social disadvantage (adjusted prevalence ratio, 1.61; 95% CI, 1.59-1.63) and to speak English as an additional language (adjusted prevalence ratio, 0.64; 95% CI, 0.63-0.65). The effect of race/ethnicity on ASD status was mediated mostly through social disadvantage, with Black pupils having the largest effect (standardized mediation coefficient, 0.018;  $P < .001$ ) and 12.41% of indirect effects through this way. **Conclusions and Relevance:** These findings suggest that significant differences in ASD prevalence exist across racial/ethnic groups and geographic areas and local authority districts, indicating possible differential phenotypic prevalence or differences in detection or referral for racial/ethnic minority groups.

## Relationship Between Neonatal Vitamin D at Birth and Risk of Autism Spectrum Disorders: the NBSIB Study

Wu, D.M., Wen, X., Han, X.R., Wang, S., Wang, Y.J., Shen, M., Fan, S.H., Zhuang, J., Li, M.Q., Hu, B., Sun, C.H., Bao, Y.X., Yan, J., Lu, J. and Zheng, Y.L.

(2018), *J Bone Miner Res*, 33: 458-466. <https://doi.org/10.1002/jbmr.3326>

### ABSTRACT

Previous studies suggested that lower vitamin D might be a risk factor for autism spectrum disorders (ASDs). The aim of this study was to estimate the prevalence of ASDs in 3-year-old Chinese children and to examine the association between neonatal vitamin D status and risk of ASDs. We conducted a study of live births who had taken part in expanded newborn screening (NBS), with outpatient follow-up when the children 3-year old. The children were confirmed for ASDs in outpatient by the Autism Diagnostic Interview-Revised and Diagnostic and Statistical Manual of Mental Disorders (DSM)-5 criteria. Intellectual disability (ID) status was defined by the intelligence quotient (IQ < 80) for all the participants. The study design included a 1:4 case to control design. The concentration of 25-hydroxyvitamin D3 [25(OH)D3] in children with ASD and controls were assessed from neonatal dried blood samples. A total of 310 children were diagnosed as having ASDs; thus, the prevalence was 1.11% (95% CI, 0.99% to 1.23%). The concentration of 25(OH)D3 in 310 ASD and 1240 controls were assessed. The median 25(OH)D3 level was significantly lower in children with ASD as compared to controls ( $p < 0.0001$ ). Compared with the fourth quartiles, the relative risk (RR) of ASDs was significantly increased for neonates in each of the three lower quartiles of the distribution of 25(OH)D3, and increased risk of ASDs by 260% (RR for lowest quartile: 3.6; 95% CI, 1.8 to 7.2;  $p < 0.001$ ), 150% (RR for second quartile: 2.5; 95% CI, 1.4 to 3.5;  $p = 0.024$ ), and 90% (RR for third quartile: 1.9; 95% CI, 1.1 to 3.3;  $p = 0.08$ ), respectively. Furthermore, the nonlinear nature of the ID-risk relationship was more prominent when the data were assessed in deciles. This model predicted the lowest relative risk of ID in the 72nd percentile (corresponding to 48.1 nmol/L of 25(OH)D3). Neonatal vitamin D status was significantly associated with the risk of ASDs and intellectual disability. The nature of those relationships was nonlinear. © 2017 American Society for Bone and Mineral Research.

## Maternal vitamin D status and infant outcomes in rural Vietnam: a prospective cohort study

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*PLoS One.* 2014 Jun 26;9(6):e99005. doi: [10.1371/journal.pone.0099005](https://doi.org/10.1371/journal.pone.0099005). eCollection 2014.

