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JCCP JOURNAL OF CLINICAL CHIROPRACTIC PEDIATRICS

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.

Pilot Studies or Hypothesis – papers which, while very broad, present with a clear hypotheses and suggest a foundation for future, in-depth studies.

Literature Reviews – studies of existing papers and books presented with the intention of supporting and encouraging new and continuing study.

Technical Descriptions – reports of new analytical/diagnostic tools for assessment and delivery of care. Controlled, Large Scale Studies – usually, but not necessarily, performed at a college or research facility. May be double-blinded.

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

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Instructions to Authors – Summary

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

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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.
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- 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.
- Inclusion of appendices is discouraged.

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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.
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- *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

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

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:^{1,2}

- 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)

Additional interesting articles to read about EBM and writing and EBCR:

Review an example of an EBCR at:

<https://www.ncbi.nlm.nih.gov/uidm/oclc.org/pmc/articles/PMC1126937/pdf/302.pdf>

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/pmc/articles/PMC3924510/>

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

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

The Whole Child

Mnemonics and acronyms. I firmly believe that I made it all the way through chiropractic school and then into active practice thanks to mnemonics and acronyms. I remember anatomy lab with instructors, Turkel and Kennedy, at my alma mater, New York Chiropractic College in Old Brookville, NY: “One, two — buckle my shoe, three, four — kick the door, five, six — pick up sticks, seven, eight — shut the gate.” Perfect for a soon to be pediatric chiropractor, yes? This helped me remember the nerve root supply of deep tendon reflexes: S1, S2 — ankle jerk, L3, L4 — knee jerk, C5, C6 — biceps and brachioradialis, C7, C8 — triceps. Then there was “C3, 4, 5 keeps the diaphragm alive” to help remember the nerve root supply of phrenic nerve which innervates the diaphragm. I can still recall much “livelier” or entertaining ones I won’t recount here!

Then there were the acronyms we went into practice with, like RICE which was the acronym for four elements of treatment for soft tissue injuries: rest, ice, compression, and elevation. Soon, there were those that became a part of everyday life working with Dr. Lorraine Golden and Dr. Tracy Barnes at the clinic of Kentuckiana Children’s Center in Louisville, KY, where they faithfully provided chiropractic care to children with special needs: FLL, FTT, AOM, EDS, ADHD, ASD, DS, ALL, EBV, PANS, PANDAS (I’ll leave you to puzzle these out! There’s an entire alphabet of them.)¹

But most importantly, I carry with me to this day the acronym I first heard while visiting Pennsylvania Institute of Straight Chiropractic as a third trimester student in search of chiropractic philosophy. ADIO, “Above-Down, Inside-Out”, was a statement of chiropractic philosophy coined by BJ Palmer who taught that the innate intelligence of the body controlled healing from the inside out and that chiropractic supported the body to achieve self-healing.²

This philosophy has kept the fire burning for 37 years of clinical practice. I would like to offer you another acronym, an acronym for pediatric chiropractors who work with the WHOLE CHILD:

W — Who are you working with? Why have they come to you? What can you offer them? Is the family Willing to do their part? When can we start (is there anything you need to do before you initiate care?)

H — Hands on (we offer our patients a valuable and effective intervention — a specific chiropractic adjustment as well as the healing power of touch on modulating the autonomic nervous system^{3,4} and we support them in Health and Healing.)

O — Observe⁵ (we are trained to use our ALL of our senses to discern our patient’s status, differentially diagnose then plan our treatment and any referrals that might be necessary to support the child where they are.)

L — Listen⁵ (to the parent and the child and any other important people in the child’s life that contribute insight into what the child is experiencing or needs (especially in the case of infants and toddlers, or older but non-verbal children.)

E — Educate⁵ (Educate yourself, first and foremost Put your Ego to bed! Do I need to study different techniques, do I need to address the cranials?^{6,7} do I appreciate the

The WHOLE CHILD

W — Who? Why? What? Willing? When?

H — Hands. Healing

O — Observation

L — Listening

E — Educate

C — Collaborate

H — Health. Honesty

I — Inspire

L — Love

D — Discern

role of fascia and treat fascial restrictions?⁸ What do other practitioners provide and I should collaborate with them?

Educate your patients and their parents. “Words matter! The chiropractic profession has been a pioneer in health care employing aspects of the whole person biopsychosocial approach with an emphasis on self-healing. This approach has involved methods that encompass psychosocial, emotional/spiritual, physical, and healthy lifestyle components which may promote functional gain/preservation, reduction of pain interference and maximization of quality of life.”⁹)

C — Collaborate with other health care providers who offer expertise different from what you are providing (from their pediatrician to their teachers and coaches and everyone in between — IBCLC, ND, OT, PT, SLP, MT, LAc, RD, mental health workers etc.) or even collaborating with another chiropractor who may have a different technique or a niche expertise or experience that you do not (yet) offer or (yet) have.

H — Help — “Primum non nocere” — our prime directive (“First, do no harm”) and Honesty, in the integrity of your communication and practice.

I — Inspire (again, educate, motive, encourage compliance and inspire your families! “Typical chiropractic encounters include distinct elements that involve “a plan that requires patient commitment and cooperation” and a goal to “develop a positive image of personal control over one’s health.”^{9,10})

L — Love (need I say more?)

D — Discern (remain present to your patient in the time that you have with them and always monitor the ever-changing environment of the family and your patients health, mood, level of understanding and compliance and when you have done your job, and they need something in addition to your ministrations.)

Palmer explicitly stated that “over-adjusting is kept to a bare minimum if at all”.^{9,11}

Clarence Gonstead, a notable chiropractor whose teaching remains influential to the present day, regularly discussed the notion that upon finding the need to manipulate the spine one should fix it and leave it alone. “The right number and kind of adjustments can set the stage for nature to heal; too many adjustments in the wrong place can undo any good that was done and slow down the healing mechanism.”^{9,12}

“Instead of waiting for symptoms to appear or become advanced, chiropractors have also maintained a focus on

early intervention and prevention measures that include addressing both biological and psychosocial elements.”⁹ Proactive maintenance care is a critical component in educating our patients (and their parents) in self-care during a critical window of opportunity with children who once empowered, can carry this “superpower” into a healthy adulthood.

But unfortunately, too often in our passionate desire to “help” our young patients, we may be over-treating. When we forget the ADIO principal, above down and inside out, when we think we are the ones healing our patients, we lose the thread. When we perpetuate an ongoing treatment plan of three times a week ad infinitum without seeing a measurable change in our patient’s status or level of function, we are encouraging passive care and not empowering self-healing and self-regulation.

Yes, in some cases, more frequent, intensive care could apply to an infant failing to thrive or a child with acute otitis media or in the throes of fever. Seemingly frequent ongoing care could apply to a very competitive athletic child who happens to also be accident prone, a child who is sensory seeking and constantly falling or crashing into things, or another child who is wheelchair-bound and due to neurologic issues, constantly fighting their restraints. But if you are continuing to treat a child and fail to discern that they require “something more” (i.e. the “athletic but accident prone” child possibly needing some rehabilitative exercise¹³ or the sensory seeking child who might benefit from something you do not provide like working on healing their gut after frequent rounds of antibiotics¹⁴ with a naturopath or some sensory integration therapy¹⁵ occupational therapy), have we fulfilled our obligation to serve them?

So, in conclusion, each child is an individual deserving of our full attention with constant self-surveillance to be sure we are attending to the child’s progress and overall well-being (even tuning in to parent and caretakers whose own self-care modeling influences our young patients), life transitions and ever-changing social pressures. We are the portal to the inclusion of chiropractic care as a component of a lifelong regimen of wellness!

Are we doing our best work if we are not treating the WHOLE CHILD?

Respectfully and with Love,



Sharon A. Vallone, DC, FICCP
Editor, Journal of Clinical Chiropractic Pediatrics

References:

1. Shah SS, Kemper AR, Ratner AJ. eds. *Pediatric Infectious Diseases: Essentials for Practice*, 2e. McGraw Hill; 2019. <https://accesspediatrics.mhmedical.com/content.aspx?bookid=2484§ionid=199373062>.
2. Palmer BJ. Palmer's law of life. Davenport: Palmer School Press; 1958. Pgs. 7-15, 131-133.
3. Field T, Diego M. Vagal Activity, Early Growth and Emotional Development Infant Behav Dev. 2008 September ; 31(3): 361—373.
4. Fludder CJ, Keil BJ. Presentation of neonates and infants with spinal vs extremity joint dysfunction. *Chiropractic Journal of Australia*. March, 2018. 46(1).
5. Keating G, Hawk C, Amarin-Woods L, Amarin-Woods D, Vallone S, Farabaugh R, Todd A, Ferrance R, Young J, O'Neill Bhogal S, Sexton H, Alevaki H, Miller J, Parkin-Smith G, Schielke A, Robinson A, and Thompson R. Clinical Practice Guideline for Best Practice Management of Pediatric Patients by Chiropractors: Results of a Delphi Consensus Process. *Journal of Integrative and Complementary Medicine*. <http://doi.org/10.1089/jicm.2023.0010> Online Ahead of Print: October 30, 2023.
6. SORSI <https://sorsi.com/sot-methods/>.
7. SOTO USA <https://soto-usa.com/what-is-sot/>.
8. Pirri C, Petrelli L, Pérez-Bellmunt A, Ortiz-Miguel S, Fede C, De Caro R, Miguel-Pérez M, Stecco C. Fetal Fascial Reinforcement Development: From “a White Tablet” to a Sculpted Precise Organization by Movement. *Biology* (Basel). 2022 May 11;11(5):735. <https://pubmed.ncbi.nlm.nih.gov/35625463/>.
9. Gliedt JA, Schneider MJ, Evans MW, King J, Eubanks JE. The biopsychosocial model and chiropractic: a commentary with recommendations for the chiropractic profession. *Chiropr Man Therap* 25, 16 (2017). <https://doi.org/10.1186/s12998-017-0147-x>.
10. Coulter ID. The patient, the practitioner, and wellness: paradigm lost, paradigm gained. *Journal of manipulative and physiological therapeutics*, (1990 Feb) Vol. 13, No. 2, pp. 107-11.
11. Palmer BJ. Answers. Davenport: Chiropractic Fountain Head; 1952. p. 763.
12. Gonstead clinical studies society. Gonstead quotes. Published Jun 15, 2013. <http://gonstead.com/gonstead-quotes/>.
13. Butler S. “The right number and kind of adjustments can set the stage for nature to heal; too many adjustments in the wrong place can undo any good that was done and slow down the healing mechanism.” <https://www.thejoint.com/2021/09/03/how-young-athletes-can-benefit-from-chiropractic-care>.
14. Ng KM, Aranda-Díaz A, Tropini C, Frankel MR, Van Treuren W, O'Loughlin CT, Merrill BD, Yu FB, Pruss KM, Oliveira RA, Higginbottom SK, Neff NF, Fischbach MA, Xavier KB, Sonnenburg JL, Huang KC. Recovery of the Gut Microbiota after Antibiotics Depends on Host Diet, Community Context, and Environmental Reservoirs. *Cell Host Microbe*. 2019 Nov 13;26(5):650-665.e4. [doi:10.1016/j.chom.2019.10.011](https://doi.org/10.1016/j.chom.2019.10.011). Erratum in: *Cell Host Microbe*. 2020 Oct 7;28(4):628.
15. Guardado KE, Sergeant SR. Sensory Integration. [Updated 2023 Jul 31]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan. <https://www.ncbi.nlm.nih.gov/books/NBK559155/>.

ERRATA

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International peer-reviewed chiropractic pediatric history and examination forms for the infant, child, and adolescent
By Sue A. Weber BSc, DC, MScAPP (Pediatric musculoskeletal health)

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Postpartum depression in mothers in a United Kingdom pediatric chiropractic setting: A survey using Edinburgh Postnatal Depression Scale

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ABSTRACT

Background: Mothers commonly present their newborn infants to chiropractors for examination and treatment. As it is known that postpartum depression is common in new mothers, we chose this population to conduct a survey. The goal of this survey was to determine the prevalence of post-partum depression in mothers who presented their child for care in a United Kingdom (UK) university teaching chiropractic clinic. **Methods:** The Edinburgh Postnatal Depression Scale (EPDS) was handed to each mother as they entered the clinic between December 2006 and December 2007. Participation was voluntary and all English-speaking mothers chose to participate. **Results:** A total of 344 mothers completed the survey. Of these, 17.2% (N=50) scored 13 or above indicating probable presence of postnatal depression and 32% (N=110) scored 10 or above indicating possible presence of postnatal depression. **Conclusion:** Possible and probable postnatal depression were more commonly reported in new mothers presenting their baby for chiropractic care than the reported global pooled prevalence. Implementing these surveys into all chiropractic offices may help to uncover under-reporting and under-diagnosis in this population. Appropriate education and referral pathways for this common problem are encouraged.

Key Words: postpartum depression, perinatal depression, Edinburgh Postnatal Depression Scale, chiropractic, pediatric.

Introduction

Postpartum depression (PPD) (also called Postnatal depression/Perinatal depression) is described by the International Classification of Diseases (ICD-11) as a syndrome associated with pregnancy or the puerperium period that involves significant mental and behavioural features.¹ Symptoms may include depressed mood, excessive crying, difficulty bonding with the baby, withdrawal from family and friends, loss of appetite, fears of not being a good mother, feelings of worthlessness, shame, guilt or inadequacy.

Maternal functioning is maintained only through significant additional effort.² Postpartum Depression has been described as the most underdiagnosed obstetric complication in America.³ Further, it is likely to be found in chiropractic practices because it is a common complication in back pain⁴ as well as mothers presenting their infant for chiropractic care.⁵

Emotional health is an important health metric in all demographics. The distinction of depression in the postpartum period is that the mother is the major caregiver to a newborn infant. Ongoing depression can interfere with parenting and is associated with a variety of negative outcomes in the mother, the family, and the child in both the

short- and long-term.⁶ During these time frames effective management is important to the health of both the mother and the infant.

Children with depressed mothers have significantly higher rates of mood and emotional development disorders relative to children whose mothers are not depressed.⁷ Long reaching effects of maternal PPD on the child have been studied by the Avon Longitudinal Study of Parents and Children in the United Kingdom.⁸ PPD was found to double the risk of child behaviour disturbances for mothers with all categories of moderate, marked and severe PPD.⁸ Severe PPD was particularly important in this category, increasing the risk for behaviour problems including hyperactivity, emotional and conduct problems, at 3.5 years of age with an odds ratio of 4.84.⁸ Cognitive and academic achievement has also been shown to be affected. Grades achieved in mathematics at 16 years of age were examined in this cohort and lower mathematics grades were achieved with an odds ratio of 2.65. With an increasing worldwide awareness of youth depression and suicide, perhaps the most disturbing is the increased incidence of depression in these children at 18 years of age with a staggering odds ratio of 7.44.⁸

Mothers and families do not go unscathed. The Confidential

Enquiries into Maternal Deaths (CEMD) identified suicide as the leading cause of maternal death in the United Kingdom up to 12 months postpartum.⁹ Fathers suffer from PPD with a prevalence rate that increases to 50 percent when the mother also experiences PPD. These fathers are less likely to present with sadness and more likely to present with symptoms of substance abuse, domestic violence, and undermining breastfeeding.¹⁰ However, a father who is not depressed is a protective factor for children of mothers with depression.¹⁰

Prevalence of PPD has been widely cited as 13 percent of all new mothers.¹¹ However it is acknowledged that in certain populations the rate may be much higher particularly in marginalized communities and developing countries.¹¹ A more recent meta-analysis and meta-regression of 296,284 women from 56 countries found the global pooled prevalence to be 21 percent using the Edinburgh Postnatal Depression Scale (EPDS) with a cut-off of 9 (possible PPD) and 16.7 percent using a cut-off of 12 (probable PPD).¹² Prevalence of positive screening for mothers of infants in Neonatal Intensive Care Unit (NICU) for at least 14 days increases to 36 percent.¹³

The importance of further education in specialized care of the pediatric population in chiropractic practice is becoming spotlighted and recognized by registration boards and professional associations worldwide.^{14,15,16}

It is important for chiropractic practices to recognize the importance of the mother/baby dyad as a dynamic unit of health, including the emotional health of the mother. This research explored the rate of PPD found in a chiropractic clinic of mothers presenting their babies for chiropractic care using the EPDS as the screening tool for need for referral as consistent with global research and emerging good practice through health professions.

Methods

A convenience sample of mothers presenting their infant less than 12 months of age to AECC University chiropractic clinic for chiropractic care between December 2006 and December 2007 were asked to complete the Edinburgh Postnatal Depression Scale questionnaire (EPDS) to screen for presence of postnatal depression symptoms. Mothers who could not speak English well enough to complete the questionnaire were excluded. A total of 344 questionnaires were collected and used for analysis. Completed questionnaires were presented and scored by the final year chiropractic intern and checked and collected by the primary researcher. Data were imported into Statistical Package for Social Sciences (SPSS) version 14 for statistical analysis. A score of 13 or above was considered probable PPD. Scores between 10 and 12 were considered possible PPD. This method of scoring and vernacular is consistent

with similar literature using the EPDS and validation.¹⁷ This also allowed for easy comparison of positive EPDS between studies and demographics. This study was evaluated and approved by the AECC-Bournemouth University Ethics Committee prior to its commencement.

Results

A total of 344 questionnaires were analysed. Of these 344 questionnaires, 17.2 percent (N=59) scored 13 or above indicating probable presence of postnatal depression and 32 percent (N=110) scored 10-12 indicating possible presence of postnatal depression. Table 1 shows the breakdown of prevalence in this clinical sample.

EPDS Score	Number	Percent
234	234	68
≥ 10 (Possible PND/Minor Depression)	110	32
≥ 13 (Probable PND/Major Depression)	59	17.2

Table 1. Edinburgh postnatal depression scale²⁷ score frequency of presentation.

Discussion

The purpose of this study was to learn how many mothers of infants presented to the clinic for chiropractic care were afflicted with potential PPD. The results of this survey showed that the prevalence of possible postpartum depression of mothers of infants in a chiropractic clinic was 32 percent. The global pooled prevalence of possible PPD using the same screening parameters was 21 percent.

These results beg questions. Why is there such a high prevalence of PPD in mothers presenting their babies to a pediatric chiropractic centre? In the recent highlighting of chiropractors treating children and babies, have we as a profession prepared for the knowledge and ability to screen, detect, and refer mothers with possible and probable PPD? Further, are our tertiary institutions and professional bodies preparing future and current chiropractors with these skills? If our patients are the infant, does our duty of care extend to the mothers of these infants? What about the fathers with possible PPD?

Is it the case that the nature of ailments treated by pediatric chiropractors may attract a higher rate of postpartum depression subjects? This is best considered in conjunction with looking at who is bringing their infants to a pediatric chiropractic clinic and it should be noted that this is a clinical population screen which differs from a general population screen. Miller¹⁸ found that 29.6 percent of

pediatric presentations to this clinic were for excess crying. An association between maternal depression and colic and/or inconsolable infant crying has been consistently reported.¹⁹

Of further interest, an analysis of mothers bringing their babies to the hospital emergency department found the most prevalent category of presenting problem with a positive screen for PPD was "crying baby." These mothers had a probable PPD rate of 16 percent (EPDS Score ≥ 13). This means that mothers who presented with a crying baby were 2.9 times more likely to screen positive for PPD than mothers not presenting with a crying baby.²⁰ However it is important to note that if PPD screening were limited to only mothers with crying or irritable babies, many cases would be missed.

Sleep deprivation and sleep problems in infants can be the most challenging aspect of parenthood for new parents. It is not surprising that maternal postnatal depression and infant sleep problems show a cyclical relationship which has been described as "chicken or egg."²¹ Sleep deprivation can cause depression and depression can cause sleep deprivation. This association may be one of the key issues surrounding PPD and maternal report of an infant's sleep problem remains a significant predictor of an EPDS score of 13 or above which is indicative of probable depression.²² This is another key reason why infants are brought to see chiropractors. In fact, parents of infants and children reporting improved sleep has been found to be the most common side effect of chiropractic care for children.²³

Do we as chiropractors have the necessary knowledge and skills to give these parents best practice care and referral? A good place to start to find answers is to look at other health profession associations and their current recommendations for good practice. In the USA, the American Academy of Pediatrics recommends that birth parents should be screened for depression at the 1-, 2-, 4-, and 6-month well-infant visits, using a validated screening tool, encourage screening the partner and when screening reveals a concern, refer as indicated.²⁴

In England and Wales, the National Institute for Health and Care Excellence (NICE) recommendations suggest at first contact with a pregnant woman and during the early postnatal period a primary care professional should ask the following depression identification questions:

- (1) During the past month, have you often been bothered by feeling down, depressed, or hopeless?
- (2) During the past month, have you often been bothered by having little interest or pleasure?

In Australia, clinical guidance by the Centre of Perinatal Excellence (COPE) recommends screening with EPDS

at least once during pregnancy and at least once postpartum. COPE provides further recommendations for implementation and guidance for referral.²⁵

Within chiropractic professional bodies, The Australian College of Chiropractic Paediatrics recently released a Perinatal Depression Policy making recommendations to the membership in Australia.²⁶ These recommendations are available online and include:

- Chiropractors involved in the care of children under 2 years of age ensure both parents, where possible, have within the preceding 6-week period completed an EPDS.
- Including the EPDS as one of the standard intake forms for the parents of new patients aged 0 to 2 years of age is recommended.

The recommendations go on to advise when further EPDS testing and referral or further action is indicated.²⁶

The scope of chiropractic care worldwide has traditionally encompassed all aspects of health with the adage of the triad of health being physical, emotional and chemical. The importance of duty of care of emotional health has been spotlighted in many professions including health professionals, teachers, and human resource managers amongst others. Mental Health First Aid courses are developing and being recognized for continual professional development and seen as a valuable addition to each workplace.

Likewise, the importance of screening of the perinatal mother and father for signs indicative of perinatal depression, when these parents present their infants for health care, has been recognized by good practice guidelines in major nations worldwide including the American Academy of Pediatrics, the United Kingdom in NICE guidelines and Australia's Centre of Perinatal Excellence (COPE). Each of these organizations recommend regular screening of the mother (and father) for signs of perinatal depression. In light of knowledge of the high prevalence of PPD in a pediatric chiropractic setting, chiropractors need to be armed with an increased knowledge of postnatal depression, and a protocol for screening and referral for appropriate treatment that is profession specific.

A major limitation of this study was that only English-speaking mothers were included leaving a vast number of parents not included. This needs to be addressed in future studies for wider inclusion.

Conclusion

Screening new mothers who presented their infant for chiropractic care using the accepted standard of the EPDS proved significant. Worldwide guidelines suggest that such screening is appropriate and recommended in all clinical

settings. Chiropractors should consider implementation of appropriate screening tools into their practice and follow guidelines for appropriate referral procedures. Such practices help protect the health of both mother and baby.

References:

1. World Health Organization. International Classification of Diseases-11. ICD-11 2022. Mental or behavioural disorders associated with pregnancy, childbirth or the puerperium, without psychotic symptoms. [Online] Available at: <https://icd.who.int/browse11/l-m/en#/http://id.who.int/icd/entity/1124422593?view=G0> [Accessed April 2023].
2. National Institute for Health and Care Excellence. Antenatal and postnatal mental health: clinical management and service guidance. NICE National Institute for Health and Care Excellence. <https://www.nice.org.uk/guidance/cg192>. Published December 17, 2014. Updated February 11, 2020. Accessed March 2023.
3. Earls MF. The Committee on Psychosocial Aspects of Child and Family Health. Clinical report- incorporating recognition and management of perinatal and postpartum depression into pediatric practice. *Pediatrics* 2010;126(5):1032-9.
4. Long G, Yao ZY, Na Y, Ping Y, Wei S, Mingsheng T. Different types of low back pain in relation to pre- and post-natal maternal depressive symptoms. *BMC Pregnancy and Childbirth*. 2020;20:551-9.
5. Miller J, Mullins-McGillion L, Holleman A. Postnatal depression in mothers of infants presented to a chiropractic clinic for care: chicken or egg? *Alternative Therapies*. 2009;15(3):S117.
6. O'Hara MW, McCabe JE. Postpartum depression: current status and future directions. *Annual Review of Clinical Psychology*. 2013;9:379-407.
7. Goodman S, Rouse M, Connell A, Broth M, Hall C, Heyward D. Maternal depression and child psychopathology: a meta-analytic review. *Clinical Child and Family Psychology Review*. 2011;14:1-27.
8. Netsi E, Pearson R, Murray L, Cooper P, Craske M, Stein A. Association of persistent and severe postnatal depression with child outcomes. *JAMA Psychiatry*. 2018;75(3):247-53.
9. Oates M. Suicide: the leading cause of maternal death. *British Journal of Psychiatry*. 2003;183:279-81.
10. Earls M, Yogman M, Mattson G, Rafferty J. Committee on psychosocial aspects of child and family health. Incorporating Recognition and Management of Perinatal Depression Into Pediatric Practice. *Pediatrics*. 143(1):e20183259.
11. O'Hara M, Swain A. Rates and risk of postpartum depression- a meta-analysis. *International Review of Psychiatry*. 1996;8:37-54.
12. Hahn-Holbrook J, Cornwell-Hinrichs T, Anaya I. Economic and health predictors of national postpartum depression prevalence: a systematic review, meta-analysis, and meta-regression of 291 Studies from 56 countries. *Frontiers in Psychiatry*. 2018;8:248.
13. Cherry A, Blucker R, Thornberry T, Hetherington C, McCaffree M, Gillaspay S. Postpartum depression screening in the Neonatal Intensive Care Unit: program development, implementation, and lessons learned. *Journal of Multidisciplinary Healthcare*. 2016;9:59-67.
14. Council on Chiropractic Pediatrics. Our history and mission. Council on Chiropractic Pediatrics. <https://www.icapediatrics.com/about-us/history/> Updated 2023. Accessed September 2023.
15. The International Chiropractic Pediatric Association. Our statement of purpose. ICPA. <https://icpa4kids.com/about/> Published 2021. Accessed September 2023.
16. Australian College of Chiropractic Paediatrics. About the ACCP. Australian College of Chiropractic Paediatrics. <https://accp.asn.au/about-the-accp> Updated 2022. Accessed September 2023.
17. Murray L, Carothers A. The validation of the Edinburgh Post-natal Depression Scale on a community sample. *British Journal of Psychiatry*. 1990;157:288-290.
18. Miller J. Demographic survey of pediatric patients presenting to a chiropractic teaching clinic. *Chiropractic and Osteopathy*. 2010;18:33.
19. Radesky J, Zuckerman B, Silverstein M, Rivara F, Barr M, Taylor J, Lengua L, Barr R. Inconsolable infant crying and maternal postpartum depressive symptoms. *Pediatrics*. 2013;131: 6:e1857-64.
20. Stock A, Chin L, Babl F, et al. Postnatal depression in mothers bringing infants to the emergency department. *Arch Dis Child*. 2013;98:36-40.
21. Armstrong K, van Haeringen A, Dadds M, Cash R. Sleep deprivation or postnatal depression in later infancy: separating the chicken from the egg. *Journal of Paediatric and Child Health*. 1998;23:260-2.
22. Kendall-Tackett K. A new paradigm for depression in new mothers: the central role of inflammation and how breastfeeding and anti-inflammatory treatments protect maternal mental health. *International Breastfeeding Journal*. 2007;2(6):6-20.
23. Miller J. Can chiropractic care improve infant's sleep. *Journal of Clinical Chiropractic Paediatrics*. 2008;9(1):557-560.
24. Earls M, Yogman M, Mattson G, Rafferty J. Committee on psychosocial aspects of child and family health. Incorporating recognition and management of perinatal depression into pediatric practice. *Pediatrics*. 2019;143:1: e20183259

25. Highet N and the Expert Working Group and Expert Subcommittees. Mental health care in the perinatal period: Australian clinical practice guideline. Centre of Perinatal Excellence (COPE). <http://www.cope.org.au/health-professionals/health-professionals-3/> Published 2023. Accessed September 24, 2023.
26. Murray S, Keil B. Policy: Perinatal Depression Screening. Australian College of Chiropractic Paediatrics. <https://accp.asn.au/policy-on-pnd>. Published July 2023. Accessed October 8, 2023.
27. Cox J, Holden J, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry*. 1987a;150:782-6.

Chiropractic management of ankyloglossia & retrognathia and their impact on breastfeeding: A case study

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ABSTRACT

Ankyloglossia diagnosis and its' management is varied. This case study followed a newborn with breastfeeding difficulties and inadequate weight gain and investigated the relevance of musculoskeletal management in supporting the dyad with breastfeeding difficulties post frenectomy. Chiropractic care was provided post frenectomy along with lactation management to assist the infant who was unable to latch directly to breastfeed and transfer milk efficiently. Further studies are needed to study the impact of chiropractic treatment on the success of frenectomy.

Key Words: neonate, breastfeeding difficulties, chiropractic, retrognathia, frenectomy, ankyloglossia, lactation difficulties.

Introduction

The management and diagnosis of ankyloglossia are varied. Ankyloglossia, also known as tongue-tie, is a congenital oral anomaly that may decrease the mobility of the tongue in elevation, extension and lateralization, therefore may decrease tongue function. It is caused by an unusually tight, short and or thick lingual frenulum, a connective tissue membrane consisting of fascia and oral mucosa, connecting the underside of the tongue to the floor of the mouth. It can be located along the entire underside of the tongue (root to tip) or a more posterior location leaving the tongue tip free.¹ The prevalence varies widely, possibly due to disagreements in how to assess and diagnose a tongue tie. Values in studies vary between 4.2 percent - 10.7 percent, however a recent meta-analysis concluded for infants under one year of age it's 8 percent.² Restricted tongue mobility as a result of ankyloglossia may lead to feeding difficulties, speech problems and can affect the height and width of the palate, position of the mandible and alignment of the teeth.³ Mills, et al., 2020 cadaver studies demonstrated the lingual frenulum to be a dynamic structure formed by the midline fold of the floor of mouth fascia together with the overlying floor of mouth mucosa.⁴

The floor of the mouth is made up of four muscles: paired mylohyoid muscles, geniohyoid, digastric muscle and stylohyoid muscle. The oral diaphragm (muscular floor of the oral cavity) bridges between the two rami of the mandible and is formed from the mylohyoid muscles.⁵ The tongue directly influences facial development due to its role in the development of the oral skeletal structures. Outward pressure is exerted on the palate, gums and descending teeth and the mandible by the tongue. The buccal musculature constricts in response to the outward forces to maintain equilibrium. In this way, the tongue drives the developing

position and shape of both the maxillae (palate and dental arch) and that of the mandible as well as the space for the erupting dentition.⁶ The alveolar bone is connected to lip, tongue, and buccal musculature via frenums (folds of tissue); the primary function of these is to maintain balance between growing bones, the tongue and lip musculature. This occurs during development of the fetus and limits movement of lips, tongue, and cheeks. Abnormal frenal attachment may affect lips, tongue and cheeks and may influence the position and shape of the jaw (as well as the maxillae) and dentition. Hence, the issue of ankyloglossia can have both long-term as well as short-term effects.⁶

Frenectomy is commonly proposed to obliterate or incise the tethering tissue(s) using laser, scalpel, or surgical scissors. However, there is much disagreement amongst health care professionals as to whether frenectomy is the sole reason for resolution of symptoms. The evidence for short term efficacy of the frenectomy show improvement in breastfeeding, immediate changes in the mothers' nipple pain, milk transfer and weight gain.^{7,8} Long term improvements are not demonstrated.

Clinical presentation varies. The focus in this case was on the complications related to breastfeeding issues. These included but were not limited to; latching difficulties, inability to sustain a latch, irritability while feeding and nipple pain during feeding for the mother. Although there are many different approaches to the problem, this case study specifically demonstrated the utility of musculoskeletal management of breastfeeding difficulties in infants with tethered oral tissue.