PMID: 24967813 PMCID: PMC4072587 DOI: 10.1371/journal.pone.0099005

### ABSTRACT

**Objective:** Vitamin D deficiency affects 1 billion people globally. It has an important role in bone homeostasis, brain development and modulation of the immune system and yet the impact of antenatal vitamin D deficiency on infant outcomes is poorly understood. We assessed the association of 25-hydroxyvitamin D levels (25-OHD) in late pregnancy and early infant growth and developmental outcomes in rural Vietnam. **Design and methods:** A prospective cohort study of 960 women who had previously participated in a double-blind cluster randomized controlled trial of antenatal micronutrient supplementation in rural Vietnam was undertaken. Maternal 25-OHD concentration was measured at 32 weeks gestation, and infants were followed until 6 months of age. Main outcome measures were cognitive, motor, socio-emotional and language scores using the Bayley Scales of Infant Development, 3rd edition, and infant length-for-age z scores at 6 months of age. **Results:** 60% (582/960) of women had 25-OHD levels <75 nmol/L at 32 weeks gestation. Infants born to women with 25-OHD deficiency (<37.5 nmol/L) had reduced developmental language scores compared to those born to women who were vitamin D replete ( $\geq 75$  nmol/L) (Mean Difference (MD) -3.48, 95% Confidence Interval (CI) -5.67 to -1.28). For every 25 nmol increase in 25-OHD concentration in late pregnancy, infant length-for-age z scores at 6 months of age decreased by 0.08 (95% CI -0.15 to -0.02). **Conclusions:** Low maternal 25-hydroxyvitamin D levels during late pregnancy are of concern in rural Vietnam, and are associated with reduced language developmental outcomes at 6 months of age. Our findings strengthen the evidence for giving vitamin D supplementation during pregnancy.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0099005>

## Association Between Proton Pump Inhibitor Use and Risk of Asthma in Children

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February 8, 2021. *JAMA Pediatr.* 2021;175(4):394-403.

doi:[10.1001/jamapediatrics.2020.5710](https://doi.org/10.1001/jamapediatrics.2020.5710)

### ABSTRACT

**Key Points:** Question: Is proton pump inhibitor (PPI) use associated with risk of asthma in children? **Findings:** This propensity score-matched cohort study included 80 870 pairs of children who were and were not new users of PPIs. The incidence rate of asthma was 21.8 per 1000 person-years among those who initiated PPI use and 14.0 per 1000 person-years among those who did not; the hazard ratio increased by 57%. **Meaning:** These findings suggest that asthma is one of several potential adverse events that should be considered when prescribing PPIs to children. **Importance:** The use of proton pump inhibitors (PPIs) in children has increased substantially in recent years, concurrently with emerging concerns that these drugs may increase the risk of asthma. Whether PPI use in the broad pediatric population is associated with increased risk of asthma is not known. **Objective:** To investigate the association between PPI use and risk of asthma in children. **Design, Setting, and Participants:** This nationwide cohort study collected registry data in Sweden from January 1, 2007, to December 31, 2016. Children and adolescents 17 years or younger were matched by age and propensity score into 80 870 pairs of those who initiated PPI use and those who did not. Data were analyzed from February 1 to September 1, 2020. **Exposures:** Initiation of PPI use. **Main Outcomes and Measures:** The primary analysis examined the risk of incident asthma with a median follow-up to 3.0 (interquartile range, 2.1-3.0) years. Cox proportional hazards regression was used to estimate hazard ratios (HRs). **Results:** Among the 80 870 pairs (63.0% girls; mean [SD] age, 12.9 [4.8] years), those who initiated PPI use had a higher incidence rate of asthma (21.8 events per 1000 person-years) compared with noninitiators (14.0 events per 1000 person-years), with an HR of 1.57 (95% CI, 1.49-1.64). The risk of asthma was significantly increased across all age groups and was highest for infants and toddlers with an HR of 1.83 (95% CI, 1.65-2.03) in the group younger than 6 months and 1.91 (95% CI, 1.65-2.22) in the group 6 months to younger than 2 years ( $P < .001$  for interaction). The HRs for individual PPIs were 1.64 (95% CI, 1.50-1.79) for esomeprazole, 1.49 (95% CI, 1.25-1.78) for lansoprazole, 1.43 (95% CI, 1.35-1.51) for omeprazole, and 2.33 (95% CI, 1.30-4.18) for pantoprazole. In analyses of the timing of asthma onset after PPI initiation, the HRs were 1.62 (95% CI, 1.42-1.85) for 0 to 90 days, 1.73 (95% CI, 1.52-1.98) for 91 to 180 days, and 1.53 (95% CI, 1.45-1.62) for 181 days to end of follow-up. The association was consistent through all sensitivity analyses, including high-dimensional propensity score matching (HR, 1.48; 95% CI, 1.41-1.55). **Conclusions and Relevance:** In this cohort study, initiation of PPI use compared with nonuse was associated with an increased risk of asthma in children. Proton pump inhibitors should be prescribed to children only when clearly indicated, weighing the potential benefit against potential harm.

## Association of Child and Family Attributes With Outcomes in Children With Autism

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March 29, 2021 *JAMA Netw Open*. 2021;4(3):e212530.