Methods

The literature search was conducted in six databases

(ScienceDirect, NCBI, PubMed, Sci-Hub, Academy of Breastfeeding Medicine, JAMA Network) from inception and completed using search terms relevant to breastfeeding difficulties, chiropractic management, retrognathia, frenectomy, ankyloglossia, lactation difficulties. The case records of the chiropractor and lactation consultant were consulted to review the case presentation and management.

Case presentation

The family presented to the chiropractic clinic. The infant was presented to the chiropractor at 32 days of age, weight was 3900g and the chief complaint was breastfeeding difficulties and inability to latch. They were currently finger feeding and using a supplemental nursing system. The lactation consultant was concerned about the infant's inability to transfer milk.

Historical findings were as follows: the mother was Gravida 1, Para 1. She had a natural vaginal delivery at 41 weeks. Delivery duration was 19 hours with active labor of about an hour. The normal vertex delivery was complicated by the use of ventouse suction, and the mother required an episiotomy. Apgar scores were 9 at 1 minute, 10 at 5 minutes and 10 at 10 minutes. Birthweight 3650g. Length 52cm, head 37cm. The discharge weight was 3400g.

Maternal medical history was insignificant; she was taking no medication.

At 12 days of age, the infant presented to a lactation consultant (LC) with an immediate aim to ensure infant received enough nutrition, as the infant's weight was 3500g, not yet achieving birth weight. The mother presented with sore nipples. The infant had no latch, suck, or milk transfer from the breast. Infant was being fed expressed milk via finger feeds or nasogastric tube as a home-made supplemental nursing system. Mother trialed a nipple shield but it did not improve the infant's efficiency in transferring milk and the infant continued losing weight. The lactation consultant encouraged her to pump and give exclusive breast milk (EBM) "top-ups", fed to the infant either using finger feeding or ng tube, or, preferably, supplemental nursing system. The LC corrected the infant's latch and referred them to another healthcare provider to consult on the diagnosis and perform a frenectomy of a posterior tongue tie. They were also referred by the LC for craniosacral therapy as she suspected bilateral tight temporomandibular joints (TMJ).

On day 13 the infant underwent a frenectomy with scissors to release the posterior tongue tie. The procedure was performed by an ear nose and throat (ENT) doctor and weight was 3580g at the local hospital. At 2 weeks old, parents were concerned about bottle feeding interfering with their ultimate goal and were adamant about their choice to

breastfeed. They were currently feeding via supplemental nursing system or finger feeding. The lactation consultant had suggested feeding in a laid-back position to assist in moving the jaw forward, as infant weighed 3455g that day, on day 15.

On day 16, three days post frenectomy, the mother messaged the lactation consultant and reported that the infant was not suckling. The mother was finger feeding as she was struggling with the laid-back position. The lactation consultant advised to try the dancer hold. A dancer hold is used to assist infants with low tone who struggle to latch. This is obtained by the mother gently cupping the underside of the breast with one hand; four fingers under the breast and the thumb on top. The hand slides forward creating a U-shape with thumb and index to hold the infant's cheeks with the chin resting in the middle of the U-shape. The lactation consultant sent suck training videos, post frenectomy exercises and a pump schedule to protect the milk supply.

At 2 weeks 5 days (Day 19) the mother again tried using a nipple shield. On video, the infant showed short sucking bursts. The mother was battling with the supplemental nursing system and was worried about finger feeding. Education on nipple shield use was given by the LC who encouraged continuation of pumping and referred for chiropractic care. No appointment was made at this time.

The following day (day 20) the infant had stopped feeding on the nipple shield and managed to latch directly onto the breast. The mother wanted to discontinue pumping if the infant was latching. The family purchased an infant scale.

At day 22, the infant's weight was 3710g. Because the mother felt the infant was transferring enough milk breastfeeding, she stopped pumping. It is unknown whether the infant was using shields at this stage.

At three weeks 6 days (day 27), the infant's weight was 3540g, and the infant had still not regained her birth weight. The lactation consultant advised the mother again to express and bottle feed (and instructed her on paced feeding — hold infant in an upright or semi — upright position, allow the infant to open their mouth over the nipple and close over the base. If the upper lips are pulled in then use your fingers to open them over the nipple to flange them out. Hold the bottle horizontally so the flow is not too fast. Build in pauses as needed), as she was concerned the infant was not transferring milk. There was great concern about possible dehydration and parents were quizzed about sufficient numbers of wet nappies per day. The family booked a follow up with the lactation consultant the same day to be shown the Medela supplemental nursing system as the infant was lethargic and did not want to suck.

The LC provided the supplemental nursing system and demonstrated its' use. Power pumping education was also given as well as information on quantities needed per feed and 3 hourly feeds were recommended.

At 4 weeks (day 28) the LC followed up on the supplementary nursing system — the infant was able to feed but the duration of feed was considered too lengthy (2 hours to drink 100mls). The feeding method was changed to a feeding tube and syringe, along with finger feeding. The mother's milk supply seemed adequate as she was able to pump 120ml per session.

The following day (day 29) the infant managed to take in a total of 630ml and was more awake. The mother was again encouraged to see a chiropractor to rule out a musculoskeletal reason why the infant was unable to transfer milk successfully. The day thereafter (day 30) the infant managed to take in a total of 730ml and feeds seemed to be going faster.

However, on day 31, the intake dropped to a total of 640ml and the mother was concerned about duration of the feeds.

At 4 weeks 4 days (day 32) total intake volume dropped to 590ml and the infant was lethargic. At this point the infant was presented for chiropractic care.

The parents presented the infant to the chiropractic clinic at 4 weeks 4 days (day 32). The infant's weight was 3900g. Previous therapy included craniosacral therapy by physiotherapist with no improvement according to the parents. This therapy was received after the frenectomy, at 2 weeks of age. Figure 1 shows the growth chart.

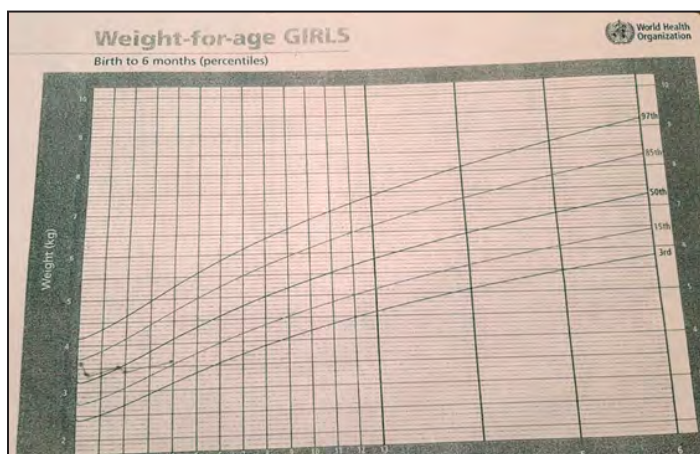


Figure 1. Weight chart.

Observation revealed retrognathia (recessed jaw), restricted tongue movement and function, decreased temporomandibular joint (TMJ) range of motion (the range was decreased more on the left than the right) and reduced

oral reflexes (rooting and sucking).⁹ The infant had a posteriorly translated cranium on cervical vertebrae 1 (C1), hyoid retraction with flexion C0/C1 which causes the chin to chest presenting as “multiple chins,” and a collapse in the anterior neck musculature presenting as red lines/ folds of skin under the chin (figures 2 and 3). The infant tilted her head to the left and when observed supine, her entire length of her body was concave on the left as if shaped like a banana. Visual assessment of the mouth was difficult due to the limited range of the jaw. Post frenectomy scarring was seen. The tongue range of motion was limited.

Feeding assessment involved the supplemental nursing system and a nipple shield (Figure 4). The parents were overwhelmed by the lack of weight gain. They were concerned that they were pursuing breastfeeding to the detriment of their infant's health. Feeds at this stage lasted longer than an hour. After these long feeds, the mother then had to pump and get ready for the next feed, and her mental health was a concern.

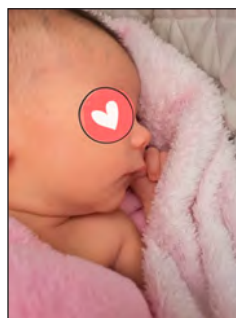


Figure 2. Treatment Day 1 - Recessed chin and multiple skin folds.



Figure 3. Day 1 Treatment — Recessed chin and multiple skin folds anterior neck.



Figure 4. Feeding assessment Day 1 with SNS and nipple shield.

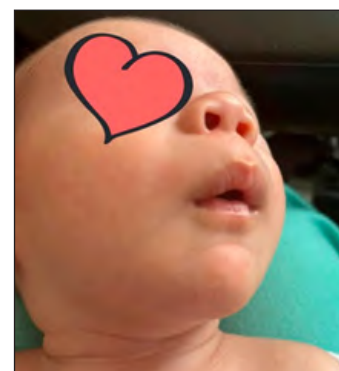


Figure 5. Second chiropractic session — visual decrease in jaw recession.

Management

Management included chiropractic adjustments modified to the age and size of the patient to the cranium, temporal mandibular joint, hyoid and performed a bilateral occipital

release. Soft tissue therapy was applied to the anterior neck musculature, including a stretch to release muscle restriction. Home exercise program included massage therapy (anterior neck, face & chest), the guppy stretch (infant lying supine and allowing the head to tilt gently into slight extension opening up the anterior neck), side to play (infant is side lying and looking at parents) and different options of tummy time. These included the rugby ball carry (one hand between legs and the infant's stomach, other hand supports head if needed, holding the infant close to you for support), tummy to mummy (infant lying on your stomach or chest so the infant is face to face) and lap time (infant prone on your lap).

On the day after the treatment (day 33), a bottle with a slow flow wide neck peristaltic teat was recommended by the chiropractor after consultation with the lactation consultant, as the mother was battling to feed the infant the required amounts via supplemental nursing system. This bottle was to be used with paced feeding technique and basic sucking exercises were given. These included gum tracing (working on lateralization of the tongue) and biting (finger to back of gum and infant bites down to increase strength of the jaw), suck training (using gentle pressure of the finger on the palate, light so as not to activate the gag reflex but increase pressure as she gets used to it, in order to initiate a seal around the finger). Feeds were to be no longer than 40 minutes in total. Feeding for longer durations meant the energy used to feed outweighed the calories consumed during that time.

The following day (day 33) the infant managed a total intake of 650ml; one feed was directly from the breast. At four weeks 6 days (day 34), she managed a total intake of 750ml from both breast and bottle. Exercises were religiously performed after every feed. Her weight increased to 3990g. Three days later (day 35), a second chiropractic treatment was given (figure 5). The infant was sucking at the breast and able to feed for extended periods of time. A total of 750ml was taken.

The day after the second chiropractic session the infant managed three breastfeeds directly from the breast. The tongue seemed to be protruding further. While breastfeeding, it seemed that the infant became frustrated at flow rate but managed four minutes of direct feeding at a time. Bottle intake was 700mls on Day 36.

Six days after the original chiropractic session (day 38) the mother reported more direct breastfeeding; she also reported a strong suck causing nipple pain. The infant had managed two full feeds from the breast and the mother continued with the home exercise program. A video was sent to the chiropractor from the mother and a feed observed (figure 6). The video showed a deeper latch;

however residual tightness remained in the facial muscles. Her milk supply seemed to have stabilized as she reported, she had "lots of milk."

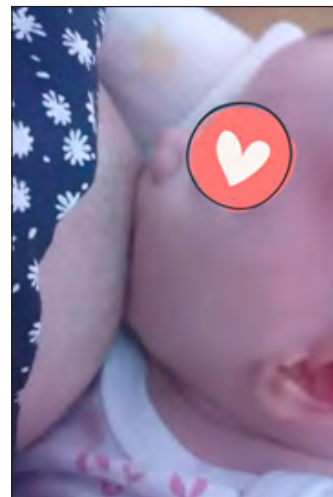


Figure 6. Feeding assessment received six days post original treatment.

A further consult to reassess the latch and cause of nipple pain occurred on day 40, which was her third chiropractic treatment. The jaw seemed to have reduced the degree of recession (figure 5) and she managed to create a seal around the breast, her tongue was more mobile and range of movement was good. Range of movement in the jaw had improved allowing a wide mouth for latching. The nipple pain the mother had been experiencing seemed to be settling.

At 6 weeks of age the infant weighed 4320g (see growth chart in Figure 1). The infant seemed to be bringing up milk which was attributed to the fact she wasn't used to the volumes she was able to drink. Education and burping techniques were given to the parents, along with holding the infant upright post feed for 20 minutes to minimize the positing as the possibility of aerophagia (taking air in at the breast often seen with oral motor dysfunction as a result of ankyloglossia, coming on and off the breast or during bouts of crying) might be contributing to the increase in refluxing.¹⁰

At 4 months of age she presented to the clinic with an acute torticollis. Treatment included modified cervical adjustments, sternal clavicular mobilizations, thoracic releases and bilateral sacrum adjustments. Home exercise program consisting of neck and core strengthening exercises were given. These included tummy time, encouraging looking up, with every nappy change side to sit up (from supine roll the infant onto their left hip, aim the right shoulder to the left hip and encourage the infant with your voice to sit up, then do opposite side). Neck stiffness cleared

after one session. At this age, infants gain neck control and feeding becomes less reflexive.^{11,12} This may lead to feeding difficulties however this infant experienced no feeding difficulties at this stage. She weighed 6640g meaning she had picked up 232g per week in the last 10 weeks. This was within normal ranges for her current age.¹³

No adverse effects were reported by the parents post chiropractic care and adjustment.

Conclusion

This case study demonstrated that a multi-disciplinary team was required to manage a difficult case of sub-optimal breastfeeding. Chiropractic care has proved to be an important part of the multi-disciplinary team used to not only treat breastfeeding difficulties but also play a role in the management of tongue tie or tethered oral tissue.

References:

1. Wongwattana P. The effect of frenotomy on long-term breastfeeding in infants with ankyloglossia. *International Journal of Pediatric Otorhinolaryngology*. 2022;152:110983.
2. Hill RR, Lee CS, Pados BF. The prevalence of ankyloglossia in children aged <1 year: a systematic review and meta-analysis. *Pediatr Res*. 2021;90(2):259-266.
3. Srinivasan C, Bhadrinath AB. Skeletal and dental characteristics in subjects with ankyloglossia. *Prog Orthod*. 2013;14(44).
4. Mills N, Geddes DT, Amirapu S, Mirjalili SA. Understanding the Lingual Frenulum: Histological Structure, Tissue Composition, and Implications for Tongue Tie Surgery. *Int J Otolaryngol*. 2020;2020:1820978. <https://europepmc.org/articles/PMC7391099>.
5. Toth J, Lappin SL. Anatomy, Head and Neck, Mylohyoid Muscle. In: *StatPearls*. Treasure Island (FL): StatPearls Publishing. Copyright © 2023, StatPearls Publishing LLC.; 2023.
6. Defabianis P. Ankyloglossia and its influence on maxillary and mandibular development. (A seven year follow-up case report). *Funct Orthod*. 2000;17(4):25-33.
7. Callea M, Wahjuningrum DA, Scalisi FC, Setiawan F, Fepiosand RA, Ramadhan DL, Morabito A. Tie Tongue and Frenotomy: An Article Review. *Journal of International Dental and Medical Research*. 2023;16:5.
8. Messner AH, Walsh J, Rosenfeld RM, Schwartz SR, Ishman SL, Baldassari C, Brietzke SE, Darrow DH, Goldstein N, Levi J, Meyer AK, Parikh S, Simons JP, Wohl DL, Lambie E, Satterfield L. Clinical Consensus Statement: Ankyloglossia in Children. *Otolaryngol Head Neck Surg*. 2020;162(5):597-611.
9. Colson SD, Meek JH, Hawdon JM. Optimal positions for the release of primitive neonatal reflexes stimulating breastfeeding. *Early Hum Dev*. 2008;84(7):441-449.
10. Kotlow L. Infant Reflux and Aerophagia Associated with the Maxillary Lip-tie and Ankyloglossia (Tongue-tie). *Clinical Lactation*. 2011;2:25-29.
11. Lee HM, Galloway JC. Early intensive postural and movement training advances head control in very young infants. *Phys Ther*. 2012;92(7):935-947.
12. Lagarde MLJ, van Alfen N, de Groot SAF, Geurts ACH, van den Engel-Hoek L. Adaptive capacity of 2- to 5-month-old infants to the flow, shape, and flexibility of different teats during bottle feeding: a cross-sectional study. *BMC Pediatr*. 2019;19(1):477.
13. Child growth standards. World Health Organization; 2023. <https://www.who.int/tools/child-growth-standards>.

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Permissions

Permission (informed consent) was received from Christine Swanepoel and most importantly the parents of the patient.

Conflict of Interest

There were no conflicts of interest.

How we used Artificial Intelligence to write a scholarly paper on infant colic

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ABSTRACT

Objective: The purpose of this paper was to investigate answers to basic research questions available on a widely used Artificial Intelligence site. Artificial Intelligence (AI) is machine intelligence which relies upon its ability to detect, identify, process and recall increasing numbers of variables within any specific topic and use it to mimic human intelligence. It is known to have benefits for medical questions. **Methods:** We asked four basic research questions (topics on which we have previously published) of an Artificial Intelligence site. The answers were presented without any changes or amendments. The site offered a “regenerate” feature if you were unhappy with the first answer and this was utilized once. **Results:** Four short articles were prepared and downloaded from the AI site in approximately 20 seconds each. **Discussion:** The short (one page) articles generated logical but not always accurate content, without any apparent clinical decision making or critical reflection. The content was mostly historical and did not include any nuanced answers with clinical perspective. It is reasonable that high school and college instructors might be concerned that students consider using this system to generate classroom paper assignments. It is anticipated that AI will be increasingly used to generate diagnoses from complex data exhibited by patients in a health care setting. **Conclusion:** The articles generated were basic and did not include any research papers past the year 2018 nor deep and thoughtful discussion as has been done in independent researcher driven papers to answer research questions. It is anticipated that AI will become more sophisticated and increasingly useful and utilized by students and professionals of all types. It needs to be held within our focus so that it can be used wisely and not merely accepted with its limitations.

Key Words: Artificial Intelligence, Infant colic, chiropractic, probiotics, pediatric, infant.

Introduction

Artificial intelligence is machine intelligence used to generate current and useful answers to human questions.¹ As such, it relies upon its ability to locate, recall, collate, process and remember huge amounts of data to formulate those answers.¹ It is used broadly in most any industry. For example, the Beatles music group recently used AI technology and released a song from 1972 that they had never had time to complete when all four of the musicians were alive. Used in this sense, it can amaze and enhance the human experience. But does it benefit science advancement and decrease human bias or might it increase flawed research because of a lack of critical and differential thinking by the AI?

The goal of this project was to present to the JCCP readership one type of use of Artificial Intelligence (AI), to answer research questions with a short, cogent written thesis. As such, what is presented are the exact questions and the exact results as generated by AI. The entire process took less than two minutes. The human part took a considerable amount of time to copy and paste and evaluate the results.

Methods

In a Chat AI site (chatGPT, chat.openai.com) questions were typed and the saved results are found herein.

Results

Question 1. Explain infant colic for a doctor. What is the cause and cure?

CHATGPT reply

Infant colic, often referred to simply as “colic,” is a term used to describe excessive, unexplained crying and fussiness in otherwise healthy and well-fed infants. It is a common concern for parents and can be quite distressing, both for the baby and their caregivers. To explain infant colic to a doctor, it’s important to discuss its characteristics, potential causes, and management options.

Characteristics of Infant Colic: Infant colic typically presents with the following features:

1. **Excessive Crying:** Colicky babies often cry for more than three hours a day, at least three days a week, and this may persist for three weeks or longer.
2. **Fussiness:** Infants with colic are often irritable and fussy, especially during the evening hours.
3. **Difficulty Soothing:** Parents may find it challenging to console their colicky baby, as the crying episodes can seem inconsolable.
4. **Symptom Onset:** Colic typically begins within the first few weeks of life and usually resolves by the time the baby is three to four months old.

Potential Causes of Infant Colic: The exact cause of infant colic is not well understood, and it may be multifactorial. Several theories have been proposed:

1. **Gastrointestinal Issues:** Some experts believe that colic may be related to gastrointestinal discomfort, such as gas, acid reflux, or an immature digestive system.
2. **Sensory Overload:** Babies may become overwhelmed by sensory stimuli, such as noise, light, or changes in their environment, leading to increased fussiness.
3. **Maternal Diet:** In some cases, a breastfeeding mother's diet (e.g., consumption of certain foods or caffeine) may contribute to colic symptoms in her baby.
4. **Parent-Infant Interaction:** Stress and anxiety in parents, as well as their response to the baby's crying, can play a role in exacerbating colic.

Management and Treatment Options: There is no one-size-fits-all cure for infant colic, and management strategies often focus on soothing the baby and providing support to the parents. Recommendations for managing colic include:

1. **Feeding:** Ensure that the baby is feeding well and consider trying different feeding techniques, such as smaller, more frequent meals.
2. **Burping:** Burp the baby frequently during and after feedings to release gas and reduce discomfort.
3. **Comfort Measures:** Use gentle rocking, swaddling, or a pacifier to provide comfort and soothe the baby.
4. **Environmental Changes:** Create a calm and quiet environment to reduce sensory stimuli during fussy periods.
5. **Parental Support:** Offer support and reassurance to parents, as coping with a colicky baby can be stressful.
6. **Dietary Changes (if breastfeeding):** If breastfeeding, the mother may try eliminating certain foods from her diet to see if it affects the baby's symptoms.

In most cases, colic gradually improves on its own as the baby grows and matures. It is essential for healthcare providers to rule out any underlying medical conditions that could be causing the symptoms. If colic persists or is causing significant distress to the baby or parents, healthcare professionals may recommend further evaluation and potential interventions.

It's important to emphasize to parents that infant colic is a temporary phase, and with patience and support, it typically resolves as the baby gets older. Encourage parents to reach out to their healthcare provider for guidance and reassurance during this challenging time.

A regeneration was requested:

CHATGPT reply:

Infant colic is a common but poorly understood condition characterized by excessive, inconsolable crying and fussiness in otherwise healthy and well-fed infants. It

typically occurs in the first few months of life, peaking around six weeks of age and often resolving by the time the baby is three to four months old.

Symptoms:

1. **Crying spells:** Colicky infants often cry for more than three hours a day, three days a week, for at least three weeks.
2. **Predictability:** Colic tends to occur at the same time each day, often in the late afternoon or evening.
3. **Posture changes:** During crying episodes, infants may clench their fists, arch their backs, and pull their knees toward their chest.

Possible Causes:

1. **Gastrointestinal issues:** Some believe that colic may be related to gastrointestinal discomfort, such as gas or indigestion. However, the evidence supporting this is not conclusive.
2. **Maternal diet:** In breastfeeding infants, certain components of the mother's diet, such as cow's milk or certain foods, may trigger colic symptoms.
3. **Overstimulation or sensitivity:** Some infants may be more sensitive to stimuli, such as light, noise, or changes in environment, leading to colic-like symptoms.

Cure/Treatment:

1. **Time:** Colic often resolves on its own as the baby grows older, usually by the time they reach three to four months of age.
2. **Comfort measures:** Parents can try various comfort measures to soothe a colicky baby, such as holding, rocking, swaddling, or using pacifiers.
3. **Feeding adjustments:** If the baby is breastfed, the mother may try adjusting her diet, eliminating potential trigger foods. For formula-fed babies, a switch to a different formula may be considered.
4. **Probiotics:** Some studies suggest that probiotics might be helpful in reducing colic symptoms, though the evidence is not yet conclusive.

It's important to note that while colic is distressing for both infants and parents, it is generally a self-limiting condition. If a parent is concerned about their baby's excessive crying or suspects an underlying issue, it is crucial to consult with a pediatrician. The doctor can evaluate the baby's health, provide guidance on managing colic, and rule out any other potential medical issues.

Question 2: What treatment has the best evidence to reduce infant colic? Give me the scientific information so that I can find it on the internet.

CHATGPT reply

Infant colic is a common condition characterized by

excessive crying and fussiness in otherwise healthy infants, typically starting around the second week of life and resolving by the fourth or fifth month. While its exact cause remains unclear, several treatments have been explored to alleviate colic symptoms, with varying degrees of success. Based on current scientific evidence, three approaches stand out as effective in reducing infant colic:

1. **Probiotics:** Numerous studies have investigated the use of probiotics, specifically strains of *Lactobacillus* and *Bifidobacterium*, to alleviate colic symptoms. One study published in the journal “Pediatrics” in 2018 (PMID: 29358284) found that probiotics reduced crying time in colicky infants. Probiotics are believed to positively influence gut flora, potentially addressing underlying gastrointestinal issues associated with colic.

2. **Reduced Lactose Formula:** Some infants with colic may have trouble digesting lactose, a sugar found in milk. Utilizing lactose-free or reduced-lactose formula has shown promise in improving colic symptoms. A study published in “JAMA Pediatrics” in 2016 (PMID: 27893896) found that switching to a hydrolyzed formula resulted in decreased crying and fussiness among colicky infants.

3. **Behavioral Interventions:** Techniques aimed at soothing and comforting colicky infants have proven beneficial. A study in the “Journal of Pediatric Health Care” in 2017 (PMID: 28162843) highlights the effectiveness of infant massage and swaddling in reducing colic-related crying. These interventions promote relaxation and comfort, potentially mitigating colic-related distress.

It is important to note that the response to treatments can vary among infants, and what works for one may not work for another. Therefore, it's advisable for parents to consult with a healthcare professional before implementing any treatment strategy for infant colic. Additionally, ongoing research may lead to new insights and treatment options, so staying up-to-date with the latest scientific literature is essential in managing infant colic effectively.

Question 3: What is the evidence that manual therapy improves infant colic? Give me the scientific information so that I can find it on the internet.

CHATGPT reply

Manual therapy, such as chiropractic or osteopathic manipulation, has been explored as a potential treatment for infant colic. However, the evidence supporting its effectiveness remains limited and controversial. Here, we'll discuss the available scientific literature on this topic.

Description: Manual therapy for infant colic involves the use of hands-on techniques to manipulate the infant's spine

or musculoskeletal system with the aim of improving colic symptoms. These therapies are typically administered by licensed healthcare providers, such as chiropractors or osteopaths, and are intended to correct any perceived musculoskeletal issues in the infant.

Explanation: While some parents report positive outcomes after manual therapy sessions for colicky infants, the scientific evidence supporting these claims is inconclusive, and there are concerns about the safety of such interventions.

Here are three scientific articles that provide insight into this topic:

1. **Article 1:** Miller JE, Newell D, Bolton JE. (2012) Efficacy of chiropractic manual therapy on infant colic: a pragmatic single-blind, randomized controlled trial. In this study published in the “Journal of Manipulative and Physiological Therapeutics” (PMID: 22489942), chiropractic manual therapy was assessed for its effect on infant colic. While the study reported some reduction in crying time, the results were not statistically significant, and the authors emphasized the need for further research.

2. **Article 2:** Olafsdottir E, Forshei S, Fluge G, Markestad T. (2001) Randomized controlled trial of infantile colic treated with chiropractic spinal manipulation. Published in the journal “Archives of Disease in Childhood” (PMID: 11788714), this study also investigated chiropractic manipulation as a treatment for infant colic. The findings suggested a slight improvement in colic symptoms among treated infants, but the study's design had limitations, and the overall evidence remained inconclusive.

3. **Article 3:** Gotink RA, Chu P, Busschbach JJ, et al. (2015) Standardised manual therapy for the treatment of infant colic: a systematic review. This systematic review, published in “European Journal of Pediatrics” (PMID: 26055212), analyzed existing studies on manual therapy for infant colic. The review concluded that while some studies reported positive effects, the overall quality of evidence was low, and further research with rigorous methodologies was needed to draw definitive conclusions.

In summary, while there are studies that suggest a potential benefit of manual therapy for infant colic, the evidence remains limited, and concerns about safety and the lack of consistent results call for caution. Parents should consult with healthcare professionals and consider alternative evidence-based treatments for infant colic, such as the ones mentioned in the previous response, before pursuing manual therapy as an option.

Question 4: What is the evidence that probiotics are helpful for infant colic? Give me the scientific information so that I can find it on the internet.

CHATGPT reply

Probiotics have gained attention as a potential treatment for infant colic due to their potential to modulate the gut microbiota, which may play a role in colic symptoms. Here, we'll discuss the scientific evidence regarding the effectiveness of probiotics in alleviating infant colic.

Description: Probiotics are live microorganisms, typically bacteria or yeast, that are believed to confer health benefits when consumed in adequate amounts. In the context of infant colic, they are administered to infants with the aim of promoting a balanced gut microbiome and reducing gastrointestinal discomfort, which is thought to contribute to colic symptoms.

Explanation: Several scientific studies have investigated the use of probiotics for infant colic, but the results have been mixed. Here are three key scientific articles that shed light on this topic:

1. **Article 1:** Savino F, Pelle E, Palumeri E, et al. (2013) Lactobacillus reuteri (American Type Culture Collection Strain 55730) versus simethicone in the treatment of infantile colic: a prospective randomized study. Published in the journal "Pediatrics" (PMID: 23589877), this study compared the effectiveness of Lactobacillus reuteri (DSM 17938) to simethicone, a commonly used over-the-counter colic remedy. The study found that the probiotic group experienced a greater reduction in crying time, suggesting a potential benefit for L. reuteri in treating colic.

2. **Article 2:** Sung V, Hiscock H, Tang MLK, et al. (2014) Treating infant colic with the probiotic Lactobacillus reuteri: double-blind, placebo-controlled randomized trial. This study, published in the journal "Pediatrics" (PMID: 25070305), conducted a randomized controlled trial to assess the effectiveness of Lactobacillus reuteri DSM 17938 in treating infant colic. The results indicated that infants receiving the probiotic had a significant reduction in crying and fussiness compared to the placebo group.

3. **Article 3:** Szajewska H, Gyrzduk E, Horvath A. (2013) Lactobacillus reuteri DSM 17938 for the management of infantile colic in breastfed infants: a randomized, double-blind, placebo-controlled trial. Published in the journal "Journal of Pediatrics" (PMID: 23796741), this study focused on breastfed infants and found that Lactobacillus reuteri DSM 17938 reduced the daily

crying time and improved colic symptoms compared to the placebo group.

While these studies suggest a potential benefit of probiotics, it's essential to note that the effectiveness of specific probiotic strains may vary, and further research is needed to confirm these findings. Probiotics appear to be a promising option for some infants with colic, but consulting with a healthcare professional before starting probiotic treatment for a colicky infant is crucial to ensure it is appropriate and safe for the individual child.

Discussion

Crying is the baby's first attempt at communication. Crying in the infant is an important survival skill as it elicits caring behaviors in the parents that insure survival of the infant.² Numerous studies and levels of research have not successfully identified specific reasons for the onset of infant colic, or excessive crying within the first two weeks of life, although some familial social conditions may be related.^{3,4} As such the ideas promoted in the AI articles are much too certain of the given etiologies. For example, although it may seem that an experienced mother might be helpful, a key risk factor for infant colic is whether or not it has occurred in the family previously.^{3,4} The associations with infant colic as discussed with AI are not commonly repeated in up-to-date research articles, but are common in the older literature, suggesting a simplistic and incomplete approach to answer the research questions. Current research does NOT suggest that maternal diet or cow's milk protein intolerance are causes for infant colic. To put it simply, if these are the causes, then there is a known reason for the crying, and by definition, the cause of the crying is not attributable to infant colic.⁵ Further, AI seems to have confused lactose free formulas with hydrolyzed formulas (which hydrolyze the protein in milk, not the sugar) and in a nutshell, neither of these are related to infant colic.⁵

Put simply, there are no randomized controlled trials that support the two treatments, reduced lactose formula and behavioral interventions that AI has called efficacious. The levels of evidence required to meet the standard of effectiveness for AI appears to be low.