[doi:10.1001/jamanetworkopen.2021.2530](https://doi.org/10.1001/jamanetworkopen.2021.2530)

### ABSTRACT

**Key Points:** Question: How prevalent is “doing well” in 5 developmental domains (communication, socialization, activities of daily living, internalizing, externalizing) as assessed by proficiency and growth in children with autism spectrum disorder in midchildhood, and what attributes of children and families are associated with it? **Findings:** In this cohort study including 272 children, between 20% and 49% of children with autism spectrum disorder were proficient within the 5 developmental domains, while 13% to 34% of children demonstrated growth. Doing well was associated with preschool scores on that specific outcome domain, as well as early language skills, household income, and family functioning. **Meaning:** These findings demonstrate the potential usefulness of taking a strengths-based approach to outcome assessments, while the importance of family income and functioning remind us that disabilities do not exist apart from a social context. **Importance:** The prevalence and attributes of positive outcomes (or doing well) among children with autism spectrum disorder (ASD) in midchildhood are not well known. **Objective:** To estimate the prevalence of doing well according to metrics of proficiency and growth and to investigate the extent to which significant associations exist between child- and family-level variables and doing well. **Design, Setting, and Participants:** This longitudinal cohort study included children with ASD from regional clinics across Canada. Participants were sampled 3 times between ages 2 and 4.9 years (T1) and twice in follow-up into middle childhood (T2). Data were analyzed March 2018 through January 2020. **Exposures:** Language and IQ assessments at first sample; household income, parent coping, and family functioning. **Main Outcomes and Measures:** Key outcome domains of developmental health included measures of socialization, communication, independent living skills, and measures of internalizing and externalizing behaviors. Thresholds for doing well in these domains by either proficiency or growth were established. The extent to which language, IQ, household income, parent coping, and family functioning were associated with assessed outcomes was determined by logistic regression. The association between outcomes and concurrent Autism Diagnostic Observation Schedule (ADOS) classification scores was also estimated. **Results:** In a total cohort of 272 children (234 [86.0%] boys; mean [SD] age, 10.76 [0.26] years), approximately 78.8% (95% CI, 73.2%-84.4%) of the sample were estimated to be doing well by either metric on at least 1 domain, and 23.6% (95% CI, 17.7%-29.4%) were doing well in 4 or 5 domains. It was possible to be doing well by either proficiency or growth and still meet ADOS criteria for ASD. For the growth metric, between 61.5% (95% CI, 40.7%-79.1%) and 79.6% (95% CI, 66.0%-88.9%) of participants had ADOS scores of 4 or greater; for the proficiency metric, between 63.8% (95% CI, 48.4%-76.9%) and 75.8% (95% CI, 63.0%-85.4%) had scores of 4 or greater. Doing well by either metric for all domains was associated with T1 scores on that outcome domain (eg, T1 daily living skills associated with doing well at T2 daily living by the proficiency metric as measured by the Vineland Adaptive Behavior Scales—Second Edition daily living skills scale [202 participants]:  $\beta = 0.07$ ; OR, 1.07; 95% CI, 1.03-1.11;  $P < .001$ ). Doing well in socialization by the growth metric was also associated with better T1 language skills scores (202 participants) ( $\beta = 0.04$ ; OR, 1.04; 95% CI, 1.00-1.07,  $P = .04$ ). Doing well in externalizing by the growth metric was also associated with higher household income at T1 (178 participants) ( $\beta = 0.10$ ; OR, 1.10; 95% CI, 1.06-1.15;  $P < .001$ ). Better family functioning at T1 was associated with doing well on both socialization and externalizing by proficiency metric and on internalizing by growth metric (socialization by proficiency [202 participants]:  $\beta = -1.01$ ; OR, 0.36; 95% CI, 0.14-0.93;  $P = .04$ ; externalizing by proficiency [178 participants]:  $\beta = 1.00$ ; OR, 0.37; 95% CI, 0.16-0.82;  $P = .02$ ; internalizing by growth [178 participants]:  $\beta = -1.03$ ; OR, 0.36; 95% CI, 0.16-0.79;  $P = .01$ ). **Conclusions and Relevance:** This cohort study found that a substantial proportion of children with ASD were doing well by middle childhood in at least 1 key domain of developmental health, and that doing well was possible even in the context of continuing to meet criteria for ASD. These results support a strengths-based approach to treatment planning that should include robust support for families to increase the potential likelihood of doing well later in life.

## Antenatal Vitamin D Status Is Not Associated with Standard Neurodevelopmental Assessments at Age 5 Years in a Well-Characterized Prospective Maternal-Infant Cohort

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*J Nutr*. 2018 Oct 1;148(10):1580-1586. PMID: 30169669

DOI: [10.1093/jn/nxy150](https://doi.org/10.1093/jn/nxy150)

### ABSTRACT

**Objective:** We aimed to explore associations between maternal and neonatal vitamin D status with childhood neurodevelopmental outcomes. **Methods:** Comprehensive clinical, demographic, and lifestyle data were collected prospectively in 734 maternal-infant dyads from the Cork BASELINE Birth Cohort Study. Serum 25-hydroxyvitamin D [25(OH)D] concentrations were quantified at 15 weeks of gestation and in umbilical cord sera at birth via a CDC-accredited liquid chromatography-tandem mass spectrometry method. Children were assessed at age 5 y through the use of the Kaufman Brief Intelligence Test (2nd Edition, KBIT-2) and the Child Behaviour Checklist (CBCL). Linear regression was used to explore associations between 25(OH)D and neurodevelopmental outcomes. **Results:** 25(OH)D concentrations were <30 nmol/L in 15% of maternal and 45% of umbilical cord sera and <50 nmol/L in 42% of mothers and 80% of cords. At age 5 y, the mean  $\pm$  SD KBIT-2 intelligence quotient (IQ) composite score was  $104.6 \pm 8.6$ ; scores were  $107.2 \pm 10.0$  in verbal and  $99.8 \pm 8.8$  in nonverbal tasks. Developmental delay (scores <85) was seen in <3% of children across all domains. The mean  $\pm$  SD CBCL total problem score was  $21.3 \pm 17.5$ ; scores in the abnormal/clinical range for internal, external, and total problem scales were present in 12%, 4%, and 6% of participants, respectively. KBIT-2 and CBCL subscale scores at 5 y were not different between children exposed to low antenatal vitamin D status, either at 30 or 50 nmol/L 25(OH)D thresholds. Neither maternal nor cord 25(OH)D (per 10 nmol/L) were associated with KBIT-2 IQ composite scores [adjusted  $\beta$  (95% CI): maternal -0.01 (-0.03, 0.02); cord 0.01 (-0.03, 0.04] or CBCL total problem scores [maternal 0.01 (-0.04, 0.05); cord 0.01 (-0.07, 0.09)]. **Conclusion:** In this well-characterized prospective maternal-infant cohort, we found no evidence that antenatal 25(OH)D concentrations are associated with neurodevelopmental outcomes at 5 y.

The BASELINE Study was registered at [www.clinicaltrials.gov](http://www.clinicaltrials.gov) as NCT01498965; the SCOPE Study was registered at <http://www.anzctr.org.au> as ACTRN12607000551493.

## Maternal Plasma 25-Hydroxyvitamin D during Gestation Is Positively Associated with Neurocognitive Development in Offspring at Age 4–6 Years

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*The Journal of Nutrition*, Volume 151, Issue 1, January 2021, Pages 132–139, <https://doi.org/10.1093/jn/nxaa309>

### ABSTRACT

**Background:** Vitamin D is critical to embryonic neuronal differentiation and other developmental processes that may affect future neurocognitive function. However, observational studies have found inconsistent associations between gestational vitamin D and neurocognitive outcomes. **Objectives:** We examined the association of gestational 25-hydroxyvitamin D [25(OH)D] with children's IQ at 4–6 y, and explored whether associations differed by race. **Methods:** This study used data from the CANDLE (Conditions Affecting Neurocognitive Development and Learning in Early Childhood) cohort. Between 2006 and 2011, CANDLE recruited 1503 women in their second trimester of healthy singleton pregnancies. Inclusion criteria for this analysis were gestation of  $\geq 34$  wk and availability of 25(OH)D and IQ data. Associations between second-trimester 25(OH)D plasma concentration and Stanford-Binet IQ scores in offspring at 4–6 y were examined using multivariable linear regression; interaction terms were used to explore possible effect modification by race. **Results:** Mean  $\pm$  SD 25(OH)D concentration among 1019 eligible dyads was  $21.6 \pm 8.4$  ng/mL, measured at a mean  $\pm$  SD gestational age of  $23.0 \pm 3.0$  wk. Vitamin D deficiency [25(OH)D < 20 ng/mL] was observed in 45.6%. Maternal 25(OH)D differed by race with a mean  $\pm$  SD of  $19.8 \pm 7.2$  ng/mL in Blacks and  $25.9 \pm 9.3$  ng/mL in Whites ( $P < 0.001$ ). In adjusted models a 10-ng/mL increase in 25(OH)D was associated with a 1.17-point higher Full Scale IQ (95% CI: 0.27, 2.06 points), a 1.17-point higher Verbal IQ (95% CI: 0.19, 2.15 points), and a 1.03-point higher Nonverbal IQ (95% CI: 0.10, 1.95 points). We observed no evidence of effect modification by race. **Conclusions:** Second-trimester maternal 25(OH)D was positively associated with IQ at 4–6 y, suggesting that gestational vitamin D status may be an important predictor of neurocognitive development. These findings may help inform prenatal nutrition recommendations and may be especially relevant for Black and other dark-skinned women at high risk of vitamin D deficiency.