There are also considerable disputes that colic resolves automatically at three or four months of age as solidly stated by the AI articles, or that it does not include negative side effects.⁶⁻⁹ The regenerated version did not fare better holding on to the ideas that colic comes from GI upset or maternal diet. Both these claims are unsupported by the research literature. However, there was mention of probiotics as a potential therapy and this is credible, but only in babies who are breastfed.¹⁰⁻¹² The latter factor was not included in the AI article and would be helpful to being able to help specific colicky infants with probiotics. Both

the original and regenerative request brought up the utility of probiotics, but neither noted that probiotics are only beneficial for breastfed babies. This is key to understanding how probiotics might be beneficial. In short, they do not critically reflect on the literature or use the most relevant literature or even interpret it correctly.

Two examples of interpretation difficulties were the use of the Miller et al. 2012 study and the Olafsdottir et al. 2001 randomized trials of manual therapy for infant colic. AI stated that the change in crying time in the Miller study was not statistically significant (not true),¹³ and that the Olafsdottir¹⁴ study found "slight improvement in colic symptoms among treated infants, but the study's design had limitations." In fact, the Olafsdottir study found no statistically significant difference between treated and untreated infants and has been repeatedly lauded for an excellent study design with good parent blinding.¹⁴ Such basic misinterpretation of the actual study findings puts all of their findings at risk. Missing out on more current trials is an important limitation to the AI review of the science to maintain accuracy as well as current relevance.

Out of the nine given references, not one had a correct PMID Number and therefore resulted in finding scientific articles that did not support the stated facts. For example, the PMID number for the research paper given for the 2nd question rendered a result for a paper¹⁵ with a completely different subject. Several of the research papers could not actually be found on PubMed or other search engines. It is important to know that all AI answers may not be factual and all references should be checked (just as articles written by humans are reviewed). Self doubt is a human trait that cannot be attributed to AI, as it glibly states falsehoods as facts.

Artificial intelligence has many advantages in that it does not tire, fatigue or develop a bad attitude. It can manage huge amounts of data that the human could not grasp. A disadvantage is that it did not, in this example, evaluate

each piece of data for its relevance or accuracy in a minute or nuanced manner, nor utilize the most up-to-date research literature. The speed of data gathering was impressive and observed in this project. The errors in data selection and evaluation were also observed in this project. With its ability to gather large amounts of data and process it quickly, it is anticipated to be helpful in automated medical diagnosis and clinical decision making.¹ However, as new approaches to unsolved problems need to be found, the human brain is needed for creativity. Further, in this project, AI was able to find the information, but not evaluate its' insufficiencies. Humility in approach to data gathering may be a useful human trait as well.

Artificial Intelligence is a fact of life for now and for the future. In this example, it did not review the most recent or most relevant science to answer the research questions that we posed. However, this was a simplistic approach and we did not provide guidelines for a detailed approach to the problem. Nor were the questions specific enough to go into detail, which might be a factor to consider when using AI. Rather, this was a rudimentary trial to see how individuals without training can use AI to help solve a clinical problem and gain some insight into the research background. Certainly those experienced in its use would be able to reach more clinically relevant and useful solutions. It is key that artificial intelligence be used in a responsible and effective manner. Some educators may be concerned that AI is subject to misuse by hasty students preparing assignments. It is important that we are all tuned in and aware to keeps its' usage appropriate, efficient and advantageous for the population it serves.

Conclusion

In the case of infant colic, the human ability to weigh and evaluate relevance in a data set appeared to be more clinically useful in answering the research questions than artificial intelligence. Improved human skills to use artificial intelligence intelligently will likely lead to obtaining improved clinical utility.

References:

1. Rahman, MM, 2021. Should I be scared of Artificial Intelligence? *Academia Letters*, Article 2536. <https://doi.org/10.20935/AL2536>.
2. LaGasse LL, Neal AR and Lester BM. Assessment of infant cry: Acoustic cry analysis and parental perception. *Mental retardation and developmental disabilities Research reviews*. 2005;11:183-93.
3. Wolke D, Bilgin A, Samar M. Systematic Review and Meta-Analysis: Fussing and Crying Durations and Prevalence of Colic in Infants. *J Pediatr*. 2017;185: 55-61.
4. Kurth, E. Predictors of Crying problems in the early postpartum period. *Journal of Obstetric Gynecologic Neonatal Nursing* 2010;39(3);250-62.
5. Miller J and Weber Hellstenius S. Is infant colic an allergic response to cow's milk? What is the evidence? *Journal of Clinical and Chiropractic Pediatrics* 2013;14(1):1097-1102.
6. Miller JE and Philips HL. Long-term effects of infant colic: A survey comparison of chiropractic treatment and non-treatment groups. *J Manipulative Physiol Ther* 2009; 32: 635-638, [doi:10.1016/j.jmpt.2009.08.017](https://doi.org/10.1016/j.jmpt.2009.08.017).
7. Wolke D, Rizzo P, Woods S. Persistent infant crying and hyperactivity problems in middle childhood. *Pediatrics* 2002; 109:1054-60.

8. Kim JS. Excessive crying: behavioral and emotional regulation disorder in infancy. *Korean Journal of Pediatrics*. 2011;54(6):229-233
9. Valla L, Smastuent MC, Andenaes R, Misvaer N, Olbjorn C, Helseth S. Association between colic and sleep problems in infancy and subsequent development, emotional and behavioral problems: a longitudinal study. *BMC Pediatrics*. 2021;21-23.
10. Williams-Frey S, Vallone S and Miller J. Do probiotics benefit new-borns and especially colic babies? A clinical opinion of the evidence. *Journal of Clinical and Chiropractic Pediatrics* 2021;19(2).1694-1701.
11. Sung, V. 2018; Infantile colic, *Aust Presc*. 2007;41(4): 105-110. [doi:10.18773/austprescr.2018.033](https://doi.org/10.18773/austprescr.2018.033).
12. Sung V, D'Amico F, Cabana MD, Chau K, Koren G, Savino F, Szajewska H, Deshpande G, Dupont C, Indrio F, Mentula S, Partty A, Tancredi D. Lactobacillus reuteri to treat infant colic: A Meta-Analysis. *Pediatrics*. 2018; 141(1):e20171811.
13. Miller JE, Newell D, Bolton JE. Efficacy of chiropractic manual therapy on infant colic: a pragmatic single-blind, randomized controlled trial. *Journal of Manipulative and Physiological Therapeutics* 2012;35(8):600-607.
14. Olafsdottir E, Forshei S, Fluge G, Markestad T. Randomized controlled trial of infantile colic treated with chiropractic spinal manipulation. *Archives of Disease in Childhood* 2001;84:138-141.
15. Michelsen B, Kvien TK. Response to: 'Depression and anxiety associate with less remission after 1 year in rheumatoid arthritis' by Boer et al *Ann Rheum Dis* 2018; 78 (1), e2 [DOI 10.1136/annrheumdis-2017-212910](https://doi.org/10.1136/annrheumdis-2017-212910), PubMed 29358284.

Why don't our adjustments "hold"? A chiropractor's perspective on the importance of the vagus nerve and adjusting the cranium

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ABSTRACT

Despite the evidence that chiropractic care can benefit the pediatric population, the burden of responsibility continues to be with the pediatric chiropractor to perform the groundwork to identify a credible diagnosis and appropriate treatment plan as well as to monitor and possibly suggest not only ancillary interventions but to monitor the outcomes of their treatment plan and interventions employed and make appropriate referrals in an attempt to optimize the child's progress. This includes continuing education in pediatric diagnosis and management as well as in chiropractic adjusting techniques to include the cranium, spine/pelvis and extremities.

KEYWORDS: pediatric, chiropractic, vagus nerve, chiropractic adjustment, cranial technique.

Although there is good evidence that most parents who present their children for chiropractic care report almost instant benefits,¹ there is a small percentage who ask:

"But, Doctor, why do we have to keep bringing our child back?"

There may be many reasons chiropractors find themselves adjusting their young patients week after week without seeing improvement or an increase in resilience and ability to retain the correction orchestrated the previous week. In those cases, the treatment may be addressing a symptom (the subluxation) and the the root cause of the problem. In research, these reasons for not "holding" their adjustments, would be called confounding variables. "Confounding variables are those that may compete with the exposure of interest (eg, treatment — *your adjustment*) in explaining the outcome of a study."² DD Palmer would have identified the confounding variables as the causes of subluxation: *trauma, toxin and thought*.³

Subject to stimuli as early as in the womb, the infant continues to assimilate and differentiate input from both their own internal physiologic processes and from a myriad of external stimuli. Movement, for example, drives proprioceptive (location of the body in space) development.

"In this period, the nervous system is being shaped and organized by innate activation of neural circuitry and environmental interaction. These processes will result in the elimination of inefficient synaptic connections, preserving the most efficient neural networks. This organization concurs with a gradual change in the quality of motor behavior, changing from a clumsy pattern with co-contractions, into fluent, precise, and well-coordinated motor performances."⁴

But is movement always a positive driver for development? A hyper-reflexive startle response (sympathetic) might result in an inability to enter a restorative state of sleep (parasympathetic) contributing to constant fussiness, refusal to eat and poor weight gain. To remedy this situation, many parents have turned to the ancient art of swaddling their infant. Beginning with a systematic review in 2007,⁵ followed by an integrative review⁶ published in 2017 and a systematic review and narrative synthesis⁷ published in 2022, the authors all concluded that with appropriate safety precautions to minimize the risks of hyperthermia, hip dysplasia and SIDS deaths, swaddling was "associated with increased duration of quiet sleep in infants and a significantly reduced number of sleep state changes among infants naïve to the intervention."⁷

Yes, there are pros and cons of swaddling.⁸ Constant swaddling decreased the infant's ability to move and some clinicians have proposed that it thus decreases proprioceptive input and consequently, primitive reflex integration and motor development. Another study suggests that swaddled babies cry less and are fed less frequently than un-swaddled babies. In the case of breastfed babies, by reducing feed frequency swaddling may impede maternal milk production and thereby infant growth.⁹ Just as swaddling tightly around the hips has been linked to hip dysplasia,⁸ this author proposes that swaddling might also result in vertebral subluxation if the infant persists in fighting the restricting garment.

But if an infant is overstimulated by their external environment, could deep pressure stimulation of joint mechanoreceptors provided by short term, supervised swaddling have a regulating effect on the nervous system with the infant calming faster when offered the swaddle in an overstimulating environment? Chiropractors who care

for crying infants need to ask probing questions, listen to parents' answers and process each child's presentation accordingly to give the best individualized treatment and home care advice on safety for our youngest patients.

An example of internal data being processed by an infant is hunger. Hunger will stimulate oral motor activity or "hunger cues" for the mother to know it is time to feed the infant. These cues include head turning to look for the breast (rooting), becoming more alert and active, opening and closing their mouth, fists moving to mouth, sucking on their hands or lip smacking. As the hunger becomes more urgent, rapid head turning back and forth accompanies by whimpering or protests may ensue before the infant begins to cry eliciting parental attention. A mother may not know that crying is not the only sign that an infant is hungry. Rather it's a sign of distress as hungry babies will show signs of hunger before they begin to cry. Once crying, they have engaged their sympathetic nervous system and their heart and respiratory rates increase, stress hormones are released, they swallow air and disrupt their gastrointestinal motility. They will initially be more disorganized at breast and if they can latch and feed, they are more prone to hiccups, intestinal cramping, and reflux. If a delay in feeding becomes a repetitive practice (having been given poor advice to feed a newborn on a schedule of every 3-4 hours, for example) the processing of these uncomfortable internal signals may ultimately result in inability to effectively coordinate suckling, swallowing and breathing once brought to breast to the extreme case of developing an aversion to feeding.^{10,11}

Dysfunctional breastfeeding can result from a myriad of causes among them tight suboccipital muscles and subluxation at the C01 junction resulting in an inability to extend at the cranial base, an inability to gape widely, a restricted hyoid bone, a posterior tongue tie or pain from a subluxated or fractured clavicle. "Try and try again!" behaviors like repeated attempts to latch onto a breast when there is a biomechanical restriction or pain may eventually lead to frustration in the infant, possibly even panic as their hunger is not satiated (engaging the sympathetic nervous system). However, in most cases neuroplasticity lends to the process of regulating their feeding behaviors or adopting compensatory behaviors to achieve their ultimate goal of transferring milk. This could result in damage to a mother's delicate breast tissue from clamping or grinding on the nipple or appear as a developing torticollis because of postural compensation. This adaptive pattern, for example, may improve their ability to remove milk at the breast but may chronically compromise cervical vertebral mobility with resultant neurologic consequences ranging from hypertonic musculature, nociceptive input and autonomic dysregulation to somatovisceral effects (physiologic changes occurring in organ systems as a result

of musculoskeletal dysfunction's effect on the nervous system). And if their inability to feed at breast is due to a true anatomical restriction, like ankyloglossia, the infant will regress to their compensatory posture despite the frequency of adjustments.^{12,13}

Likewise, if the treatment has not addressed the cranial and/or cranio-cervical subluxation successfully, there will be a persistence of the retrognathic mandible, narrow elevated or tipped palate, elevated and retracted hyoid all contributing to the tongue's inability to extend and elevate to cradle the nipple and draw it along the palate while nursing. A frenotomy will be an inappropriate intervention and will not result in normalized oral motor function and the compensations will still persist.^{14,15}

Autonomically dysregulated infants (or "cry babies") often cry unceasingly, adopt a rigid habitus, may be slow to reach developmental milestones, are not sleeping restfully (nor are their parents), may fail to feed at breast or on bottle without struggling, and may ultimately present to you with the diagnosis of "failure to thrive."¹⁶ Again, as suggested in the earlier study, if parents have resorted to interventions like swaddling, it could possibly have worsened the situation by reducing arousal time and again limiting the infant's milk intake.⁹

When evaluating an infant who is failing to feed efficiently, for example, a complete history should include pre-gestational, gestational, labor and delivery and postpartum details including all interventions employed that might have contributed to the infant's presenting circumstance and importantly, may also be contributing to the persistence of the chief complaint despite compliance to all the recommendations the parents have received thus far from other healthcare providers, family and friends (including social media). Then, the physical evaluation which normally includes muscular tone as well as articular dysfunction of the spine and extremities, will be more thorough if the movement of the cranial bones and tension and restrictions within the connective tissues of the body are also evaluated. These would include the transverse and sagittal diaphragms (starting at the falx cerebri and tentorium cerebelli to the pelvic floor), as well as the dural membranes and fascia supporting individual joints and muscles that could have been influenced by in utero constraint or birth trauma.^{12,15} It should also include a neurologic assessment including infant responsiveness and primitive reflexes. Is the tone of the oral musculature intact? Are the primitive reflexes associated with feeding intact?¹⁷ Is there symmetry bilaterally? Are these reflexes hyper or hypo-reflexive?

There are multiple cranial nerves involved in infant feeding which would suggest the importance of understanding cranial anatomy and the exodus of the cranial nerves via

the foramen of the cranial base and techniques to treat effectively. One of these cranial nerves, the tenth cranial nerve, the vagus nerve, provides motor pathways to the palatoglossus muscle and modulates the gag reflex (both critical in an infant's ability to breastfeed) and is involved in the infant's ability to integrate sucking, swallowing and breathing simultaneously when feeding.¹⁸ It also provides general sensory afferent fibers to the dura mater of the posterior cranial fossa, so it would be prudent to include an evaluation of cranial mobility as restriction may result in an alteration in the activity of the vagus nerve resulting in a dysregulated infant.¹⁹

When the examination is thorough and structural findings are coupled with other physiologic markers, the reduction of vagal dysfunction by applying appropriate cranial and cervical techniques (thus restoring balance to the autonomic nervous system) may be key as it can deleteriously affect oral motor competency as well as many of the bodily systems that maintain homeostasis. For example, gastrointestinal integrity, including motility, sensitivity, secretion, permeability, immunity and diversity of the microbiome, are all heavily influenced by vagal function.²⁰

GI function can also be influenced by a somatovisceral feedback loop (subluxation resulting in GI dysfunction) as well as a viscerosomatic effect (for example, disrupting the gastrointestinal environment with antibiotic administration may result in nociceptive input via the sensory component of the vagus nerve causing a change in fascial integrity, musculoskeletal dysfunction or subluxation). An in-depth analysis of the situation to determine the root of the problem will prevent our adjustment from being applied repeatedly as an amelioration rather than determining the diagnosis is a subluxation with the goal of the adjustment to restore normal mobility and reduce altered neurologic function.

The older child is not immune from these issues. Dysregulated preschool and school age children (mirroring perhaps the dysregulated adults around them) may suffer from sensory overload, behavioral outburst and or an inability to focus and learn. Any alteration in the function of the vagus nerve may impair the child's ability to modulate their own autonomic nervous system leaving them in a hyper-sympathetic state and leaving them incapable of smoothly transitioning into parasympathetic or "rest and digest" and back again when necessary to run or defend once again.

Focus and learning suffer when children are dysregulated. Researchers have found that there is a direct connection between the vagus nerve, the cholinergic system that regulates certain aspects of brain function, and motor cortex neurons that are essential in learning new skills.²¹

In this age group, more than one factor may constitute a stressor (toxins like processed foods and sugar, traumas like a fall, or thoughts like bullying or watching TikTok six hours a day or being disciplined harshly by stressed authority figures). With each of these stressors, the autonomic nervous system "lights up" and the physiologic responses of the sympathetic nervous system are engaged. The one we are most familiar with is the Fight or Flight (behaviors like hiding or bolting (flight), aggression, tantrums or tearfulness (defensiveness) or the "deer in headlights" (freeze) response. Stimulation of the hypothalamic/pituitary/adrenal axis and release of initially helpful but over time, harmful, chemicals are triggered over and over again during the 24 hours of a child's day.

The vagus nerve is responsible for modulating the "fight or flight" response and enables social connection. The vagus nerve provides the network that influences heart rate and blood pressure, controls temperature through sweating, regulates digestion, keeps inflammation in check and supports a healthy immune system. The physiologic and neurologic dysregulation presenting daily to chiropractors' clinics may be the result of vagal compromise. Whether that compromise is structural requiring the application of specific cranial and spinal techniques or related to other stressors as outlined, the chiropractor is in an excellent position to evaluate and offer guidance and referrals as appropriate to help families move out of the spiral of care that can occur when the healthcare provider cannot think "outside of the box" and dig deeper for an answer.

Besides mastering the art of differential diagnosis, and that of providing a specific chiropractic adjustment with a well-defined treatment plan, an appreciation of the appropriate and safe use of ancillary interventions and supportive education offered to parents during the developmentally vulnerable years should be a prerequisite to caring for children. The chiropractor's ability to support the dyad to successfully breastfeed is priceless as the current research on the effect of breastfeeding, the first "natural intervention" on the infant physiology, could be an important part of education and treatment planning for our patient's parents.

A study published in 2022 investigated autonomic regulation during feeding in six-month old infants with a history of excessive crying (EC) and their social-behavioral development at 12 and 24 months. Bottle fed excessively crying infants demonstrated atypical autonomic regulation, while breastfed excessively crying infants had patterns of autonomic regulation similar to non-crying infants. Their behavioral data suggested that while a history of excessive crying was related to social-emotional behaviors at 12 and 24 months, breastfeeding may buffer the behavioral effects of excessive crying on sociability at 24 months.²²

In conclusion, chiropractor's work with children has shown very good results very quickly. Guidelines as a result of a Delphi Consensus process can help guide clinicians in their decision making process.²³ When a clinician learns that the child is not recovering at the anticipated rate, a re-evaluation with particular attention to involvement of the cranium and the vagus nerve or an appropriate referral to collaborate with another health care provider is a reasonable way forward to avoid disappointment for the parents, child and doctor.

Despite the evidence that chiropractic care can benefit the

pediatric population, the burden of responsibility continues to be with the pediatric chiropractor to perform the groundwork to identify a credible diagnosis and appropriate treatment plan as well as to monitor and possibly suggest not only ancillary interventions but to monitor the outcomes of their treatment plan and interventions employed and make appropriate referrals in an attempt to optimize the child's progress. This includes continuing education in pediatric diagnosis and management as well as in chiropractic adjusting techniques to include the cranium, spine/pelvis and extremities.

References:

1. Keating G. Parent reports of chiropractic care for children: A preliminary report from 22,043 parents in Australia. *Journal Clinical Chiropractic Pediatrics* 2021; 20(1): 1731-2. Accessed on 12/2/2023: <https://jccponline.com/keating20-01.pdf>.
2. Skelly AC, Dettori JR, Brodt ED. Assessing bias: the importance of considering confounding. *Evid Based Spine Care J*. 2012 Feb;3(1):9-12. doi:10.1055/s-0031-1298595. PMID: 23236300; PMCID: PMC3503514. Accessed on 12/2/2023: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3503514/>.
3. Palmer DD. The Chiropractic Adjuster: A Compilation of the Writing of DD Palmer. Des Moines IA. Palmer School of Chiropractic; 1921.
4. Kuiper MJ, Brandsma R, Lunsing RJ, Eggink H, Ter Horst HJ, Bos AF, Sival DA. The neurological phenotype of developmental motor patterns during early childhood. *Brain Behav*. 2019 Jan;9(1):e01153. doi:10.1002/brb3.1153. Epub 2018 Nov 28. PMID: 30485703; PMCID: PMC6346655. Accessed on 12/2/2023: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6346655/>.
5. Nelson AM. Risks and Benefits of Swaddling Healthy Infants: An Integrative Review. *MCN Am J Matern Child Nurs*. 2017 Jul/Aug;42(4):216-225. doi:10.1097/NMC.0000000000000344. PMID: 28394766. Accessed on 12/2/2023: <https://pubmed.ncbi.nlm.nih.gov/28394766/>.
6. van Sleuwen BE, Engelberts AC, Boere-Boonekamp MM, Kuis W, Schulpen TW, L'Hoir MP. Swaddling: a systematic review. *Pediatrics*. 2007 Oct;120(4):e1097-106. doi:10.1542/peds.2006-2083. PMID: 17908730. Accessed on 12/2/2023 <https://pubmed.ncbi.nlm.nih.gov/17908730/>.
7. Dixley A, Ball HL. The effect of swaddling on infant sleep and arousal: A systematic review and narrative synthesis. *Front Pediatr*. 2022 Nov 30;10:1000180. doi:10.3389/fped.2022.1000180. PMID: 36533224; PMCID: PMC9748185. Accessed on 12/2/2023: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9748185/>.
8. Nelson AM. Risks and Benefits of Swaddling Healthy Infants: An Integrative Review. *MCN Am J Matern Child Nurs*. 2017 Jul/Aug;42(4):216-225. doi:10.1097/NMC.0000000000000344. PMID: 28394766. Accessed on 12/2/2023: <https://pubmed.ncbi.nlm.nih.gov/28394766/>.
9. Dixley A, Ball HL. The impact of swaddling upon breastfeeding: A critical review. *Am J Hum Biol*. 2023 Jun;35(6):e23878. doi:10.1002/ajhb.23878. Epub 2023 Feb 14. PMID: 36787374.
10. Hodges EA, Wasser HM, Colgan BK, Bentley ME. Development of Feeding Cues During Infancy and Toddlerhood. *MCN Am J Matern Child Nurs*. 2016 Jul/Aug;41(4):244-251. doi:10.1097/NMC.0000000000000251. PMID: 27710994; PMCID: PMC5057392. Accessed on 12/2/2023: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5057392/>.
11. Zhao F, Sun Y, Zhang Y, Xu T, Wang N, Yan S, Zeng T, Zhang F, Gao J, Yue Q, Rozelle S. Comparison of mothers' perceptions of hunger cues in 3-month-old infant under different feeding methods. *BMC Public Health*. 23, Article number: 444 (2023). Accessed on 12/2/2023: <https://bmcpublihealth.biomedcentral.com/articles/10.1186/s12889-023-15325-3#citeas>.
12. Tow J, Vallone S. Development of an integrative relationship in the care of the breastfeeding newborn: lactation consultant and chiropractor. *Journal of Clinical Chiropractic Pediatrics*. June 2009. 10(1):626-632. Accessed on 12/2/2023: https://jccponline.com/jccp_v10_n1.pdf.
13. Vallone S. Evaluation and treatment of breastfeeding difficulties associated with cervicocranial dysfunction: a chiropractic perspective. *Journal of Clinical Chiropractic Pediatrics*. 2016; 15(3), 1301-1305. Accessed on 12/2/2023: <https://jccponline.com/Vol15no3.pdf>.
14. Vallone S, Carnegie-Hargreaves F. The infant with dysfunctional feeding patterns -the chiropractic assessment. *Journal of Clinical Chiropractic Pediatrics*. 2016; 15(2): 1230-1235. Accessed on 12/2/2023: <https://jccponline.com/Feeding2016.pdf>.
15. Dorough A, Vallone S. Differentiating the impact of biomechanical forces of labor and delivery vs. the effect of a posterior tongue tie on neonatal and infant feeding dysfunction: a clinical evaluation. *Journal of Clinical Chiropractic Pediatrics*. 2022; 21(2): 1893-1901. Accessed on 12/2/2023: <https://jccponline.com/Dorough21-02.pdf>.
16. Miller J. Cry babies: A framework for chiropractic care. *Clinical Chiropractic*, 2007; 10(3):139-146. ISSN 1479-2354, Accessed on 12/2/2023: <https://www.dcsience.net/miller-2007-cry-babies.pdf>.

17. Colson SD, Meek JH, Hawdon JM. Optimal positions for the release of primitive neonatal reflexes stimulating breastfeeding. *Early Hum Dev*. 2008 Jul;84(7):441-9. doi:10.1016/j.earlhumdev.2007.12.003. Epub 2008 Feb 19. PMID: 18243594.
18. Watson Genna C. *Supporting Sucking Skills in Breastfeeding Infants*. Fourth Edition. Massachusetts: Jones and Bartlett Learning; 2023.
19. Byrne M. Vagus Nerve, KenHub Anatomy. 2023 Oct. Accessed on 12/2/2023: <https://www.kenhub.com/en/library/anatomy/the-vagus-nerve>.
20. Bonaz B , Sinniger V , Pellissier S . Therapeutic Potential of Vagus Nerve Stimulation for Inflammatory Bowel Diseases. *Frontiers in Neuroscience*. 2021; 15:1-16. doi:10.3389/fnins.2021.650971 ISSN=1662-453X Accessed on 12/2/2023: <https://www.frontiersin.org/articles/10.3389/fnins.2021.650971>.
21. Bowles S, Hickman J, Peng X, Williamson WR, Huang R, Washington K, Donegan D, Welle CG. Vagus nerve stimulation drives selective circuit modulation through cholinergic reinforcement. *Neuron*. 2022 Sept 7; 110: 2867—2885. <https://doi.org/10.1016/j.neuron.2022.06.017> Accessed on 12/2/2023: [https://www.cell.com/neuron/fulltext/S0896-6273\(22\)00555-4](https://www.cell.com/neuron/fulltext/S0896-6273(22)00555-4).
22. Heilman KJ, Zageris DM, Keir D, Aylward SA, Burkhardt T, Gilkerson L, Boukydis Z, Gray L, Porges SW. Breastfeeding is related to atypical autonomic and behavior regulation in infants with a history of excessive crying. *International Journal of Psychophysiology*, 2022;175:119-128. ISSN 0167-8760, Accessed on 12/2/2023: <https://doi.org/10.1016/j.ijpsycho.2022.03.012> or <https://www.sciencedirect.com/science/article/pii/S0167876022000848>.
23. Keating G, Hawk C, Amarin-Woods L, Amarin-Woods D, Vallone S, Farabaugh, Todd A, Ferrance R, Young J, O'Neill-Bhagal, Sexton H, Al-evaki H, Miller J, Parking-Smith G, Schielke A, Robinson A, Thompson R. Clinical practice guideline for best practice management of pediatric patients by chiropractors: results of a delphi consensus process. *Journal of Integrative and Complementary Medicine*. 2023, Oct 30; 0(0): pp. 1—17. doi:10.1089/jicm.2023.0010. Accessed on 12/2/2023: <https://www.liebertpub.com/doi/10.1089/jicm.2023.0010>.



Clinical Practice Guideline for Best Practice Management of Pediatric Patients by Chiropractors: Results of a Delphi Consensus Process

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Abstract

Objective: To build upon existing recommendations on best practices for chiropractic management of children by conducting a formal consensus process and best evidence synthesis. **Design:** Best practice guide based on recommendations from current best available evidence and formal consensus of a panel of experienced practitioners, consumers, and experts for chiropractic management of pediatric patients. **Methods:** Synthesis of results of a literature search to inform the development of recommendations from a multidisciplinary steering committee, including experts in pediatrics, followed by a formal Delphi panel consensus process. **Results:** The consensus process was conducted June to August 2022. All 60 panelists completed the process and reached at least 80% consensus on all recommendations after three Delphi rounds. Recommendations for best practices for chiropractic care for children addressed these aspects of the clinical encounter: patient communication, including informed consent; appropriate clinical history, including health habits; appropriate physical examination procedures; red flags/contraindications to chiropractic care and/or spinal manipulation; aspects of chiropractic management of pediatric patients, including infants; modifications of spinal manipulation and other manual procedures for pediatric patients; appropriate referral and co-management; and appropriate health promotion and disease prevention practices. **Conclusion:** This set of recommendations represents a general framework for an evidence-informed and reasonable approach to the management of pediatric patients by chiropractors.

Keywords: adolescent, chiropractic, child, infant, spine, spinal, manipulation, mobilization, pediatrics.



Fetal Fascial Reinforcement Development: From “a White Tablet” to a Sculpted Precise Organization by Movement

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Abstract

Fasciae have received much attention in recent years due to their important role in proprioception and muscular force transmission, but few studies have focused on fetal fasciae development and there is no study on the retinacula. The latter are fascial reinforcements that play a key role in proprioception and motor coordination. Furthermore, it is still unclear if they are genetically determined or if they are defined by movements, and if they are present during gestation or if they appear only later in the childhood. We aim to identify their structural organization by qualitative and quantitative assessments to establish their role in the myofascial development, highlighting their appearance and organization. Samples from the wrist retinacula, posterior forearm, ankle retinacula, anterior leg, iliotibial tract and anterior thigh of six fetus body donors (from 24th to 40th week of gestation) and histological sections were obtained and a gross anatomy dissection was performed. Sections were stained with hematoxylin-eosin to observe their overall structure and measure their thicknesses. Using Weigert Van Gieson, Alcian blue and immunostaining to detect Hyaluronic Acid Binding Protein (HABP), Collagens I and III (Col I and III) were realized to assess the presence of elastic fibers and hyaluronan. This study confirms that the deep fasciae initially do not have organized layers and it is not possible to highlight any reinforcement. The fascial development is different according to the various area: while the deep fascia and the iliotibial tract is already evident by the 27th week, the retinacula begin to be defined only at the end of pregnancy, and their complete maturation will probably be reached only after birth. These findings suggest that the movement models the retinacula, structuring the fascial system, in particular at the end of pregnancy and in the first months of life. The fasciae can be imagined, initially, as “white tablets” composed of few elastic fibers, abundant collagens and HA, on which various forces, movements, loads and gravity “write their history.”

Keywords: fetus; fascia development; retinacula; gross functional movements.



Chiropractic care and research priorities for the pediatric population: A cross-sectional survey of Quebec chiropractors

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doi.org/10.1186/s12998-023-00514-z.

Abstract

Background: Chiropractors commonly treat pediatric patients within their private practices. The objectives of this study were (1) to identify the treatment techniques and health advice used by Quebec chiropractors with pediatric patients; (2) to explore the research priorities of Quebec chiropractors for the pediatric population; and (3) to identify Quebec chiropractors' training in the field of pediatric chiropractics. **Methods:** A web-based cross-sectional survey was conducted among all licensed Quebec chiropractors (Qc, Canada). Descriptive statistics were used to analyze all quantitative variables. **Results:** The results showed that among the 245 respondents (22.8% response rate), practitioners adapted their treatment techniques based on their patients' age group, thus using softer techniques with younger pediatric patients and slowly gravitating toward techniques used with adults when patients reached the age of six. In terms of continuing education, chiropractors reported an average of 7.87 h of training on the subject per year, which mostly came from either Quebec's College of Chiropractors (OCQ) (54.7%), written articles (46.9%) or seminars and conferences (43.7%). Both musculoskeletal (MSK) and viscerosomatic conditions were identified as high research priorities by the clinicians. **Conclusions:** Quebec chiropractors adapt their treatment techniques to pediatric patients. In light of limited sources of continuing education in the field of pediatric chiropractics, practitioners mostly rely on the training provided by their provincial college and scientific publications. According to practitioners, future research priorities for pediatric care should focus on both MSK conditions and non-MSK conditions.