Keywords: vitamin D, 25-hydroxyvitamin D, neurodevelopment, IQ, prenatal nutrition

<https://academic.oup.com/jn/article/151/1/132/5951845>

## Association Between Maternal Caffeine Consumption and Metabolism and Neonatal Anthropometry: A Secondary Analysis of the NICHD Fetal Growth Studies—Singletons

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March 25, 2021. *JAMA Netw Open*. 2021;4(3):e213238.

[doi:10.1001/jamanetworkopen.2021.3238](https://doi.org/10.1001/jamanetworkopen.2021.3238)

### ABSTRACT

**Key Points:** Question: Is maternal caffeine intake associated with neonatal anthropometry? **Findings:** In this cohort study of 2055 women from 12 clinical sites, measures of caffeine consumption (plasma caffeine and paraxanthine and self-reported consumption) were associated with neonatal size at birth. Increasing caffeine measures were significantly associated with lower birth weight, shorter length, and smaller head, arm, and thigh circumference. **Meaning:** In this study, caffeine consumption during pregnancy, even in amounts less than the recommended 200 mg per day, was associated with smaller neonatal anthropometric measurements. **Importance:** Higher caffeine consumption during pregnancy has been associated with lower birth weight. However, associations of caffeine consumption, based on both plasma concentrations of caffeine and its metabolites, and self-reported caffeinated beverage intake, with multiple measures of neonatal anthropometry, have yet to be examined. **Objective:** To evaluate the association between maternal caffeine intake and neonatal anthropometry, testing effect modification by fast or slow caffeine metabolism genotype. **Design, Setting, and Participants:** A longitudinal cohort study, the National Institute of Child Health and Human Development Fetal Growth Studies—Singletons, enrolled 2055 nonsmoking women at low risk for fetal growth abnormalities with complete information on caffeine consumption from 12 US clinical sites between 2009 and 2013. Secondary analysis was completed in 2020. **Exposures:** Caffeine was evaluated by both plasma concentrations of caffeine and paraxanthine and self-reported caffeinated beverage consumption measured/reported at 10-13 weeks gestation. Caffeine metabolism defined as fast or slow using genotype information from the single nucleotide variant rs762551 (CYP1A2\*1F). **Main Outcomes and Measures:** Neonatal anthropometric measures, including birth weight, length, and head, abdominal, arm, and thigh circumferences, skin fold and fat mass measures. The  $\beta$  coefficients represent the change in neonatal anthropometric measure per SD change in exposure. **Results:** A total of 2055 participants had a mean (SD) age of 28.3 (5.5) years, mean (SD) body mass index of 23.6 (3.0), and 580 (28.2%) were Hispanic, 562 (27.4%) were White, 518 (25.2%) were Black, and 395 (19.2%) were Asian/Pacific Islander. Delivery occurred at a mean (SD) of 39.2 (1.7) gestational weeks. Compared with the first quartile of plasma caffeine level ( $\leq 28$  ng/mL), neonates of women in the fourth quartile ( $>659$  ng/mL) had lower birth weight ( $\beta = -84.3$  g; 95% CI, -145.9 to -22.6 g;  $P = .04$  for trend), length ( $\beta = -0.44$  cm; 95% CI, -0.78 to -0.12 cm;  $P = .04$  for trend), and head ( $\beta = -0.28$  cm; 95% CI, -0.47 to -0.09 cm;  $P < .001$  for trend), arm ( $\beta = -0.25$  cm; 95% CI, -0.41 to -0.09 cm;  $P = .02$  for trend), and thigh ( $\beta = -0.29$  cm; 95% CI, -0.58 to -0.04 cm;  $P = .07$  for trend) circumference. Similar reductions were observed for paraxanthine quartiles, and for continuous measures of caffeine and paraxanthine concentrations. Compared with women who reported drinking no caffeinated beverages, women who consumed approximately 50 mg per day ( $\sim 1/2$  cup of coffee) had neonates with lower birth weight ( $\beta = -66$  g; 95% CI, -121 to -10 g), smaller arm ( $\beta = -0.17$  cm; 95% CI, -0.31 to -0.02 cm) and thigh ( $\beta = -0.32$  cm; 95% CI, -0.55 to -0.09 cm) circumference, and smaller anterior flank skin fold ( $\beta = -0.24$  mm; 95% CI, -0.47 to -0.01 mm). Results did not differ by fast or slow caffeine metabolism genotype. **Conclusions and Relevance:** In this cohort study, small reductions in neonatal anthropometric measurements with increasing caffeine consumption were observed. Findings suggest that caffeine consumption during pregnancy, even at levels much lower than the recommended 200 mg per day of caffeine, are associated with decreased fetal growth.

## The global summit on the efficacy and effectiveness of spinal manipulative therapy for the prevention and treatment of non-musculoskeletal disorders: a systematic review of the literature

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### ABSTRACT

**Background:** A small proportion of chiropractors, osteopaths, and other manual medicine providers use spinal manipulative therapy (SMT) to manage non-musculoskeletal disorders. However, the efficacy and effectiveness of these interventions to prevent or treat non-musculoskeletal disorders remain controversial. **Objectives:** We convened a Global Summit of international scientists to conduct a systematic review of the literature to determine the efficacy and effectiveness of SMT for the primary, secondary and tertiary prevention of non-musculoskeletal disorders. **Global summit:** The Global Summit took place on September 14–15, 2019 in Toronto, Canada. It was attended by 50 researchers from 8 countries and 28 observers from 18 chiropractic organizations. At the summit, participants critically appraised the literature and synthesized the evidence. **Systematic review of the literature:** We searched MEDLINE, Embase, the Cochrane Central Register of Controlled Trials, the Cumulative Index to Nursing and Allied Health, and the Index to Chiropractic Literature from inception to May 15, 2019 using subject headings specific to each database and free text words relevant to manipulation/ manual therapy, effectiveness, prevention, treatment, and non-musculoskeletal disorders. Eligible for review were randomized controlled trials published in English. The methodological quality of eligible studies was assessed independently by reviewers using the Scottish Intercollegiate Guidelines Network (SIGN) criteria for randomized controlled trials. We synthesized the evidence from articles with high or acceptable methodological quality according to the Synthesis without Meta-Analysis (SWiM) Guideline. The final risk of bias and evidence tables were reviewed by researchers who attended the Global Summit and 75% (38/50) had to approve the content to reach consensus. **Results:** We retrieved 4997 citations, removed 1123 duplicates and screened 3874 citations. Of those, the eligibility of 32 articles was evaluated at the Global Summit and 16 articles were included in our systematic review. Our synthesis included six randomized controlled trials with acceptable or high methodological quality (reported in seven articles). These trials investigated the efficacy or effectiveness of SMT for the management of infantile colic, childhood asthma, hypertension, primary dysmenorrhea, and migraine. None of the trials evaluated the effectiveness of SMT in preventing the occurrence of non-musculoskeletal disorders. Consensus was reached on the content of all risk of bias and evidence tables. All randomized controlled trials with high or acceptable quality found that SMT was not superior to sham interventions for the treatment of these non-musculoskeletal disorders. Six of 50 participants (12%) in the Global Summit did not approve the final report. **Conclusion:** Our systematic review included six randomized clinical trials (534 participants) of acceptable or high quality investigating the efficacy or effectiveness of SMT for the treatment of non-musculoskeletal disorders. We found no evidence of an effect of SMT for the management of non-musculoskeletal disorders including infantile colic, childhood asthma, hypertension, primary dysmenorrhea, and migraine. This finding challenges the validity of the theory that treating spinal dysfunctions with SMT has a physiological effect on organs and their function. Governments, payers, regulators, educators, and clinicians should consider this evidence when developing policies about the use and reimbursement of SMT for non-musculoskeletal disorders. **Keywords:** Spinal manipulation, Mobilization, Effectiveness, Efficacy, Systematic review, Non-musculoskeletal, Chiropractic