Keywords: Research, Pediatric care, Treatment modalities.



A commentary on the 2019 Safer Care Victoria review

Genevieve Keating; Lyndon Amorin-Woods

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<https://www.cjaonline.com.au/index.php/cja/article/view/312>.

Abstract

In 2019, Safer Care Victoria (SCV) conducted a government-funded inquiry into the practice of spinal manipulation (SMT) of children under 12 years of age by chiropractors. SCV assembled an advisory panel, commissioned a Cochrane Collaboration Review, and invited submissions from consumers, health practitioners, insurers, education institutions, professional organizations, and interested stakeholders. The report's principal findings were that while spinal manipulation of children results in very rare instances of harm, since evidence of the effectiveness of SMT is lacking, SMT cannot be recommended for children under 12 for a list of conditions or for general wellness. **Critique and Discussion:** Five reviewers evaluated the Cochrane Review that formed a part of the inquiry using the Scottish Intercollegiate Guideline Network (SIGN) instrument. Two reviewers also evaluated the SCV report in its entirety. A strength of the report is the safety review and the information in the detailed responses from consumers. There were 29,599 online submissions received from across Australia, making it the largest survey of this kind. There were no reports of physical, mental, or financial harm to a child derived from this robust process. However, the report and the Cochrane Review contain weaknesses. 1) An internal contradiction erroneously reported a cerebrovascular incident (CVI) rate of 1:20,000 with SMT among children in the main text. 2) There was a departure from the inclusion/exclusion criteria for effectiveness studies. 3) The final recommendations disregard the submissions from consumers, the public, and practitioners. **Conclusion:** While it has strengths, the SCV report is also flawed, and its final recommendations should be viewed with caution. The Cochrane Review within the report adds little to the body of knowledge or clinical practice for chiropractors managing children under 12.

Keywords: Child, Children, Infant, Chiropractic, Government, Manipulation, Safety, Spinal, Risk Assessment, Parents.



A new paradigm for depression in new mothers: the central role of inflammation and how breastfeeding and anti-inflammatory treatments protect maternal mental health

Kathleen Kendall-Tackett

Int Breastfeed J. 2007 Mar 30;2:6.

[doi:10.1186/1746-4358-2-6](https://doi.org/10.1186/1746-4358-2-6).

Abstract

Background: Research in the field of psychoneuroimmunology (PNI) has revealed that depression is associated with inflammation manifested by increased levels of proinflammatory cytokines. **Discussion:** The old paradigm described inflammation as simply one of many risk factors for depression. The new paradigm is based on more recent research that has indicated that physical and psychological stressors increase inflammation. These recent studies constitute an important shift in the depression paradigm: inflammation is not simply a risk factor; it is the risk factor that underlies all the others. Moreover, inflammation explains why psychosocial, behavioral and physical risk factors increase the risk of depression. This is true for depression in general and for postpartum depression in particular. Puerperal women are especially vulnerable to these effects because their levels of proinflammatory cytokines significantly increase during the last trimester of pregnancy--a time when they are also at high risk for depression. Moreover, common experiences of new motherhood, such as sleep disturbance, postpartum pain, and past or current psychological trauma, act as stressors that cause proinflammatory cytokine levels to rise. Breastfeeding has a protective effect on maternal mental health because it attenuates stress and modulates the inflammatory response. However, breastfeeding difficulties, such as nipple pain, can increase the risk of depression and must be addressed promptly. **Conclusion:** PNI research suggests two goals for the prevention and treatment of postpartum depression: reducing maternal stress and reducing inflammation. Breastfeeding and exercise reduce maternal stress and are protective of maternal mood. In addition, most current treatments for depression are anti-inflammatory. These include long-chain omega-3 fatty acids, cognitive therapy, St. John's wort, and conventional antidepressants.



Identification of women at high risk of postpartum psychiatric episodes: A population-based study quantifying relative and absolute risks following exposure to selected risk factors and genetic liability

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doi.org/10.1111/acps.13622.

Abstract

Background: We quantified relative and absolute risks of postpartum psychiatric episodes (PPE) following risk factors: Young age, past personal or family history of psychiatric disorders, and genetic liability. **Methods:** We conducted a register-based study using the iPSYCH2012 case-cohort sample. **Exposures:** were personal history of psychiatric episodes prior to childbirth, being a young mother (giving birth before the age of 21.5 years), having a family history of psychiatric disorders, and a high (highest quartile) polygenic score (PGS) for major depression. PPE was defined within 12 months postpartum by prescription of psychotropic medication or in- and outpatient contact to a psychiatric facility. We included primiparous women born 1981–1999, giving birth before January 1st, 2016. We conducted Cox regression to calculate hazard ratios (HRs) of PPE, absolute risks were calculated using cumulative incidence functions. **Results:** We included 8174 primiparous women, and the estimated baseline PPE risk was 6.9% (95% CI 6.0%–7.8%, number of PPE cases: 2169). For young mothers with a personal and family history of psychiatric disorders, the absolute risk of PPE was 21.6% (95% CI 15.9%–27.8%). Adding information on high genetic liability to depression, the risk increased to 29.2% (95% CI 21.3%–38.4%) for PPE. **Conclusions:** Information on prior personal and family psychiatric episodes as well as age may assist in estimating a personalized risk of PPE. Furthermore, additional information on genetic liability could add even further to this risk assessment.



The incidence of depressive episodes is different before, during, and after pregnancy: A population-based study
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doi.org/10.1016/j.jad.2022.11.031

Abstract

Background: Depressive episodes during pregnancy are widely investigated but it is still unknown whether pregnancy is a high-risk period compared to the pre-pregnancy period. Therefore, we aimed to investigate the incidence and recurrence of depressive episodes before, during, and after pregnancy. **Methods:** In the current population-based registry study, we calculated monthly incidence and recurrence of psychiatric inpatient admissions and outpatient psychiatric contact for depressive episodes. We identified a population consisting of all first childbirths in Denmark from 1999 through 2015 (N = 392,287). **Results:** Incidence of inpatient admission during pregnancy was lower than before pregnancy. After childbirth, a significant increase in first-time and recurrent psychiatric inpatient admissions was observed, especially in the first months. In contrast, outpatient psychiatric treatment incidence and recurrence were increased both during pregnancy as well as in the postpartum period, as compared to pre-pregnancy. **Limitations:** Analyses were performed on depressive episodes representing the severe end of the spectrum, questioning generalizability to milder forms of depression treated outside psychiatric specialist treatment facilities. **Conclusion:** We found a different pattern of severe episodes of depression compared to moderate episodes before, during, and after pregnancy. In light of our findings and those of others, we suggest distinguishing between timing of onset in the classification of depression in the perinatal period: Depression with pregnancy onset OR with postpartum onset (instead of the current DSM classifier “with perinatal onset”), as well as severity of depression, which is important for both clinical and future research endeavors.



Maternal vaginal microbiome composition does not affect development of the infant gut microbiome in early life
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Front. Cell. Infect. Microbiol., 30 March 2023 Sec. Microbiome in Health and Disease Volume 13 - 2023.
doi.org/10.3389/fcimb.2023.1144254

Abstract

Birth mode has been implicated as a major factor influencing neonatal gut microbiome development, and it has been assumed that lack of exposure to the maternal vaginal microbiome is responsible for gut dysbiosis among caesarean-delivered infants. Consequently, practices to correct dysbiotic gut microbiomes, such as vaginal seeding, have arisen while the effect of the maternal vaginal microbiome on that of the infant gut remains unknown. We conducted a longitudinal, prospective cohort study of 621 Canadian pregnant women and their newborn infants and collected pre-delivery maternal vaginal swabs and infant stool samples at 10-days and 3-months of life. Using cpn60-based amplicon sequencing, we defined vaginal and stool microbiome profiles and evaluated the effect of maternal vaginal microbiome composition and various clinical variables on the development of the infant stool microbiome. Infant stool microbiomes showed significant differences in composition by delivery mode at 10-days postpartum; however, this effect could not be explained by maternal vaginal microbiome composition and was vastly reduced by 3 months. Vaginal microbiome clusters were distributed across infant stool clusters in proportion to their frequency in the overall maternal population, indicating independence of the two communities. Intrapartum antibiotic administration was identified as a confounder of infant stool microbiome differences and was associated with lower abundances of *Escherichia coli*, *Bacteroides vulgatus*, *Bifidobacterium longum* and *Parabacteroides distasonis*. Our findings demonstrate that maternal vaginal microbiome composition at delivery does not affect infant stool microbiome composition and development, suggesting that practices to amend infant stool microbiome composition focus factors other than maternal vaginal microbes.

Key Words: vaginal microbiome, infant stool microbiome, infant gut, Cpn60, vaginal seeding, birth mode, microbiome.



Prepregnancy plant-based diets and risk of hypertensive disorders of pregnancy

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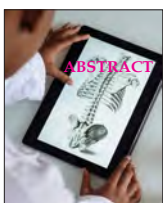
Am J Obstet Gynecol. 2023 Aug 19:S0002-9378(23)00548-3.

[doi:10.1016/j.ajog.2023.07.057](https://doi.org/10.1016/j.ajog.2023.07.057). PMID: 37598996.

Abstract

Objective: This study aimed to evaluate the prospective association between adherence to plant-based diets before pregnancy and the risk for hypertensive disorders of pregnancy. We hypothesized that women with higher adherence to plant-based diets would have a lower risk for hypertensive disorders of pregnancy. **Study design:** We followed 11,459 parous women (16,780 singleton pregnancies) without chronic diseases, a history of preeclampsia, and cancers who participated in the Nurses' Health Study II (1991-2009), which was a prospective cohort study. Diet was assessed every 4 years using a validated food frequency questionnaire from which we calculated the plant-based diet index (higher score indicates higher adherence) to evaluate the health associations of plant-based diets among participants while accounting for the quality of plant-based foods. Participants self-reported hypertensive disorders of pregnancy, including preeclampsia and gestational hypertension. We estimated the relative risk of hypertensive disorders of pregnancy in relation to plant-based diet index adherence in quintiles using generalized estimating equations log-binomial regression while adjusting for potential confounders and accounting for repeated pregnancies for the same woman. **Results:** The mean (standard deviation) age at first in-study pregnancy was 35 (4) years. A total of 1033 cases of hypertensive disorders of pregnancy, including 482 cases of preeclampsia (2.9%) and 551 cases of gestational hypertension (3.3%) were reported. Women in the highest quintile of plant-based diet index were significantly associated with a lower risk for hypertensive disorders of pregnancy than women in the lowest quintile (relative risk, 0.76; 95% confidence interval, 0.62-0.93). There was an inverse dose-response relationship between plant-based diet index and risk for hypertensive disorders of pregnancy. The multivariable-adjusted relative risk (95% confidence interval) of hypertensive disorders of pregnancy for women in increasing quintiles of plant-based diet index were 1 (ref), 0.93 (0.78-1.12), 0.86 (0.72-1.03), 0.84 (0.69-1.03), and 0.76 (0.62-0.93) with a significant linear trend across quintiles (P trend=.005). This association was slightly stronger for gestational hypertension (relative risk, 0.77; 95% confidence interval, 0.60-0.99) than for preeclampsia (relative risk, 0.80; 95% confidence interval, 0.61-1.04). Mediation analysis suggested that body mass index evaluation for dietary assessment and pregnancy explained 39% (95% confidence interval, 15%-70%) of the relation between plant-based diet index and hypertensive disorders of pregnancy and 48% (95% confidence interval, 12%-86%) of the relation between plant-based diet index and gestational hypertension. **Conclusion:** Higher adherence to plant-based diets was associated with a lower risk of developing hypertensive disorders of pregnancy. Much of the benefit seems to be related to improved weight control.

Keywords: Craniosacral therapy; Crying; Infantile colic; Manual therapy; Osteopathy; Sleep; gestational hypertension; hypertensive disorders of pregnancy; plant-based diet; preconceptional care; preeclampsia.



Adverse infant outcomes among women with sleep apnea or insomnia during pregnancy: A retrospective cohort study

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doi.org/10.1016/j.sleh.2022.09.012.

Abstract

Objective: To evaluate whether sleep apnea or insomnia among pregnant people is associated with increased risk for adverse infant outcomes. **Design:** Retrospective cohort study. **Setting:** California. **Participants:** The sample included singleton live births. Sleep apnea and insomnia were defined based on ICD-9 and -10 codes. A referent group was selected using exact propensity score matching on maternal characteristics, obstetric factors, and infant factors among individuals without a sleep disorder. **Measurements:** Adverse infant outcomes were obtained from birth certificate, hospital discharge, and death records (eg, Apgar scores, neonatal intensive care unit (NICU) stay, infant death, long birth stay, etc.). Logistic regression was used to calculate odds of an adverse infant outcome by sleep disorder type. **Results:** Propensity-score matched controls were identified for 69.9% of the 3371 sleep apnea cases and 68.8% of the 3213 insomnia cases. Compared to the propensity-matched referent group, individuals with a diagnosis of sleep apnea ($n = 2357$) had infants who were more likely to have any adverse outcome, low 1-min Apgar scores, NICU stay, and an emergency room visit in the first year of life. Infants born to mothers with a diagnosis of insomnia ($n = 2212$) were at increased risk of few negative outcomes relative to the propensity matched referent group, with the exception of an emergency room visit. **Conclusions:** In unadjusted analyses, infants born to individuals with a diagnosis of sleep apnea or insomnia were at increased risk of several adverse outcomes. These were attenuated when using propensity score matching, suggesting these associations were driven by other comorbidities.



Association of Antepartum and Postpartum Air Pollution Exposure With Postpartum Depression in Southern California

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[doi:10.1001/jamanetworkopen.2023.38315](https://doi.org/10.1001/jamanetworkopen.2023.38315).

Abstract

Importance: Women are especially vulnerable to mental health matters post partum because of biological, emotional, and social changes during this period. However, epidemiologic evidence of an association between air pollution exposure and postpartum depression (PPD) is limited. **Objective:** To examine the associations between antepartum and postpartum maternal air pollution exposure and PPD. **Design, setting, and participants:** This retrospective cohort study used data from Kaiser Permanente Southern California (KPSC) electronic health records and included women who had singleton live births at KPSC facilities between January 1, 2008, and December 31, 2016. Data were analyzed between January 1 and May 10, 2023. **Exposures:** Ambient air pollution exposures were assessed based on maternal residential addresses using monthly averages of particulate matter less than or equal to 2.5 μm (PM_{2.5}), particulate matter less than or equal to 10 μm (PM₁₀), nitrogen dioxide (NO₂), and ozone (O₃) from spatial interpolation of monitoring station measurements. Constituents of PM_{2.5} (sulfate, nitrate, ammonium, organic matter, and black carbon) were obtained from fine-resolution geoscience-derived models based on satellite, ground-based monitor, and chemical transport modeling data. **Main outcomes and measures:** Participants with an Edinburgh Postnatal Depression Scale score of 10 or higher during the 6 months after giving birth were referred to a clinical interview for further assessment and diagnosis. Ascertainment of PPD was defined using a combination of diagnostic codes and prescription medications. **Results:** The study included 340 679 participants (mean [SD] age, 30.05 [5.81] years), with 25 674 having PPD (7.54%). Increased risks for PPD were observed to be associated with per-IQR increases in antepartum and postpartum exposures to O₃ (adjusted odds ratio [AOR], 1.09; 95% CI, 1.06-1.12), PM₁₀ (AOR, 1.02; 95% CI, 1.00-1.04), and PM_{2.5} (AOR, 1.02; 95% CI, 1.00-1.03) but not with NO₂; PPD risks were mainly associated with PM_{2.5} organic matter and black carbon. Overall, a higher risk of PPD was associated with O₃ during the entire pregnancy and postpartum periods and with PM exposure during the late pregnancy and postpartum periods. **Conclusions and relevance:** The study findings suggest that long-term exposure to antepartum and postpartum air pollution was associated with higher PPD risks. Identifying the modifiable environmental risk factors and developing interventions are important public health issues to improve maternal mental health and alleviate the disease burden of PPD.