<https://chiromt.biomedcentral.com/track/pdf/10.1186/s12998-021-00362-9.pdf>

## Distance Management of Spinal Disorders in the COVID-19 pandemic and beyond: Evidence-based Patient and Clinician Guides from the Global Spine Care Initiative

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*JMIR Public Health and Surveillance*. 19/01/2021:25484 (forthcoming/in press)

DOI: [10.2196/25484](https://doi.org/10.2196/25484) PMID: 33471778

URL: <https://preprints.jmir.org/preprint/25484>

### ABSTRACT

**Background:** The COVID-19 pandemic has greatly limited patients' access to care for spine-related symptoms and disorders. However, physical distancing between clinicians and patients with spine-related symptoms is not solely limited to restrictions imposed by pandemic-related lockdowns. In most low- and middle-income countries, as well as many underserved marginalized communities in high-income countries, there is little to no access to clinicians trained in evidence-based care for people experiencing spinal pain.

**Objective:** The aim of this study is to describe the development and present the components of evidence-based patient and clinician guides for the management of spinal disorders where in-person care is not available. **Methods:** Ultimately, two sets of guides were developed (one for patients and one for clinicians) by extracting information from the published Global Spine Care Initiative (GSCI) papers. An international, interprofessional team of 29 participants from 10 countries on 4 continents participated. The team included practitioners in family medicine, neurology, physiatry, rheumatology, psychology, chiropractic, physical therapy, and yoga, as well as epidemiologists, research methodologists, and laypeople. The participants were invited to review, edit, and comment on the guides in an open iterative consensus process. **Results:** The Patient Guide is a simple 2-step process. The first step describes the nature of the symptoms or concerns. The second step provides information that a patient can use when considering self-care, determining whether to contact a clinician, or considering seeking emergency care. The Clinician Guide is a 5-step process: (1) Obtain and document patient demographics, location of primary clinical symptoms, and psychosocial information. (2) Review the symptoms noted in the patient guide. (3) Determine the GSCI classification of the patient's spine-related complaints. (4) Ask additional questions to determine the GSCI subclassification of the symptom pattern. (5) Consider appropriate treatment interventions. **Conclusions:** The Patient and Clinician Guides are designed to be sufficiently clear to be useful to all patients and clinicians, irrespective of their location, education, professional qualifications, and experience. However, they are comprehensive enough to provide guidance on the management of all spine-related symptoms or disorders, including triage for serious and specific diseases. They are consistent with widely accepted evidence-based clinical practice guidelines. They also allow for adequate documentation and medical record keeping. These guides should be of value during periods of government-mandated physical or social distancing due to infectious diseases, such as during the COVID-19 pandemic. They should also be of value in underserved communities in high-, middle-, and low-income countries where there is a dearth of accessible trained spine care clinicians. These guides have the potential to reduce the overutilization of unnecessary and expensive interventions while empowering patients to self-manage uncomplicated spinal pain with the assistance of their clinician, either through direct in-person consultation or via telehealth communication.

*JMIR Public Health Surveill* 2021;7(2):e25484

## Extrapolating Beyond the Data in a Systematic Review of Spinal Manipulation for Nonmusculoskeletal Disorders: A Fall From the Summit

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*J Manipulative Physiol Ther* 2021;44;271-279)

PMID: 33879350 DOI: [10.1016/j.jmpt.2021.02.003](https://doi.org/10.1016/j.jmpt.2021.02.003)

### ABSTRACT

**Objective:** The purpose of this article is to discuss a literature review—a recent systematic review of nonmusculoskeletal disorders—that demonstrates the potential for faulty conclusions and misguided policy implications, and to offer an alternate interpretation of the data using present models and criteria. **Methods:** We participated in a chiropractic meeting (Global Summit) that aimed to perform a systematic review of the literature on the efficacy and effectiveness of mobilization or spinal manipulative therapy (SMT) for the primary, secondary, and tertiary prevention and treatment of nonmusculoskeletal disorders. After considering an early draft of the resulting manuscript, we identified points of concern and therefore declined authorship. The present article was developed to describe those concerns about the review and its conclusions. **Results:** Three main concerns were identified: the inherent limitations of a systematic review of 6 articles on the topic of SMT for nonmusculoskeletal disorders, the lack of biological plausibility of collapsing 5 different disorders into a single category, and considerations for best practices when using evidence in policy-making. We propose that the following conclusion is more consistent with a review of the 6 articles. The small cadre of high- or moderate-quality randomized controlled trials reviewed in this study found either no or equivocal effects from SMT as a stand-alone treatment for infantile colic, childhood asthma, hypertension, primary dysmenorrhea, or migraine, and found no or low-quality evidence available to support other nonmusculoskeletal conditions. Therefore, further research is needed to determine if SMT may have an effect in these and other nonmusculoskeletal conditions. Until the results of such research are available, the benefits of SMT for specific or general nonmusculoskeletal disorders should not be promoted as having strong supportive evidence. Further, a lack of evidence cannot be interpreted as counterevidence, nor used as evidence of falsification or verification. **Conclusion:** Based on the available evidence, some statements generated from the Summit were extrapolated beyond the data, have the potential to misrepresent the literature, and should be used with caution. Given that none of the trials included in the literature review were definitively negative, the current evidence suggests that more research on nonmusculoskeletal conditions is warranted before any definitive conclusions can be made. Governments, insurers, payers, regulators, educators, and clinicians should avoid using systematic reviews in decisions where the research is insufficient to determine the clinical appropriateness of specific care.

Key Indexing Terms: Humans; Manipulation, Spinal; Publications; Policy Making; Public Health.



## EDITORIAL: Gratitude for chiropractic's canaries in the coal-mine

Phillip Ebrall, PhD.

*Asia Pacific Chiropractic Journal* · Editorial

[https://www.researchgate.net/publication/352835744\\_GratITUDE\\_for\\_chiropractic's\\_canaries\\_in\\_the\\_coal-mine](https://www.researchgate.net/publication/352835744_GratITUDE_for_chiropractic's_canaries_in_the_coal-mine)

### ABSTRACT

Our previous editorial (Ebrall, 2021) expressed concern with a report by Côté et al (2021). We were the first to call out this paper for what we saw it to be, an unashamed use of purported scientific method to set a self-serving political agenda. It is always nervous to make such a big call, especially against persons holding hallowed status in our profession, but today we see they have feet of clay and the *Journal* has been vindicated by not just one, but many canaries calling out their concerns. Thankfully our profession's canaries are highly reputable scientists, writers, and educators who represent the best of our contemporary thought.

In a nutshell, Côté et al undertook inquiry with questionable methods and with a good dose of spin, turned into into a 'global summit' meant to inform decision makers. Their conclusions were unfavourable to our profession, but of course, were also unfounded as many others now show. The lead was taken by the newly appointed Chair of the WFC Research Committee, Christine Goertz, and her paper Goetz et al (2021). It drew three conclusions, none of them favourable:

- some statements generated from the Summit were extrapolated beyond the data, have the potential to misrepresent the literature;
- the current evidence suggests that more research on nonmusculoskeletal conditions is warranted before any definitive conclusions can be made; and, critically
- Governments, insurers, payers, regulators, educators, and clinicians should avoid using systematic reviews in decisions where the research is insufficient to determine the clinical appropriateness of specific care

Readers should be under no misunderstanding that Goertz et al write with authority. In my Editorial of September 2020 (Ebrall, 2020) I stated 'We are strongly of the view that our profession must move towards research with integrity and we are confident that Goertz will lead the WFC in this direction.' In her role as Chair of the WFC Research Committee Goertz and her colleagues have made a clear statement that the chiropractic research committee will no longer play politics and will instead exercise their considerable skills in producing quality research outputs that will advance the profession in the clinical sense.

The *Journal's* Editorial Board has concluded that Goetz et al are correct in their expressed concerns that Côté et al (2021):

- 'Privileged certain forms of evidence over others' and that this 'may ultimately be a political act, not a scientific one'; and
- Made 'strong policy implications based on weak scientific evidence' which we agree is indeed 'a cause for concern'.

However we question their view that is 'disconcerting' for policy-makers, to whom Côté et al directed their conclusion, to be excluded from discussion regarding findings that they are not recommended to follow. Our concern is that policy-makers are expected to make policy based on the best-available evidence. They are not researchers but may well benefit from expert research guidance of the nature Goetz and both the WFC and ICA are able to offer. We see it is erroneous to bring policymakers to the table while evidence is being formulated; this is a specialised, high-skill process far beyond consensus arguments and other confrontational styles of Western decision-making.

Let the policy-makers be informed of the evidence and what it says, perhaps by commissioned reports from appropriate panels of clinical experts and researchers, and don't confuse policy making with evidence generation. Evidence interpretation and application? Yes. Evidence generation? No. Understanding and meaning? Well, this editorial proposes we leave that to our philosophers.