Persistence of Autism Spectrum Disorder From Early Childhood Through School Age

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Abstract

Importance: While the prevalence of autism spectrum disorder (ASD) continues to increase and early diagnosis is emphasized, there is limited information on outcomes for children diagnosed with ASD in early childhood using contemporary diagnostic criteria. **Objectives:** To determine the frequency with which children who are clinically diagnosed with ASD at 12 to 36 months of age continue to meet diagnostic criteria for ASD at 5 to 7 years of age and to evaluate whether baseline child-specific and demographic characteristics and receipt of interventions are associated with ASD persistence. **Design, setting, and participants:** In this natural history cohort study, children who received a clinical ASD diagnosis at 12 to 36 months of age underwent a research diagnostic assessment at 5 to 7 years of age. Research assessments occurred from August 14, 2018, to January 8, 2022. **Intervention:** Children received community-based interventions, and parents provided details about interventions received. **Main outcomes and measures:** The main outcome was persistence of ASD diagnosis based on current functioning. An experienced research psychologist assigned an ASD diagnosis (present or absent) according to criteria from the Diagnostic and Statistical Manual of Mental Disorders (Fifth Edition) after the research assessment. The research assessment included administration of the Autism Diagnostic Observation Schedule-2, Autism Diagnostic Interview-Research, and a cognitive measure. **Results:** Of the 213 participants diagnosed with ASD at initial clinical assessment (mean [SD] age, 24.6 [3.9] months; 177 boys [83.1%]), 79 (37.1%) did not continue to meet diagnostic criteria for ASD (nonpersistent ASD) at research assessment (mean [SD] age, 74.3 [7.1] months). All children with nonpersistent ASD had IQ of at least 70, while there was a bimodal distribution of IQ for those with persistent ASD (46 with IQ <70 and 88 with IQ \geq 70). All children received some interventions, and 201 (94.4%) received ASD-specific intervention, mostly applied behavioral analysis. In a multilevel logistic regression model, the only variables associated with increased odds of being in the nonpersistent ASD group at 6 years of age were higher baseline adaptive skills (b coefficient = -0.287 [SE, 0.108]) and female sex (b = 0.239 [SE, 0.064]). **Conclusions and relevance:** The findings of this cohort study suggest that among toddlers diagnosed with ASD, baseline adaptive function and sex may be associated with persistence of ASD.



Association Between the COVID-19 Pandemic and Early Childhood Development

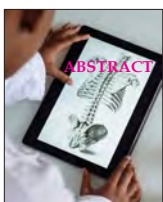
Koryu Sato, MPH; Taiyo Fukai, PhD; Keiko K. Fujisawa, PhD; Makiko Nakamuro, PhD

JAMA Pediatr. 2023;177(9):930-938.

doi:10.1001/jamapediatrics.2023.2096 Published online July 10, 2023.

Abstract

Importance: Although a growing number of studies have reported negative associations of the COVID-19 pandemic with academic performance among school-aged children, less is known about the pandemic's association with early childhood development. **Objective:** To examine the association between the COVID-19 pandemic and early childhood development. **Design, setting, and participants:** In this cohort study conducted in all accredited nursery centers in a Japanese municipality, baseline surveys of children aged 1 and 3 years (1000 and 922, respectively) were conducted between 2017 and 2019, and participants were followed up for 2 years. **Exposure:** Children's development was compared at age 3 or 5 years between cohorts that were exposed to the pandemic during the follow-up and a cohort that was not. **Main outcomes and measures:** Children's developmental age was measured by nursery teachers using the Kinder Infant Development Scale (KIDS). Data were analyzed between December 8, 2022, and May 6, 2023. **Results:** A total of 447 children (201 girls [45.0%] and 246 boys [55.0%]) aged 1 year at baseline were followed up to age 3 years, and 440 children (200 girls [45.5%] and 240 boys [54.5%]) aged 3 years at baseline were followed up to age 5 years. During the follow-up, the cohorts that were exposed to the pandemic were 4.39 months behind in development at age 5 compared with the cohort that was not (coefficient, -4.39; 95% credible interval, -7.66 to -1.27). Such a negative association was not observed in development at age 3 years (coefficient, 1.32; 95% credible interval, -0.44 to 3.01). Variations in development were greater during the pandemic than before the pandemic regardless of age. Additionally, the quality of care at nursery centers was positively associated with development at age 3 years during the pandemic (coefficient, 2.01; 95% credible interval, 0.58-3.44), while parental depression appeared to amplify the association between the pandemic and delayed development at age 5 (coefficient of interaction, -2.62; 95% credible interval, -4.80 to -0.49; $P = .009$). **Conclusions and relevance:** The findings of this study showed an association between exposure to the pandemic and delayed childhood development at age 5 years. Variations in development widened during the pandemic regardless of age. It is important to identify children with developmental delays associated with the pandemic and provide them with support for learning, socialization, physical and mental health, and family support.



Maternal and Infant Antibiotic and Acid Suppressant Use and Risk of Eosinophilic Esophagitis

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<https://jamanetwork.com/journals/jamapediatrics/article-abstract/2811153>.

Abstract

Importance: Eosinophilic esophagitis (EoE), a chronic disease with significant patient and health care burden, has increased rapidly in incidence across many countries. Elucidating risk factors for disease development is a priority for health care practitioners and patients. **Objective:** To evaluate the association of maternal and infant use of antibiotics and acid suppressants with the development of EoE. **Design, Setting, and Participants:** This was a population-based, case-control study of pediatric EoE (1996-2019) in Denmark using pathology, prescription, birth, inpatient, and outpatient health registry data and with complete ascertainment of all EoE cases among Danish residents born between 1997 and 2018. Study data were analyzed from September 2020 to August 2023. **Exposures:** Maternal and infant use of antibiotics and acid suppressants, examining medication class, timing, and frequency of use. **Main Outcome and Measure:** Development of EoE. **Results:** Included in the study was a total of 392 cases and 3637 sex- and year of birth-matched controls with a median (IQR) age of 11.0 (6.0-15.0) years, 2772 male individuals (68.8%), and 1257 female individuals (31.2%). Compared with children with no antibiotic prescriptions filled during infancy, those with any use of an antibiotic had an associated 40% increase in risk of EoE (adjusted odds ratio [aOR], 1.4; 95% CI, 1.1-1.7). Those with 3 or more prescriptions had an associated 80% increase in risk of EoE (aOR, 1.8; 95% CI, 1.3-2.5). Frequency of maternal antibiotic use was associated with an increased risk (1 prescription: aOR, 1.4; 95% CI, 1.0-1.8; 3≤ prescriptions: aOR, 2.1; 95% CI, 1.4-3.2). Risk was highest for use in the third trimester and in the first 6 months from birth. Any acid suppressant use in infancy was associated with increased risk of EoE (aOR, 15.9; 95% CI, 9.1-27.7). Restriction of cases to those diagnosed at 5 years or older yielded similar results (aOR, 11.6; 95% CI, 5.5-24.8). For maternal use, 3 or more prescriptions were associated with an increased risk of EoE for her offspring (aOR, 5.1; 95% CI, 1.8-14.8). **Conclusions and Relevance:** Maternal and infant antibiotic use were associated with increased risk of developing EoE, in a dose-response manner, and the magnitude of association was highest for exposure near the time of delivery. Increased risk was also observed with maternal and infant acid suppressant use. Exposure during early life, a period of known developmental susceptibility, may confer the greatest risk and opportunity for risk mitigation.



Detection of Messenger RNA COVID-19 Vaccines in Human Breast Milk

Nazeeh Hanna, MD; Ari Heffes-Doon, MD; Xinhua Lin, PhD; Claudia Manzano De Mejia, MD; Bishoy Botros, BS; Ellen Gurzenda, BS; Amrita Nayak, MD

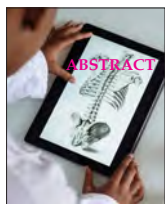
JAMA Pediatr. 2022;176(12):1268-1270.

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Abstract

Vaccination is a cornerstone in fighting the COVID-19 pandemic. However, the initial messenger RNA (mRNA) vaccine clinical trials excluded several vulnerable groups, including young children and lactating individuals. The US Food and Drug Administration deferred the decision to authorize COVID-19 mRNA vaccines for infants younger than 6 months until more data are available because of the potential priming of the children's immune responses that may alter their immunity. The Centers for Disease Control and Prevention recommends offering the COVID-19 mRNA vaccines to breastfeeding individuals, although the possible passage of vaccine mRNAs in breast milk resulting in infants' exposure at younger than 6 months was not investigated. This study investigated whether the COVID-19 vaccine mRNA can be detected in the expressed breast milk (EBM) of lactating individuals receiving the vaccination within 6 months after delivery. **Methods:** This cohort study included 11 healthy lactating individuals who received either the Moderna mRNA-1273 vaccine (n=5) or the Pfizer BNT162b2 vaccine (n=6) within 6 months after delivery (Table 1). Participants were asked to collect and immediately freeze EBM samples at home until transported to the laboratory. Samples of EBM were collected before vaccination (control) and for 5 days postvaccination. A total of 131 EBM samples were collected 1 hour to 5 days after vaccine administration. Extracellular vesicles (EVs) were isolated in EBM using sequential centrifugation, and the EV concentrations were determined by ZetaView (Analytik) (eMethods in the Supplement). The presence of COVID-19 vaccine mRNA in different milk fractions (whole EBM, fat, cells, and supernatant EVs) was assayed using 2-step quantitative reverse transcriptase—polymerase chain reaction. The vaccine detection limit was 1 pg/mL of EBM (eMethods in the Supplement). **Results:** Of 11 lactating individuals enrolled, trace amounts of BNT162b2 and mRNA-1273 COVID-19 mRNA vaccines were detected in 7 samples from 5 different participants at various times up to 45 hours postvaccination (Table 2). The mean (SD) yield of EVs isolated from EBM was 9.110 (5.010) particles/mL, and the mean (SD) particle size was 110.0 (3.0) nm. The vaccine mRNA appears in higher concentrations in the EVs than in whole milk (Table 2). No vaccine mRNA was detected in prevaccination or postvaccination EBM samples beyond 48 hours of collection. Also, no COVID-19 vaccine mRNA was detected in the EBM fat fraction or the EBM cell pellets. **Discussion:** The sporadic presence and trace quantities of COVID-19 vaccine mRNA detected in EBM suggest that breastfeeding after COVID-19 mRNA vaccination is safe, particularly beyond 48 hours after vaccination. These data demonstrate for the first time to our knowledge the biodistribution of COVID-19 vaccine mRNA to mammary cells and the potential ability of tissue EVs to package the vaccine mRNA that can be transported to distant cells. Little has been reported on lipid nanoparticle biodistribution and localization in human tissues after COVID-19 mRNA vaccination. In rats, up to 3 days following intramuscular administration, low vaccine mRNA levels were detected in the heart, lung, testis, and brain tissues, indicating tissue biodistribution. We speculate that, following the vaccine administration, lipid nanoparticles containing the vaccine mRNA are carried to mammary glands via hematogenous and/or lymphatic routes. Furthermore, we speculate that vaccine mRNA released into mammary cell cytosol can be recruited into developing EVs that are later secreted in EBM.

The limitations of this study include the relatively small sample size and the lack of functional studies demonstrating whether detected vaccine mRNA is translationally active. Also, we did not test the possible cumulative vaccine mRNA exposure after frequent breastfeeding in infants. We believe it is safe to breastfeed after maternal COVID-19 vaccination. However, caution is warranted about breastfeeding children younger than 6 months in the first 48 hours after maternal vaccination until more safety studies are conducted. In addition, the potential interference of COVID-19 vaccine mRNA with the immune response to multiple routine vaccines given to infants during the first 6 months of age needs to be considered. It is critical that lactating individuals be included in future vaccination trials to better evaluate the effect of mRNA vaccines on lactation outcomes.



Physical Activity Interventions to Alleviate Depressive Symptoms in Children and Adolescents: A Systematic Review and Meta-analysis

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Abstract

Importance: Depression is the second most prevalent mental disorder among children and adolescents, yet only a small proportion seek or receive disorder-specific treatment. Physical activity interventions hold promise as an alternative or adjunctive approach to clinical treatment for depression. **Objective:** To determine the association of physical activity interventions with depressive symptoms in children and adolescents. **Data sources:** PubMed, CINAHL, PsycINFO, EMBASE, and SPORTDiscus were searched from inception to February 2022 for relevant studies written in English, Chinese, or Italian. **Study selection:** Two independent researchers selected studies that assessed the effects of physical activity interventions on depressive symptoms in children and adolescents compared with a control condition. **Data extraction and synthesis:** A random-effects meta-analysis using Hedges g was performed. Heterogeneity, risk of bias, and publication bias were assessed independently by multiple reviewers. Meta-regressions and sensitivity analyses were conducted to substantiate the overall results. The study followed the PRISMA reporting guideline. **Main outcomes and measures:** The main outcome was depressive symptoms as measured by validated depression scales at postintervention and follow-up. **Results:** Twenty-one studies involving 2441 participants (1148 [47.0%] boys; 1293 [53.0%] girls; mean [SD] age, 14 [3] years) were included. Meta-analysis of the postintervention differences revealed that physical activity interventions were associated with a reduction in depressive symptoms compared with the control condition ($g = -0.29$; 95% CI, -0.47 to -0.10 ; $P = .004$). Analysis of the follow-up outcomes in 4 studies revealed no differences between the physical activity and control groups ($g = -0.39$; 95% CI, -1.01 to 0.24 ; $P = .14$). Moderate study heterogeneity was detected ($Q = 53.92$; $df = 20$; $P < .001$; $I^2 = 62.9\%$ [95% CI, 40.7%-76.8%]). The primary moderator analysis accounting for total physical activity volume, study design, participant health status, and allocation and/or assessment concealment did not moderate the main treatment effect. Secondary analyses demonstrated that intervention (ie, <12 weeks in duration, 3 times per week, unsupervised) and participant characteristics (ie, aged ≥ 13 years, with a mental illness and/or depression diagnosis) may influence the overall treatment effect. **Conclusions and relevance:** Physical activity interventions may be used to reduce depressive symptoms in children and adolescents. Greater reductions in depressive symptoms were derived from participants older than 13 years and with a mental illness and/or depression diagnosis. The association with physical activity parameters such as frequency, duration, and supervision of the sessions remains unclear and needs further investigation.



Associations Between Infant Screen Use, Electroencephalography Markers, and Cognitive Outcomes

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Abstract

Importance: Research evidence is mounting for the association between infant screen use and negative cognitive outcomes related to attention and executive functions. The nature, timing, and persistence of screen time exposure on neural functions are currently unknown. Electroencephalography (EEG) permits elucidation of the neural correlates associated with cognitive impairments. **Objective:** To examine the associations between infant screen time, EEG markers, and school-age cognitive outcomes using mediation analysis with structural equation modeling. **Design, Setting, and Participants:** This prospective maternal-child dyad cohort study included participants from the population-based study Growing Up in Singapore Toward Healthy Outcomes (GUSTO). Pregnant mothers were enrolled in their first trimester from June 2009 through December 2010. A subset of children who completed neurodevelopmental visits at ages 12 months and 9 years had EEG performed at age 18 months. Data were reported from 3 time points at ages 12 months, 18 months, and 9 years. Mediation analyses were used to investigate how neural correlates were involved in the paths from infant screen time to the latent construct of attention and executive functioning. Data for this study were collected from November 2010 to March 2020 and were analyzed between October 2021 and May 2022. **Exposures:** Parent-reported screen time at age 12 months. **Main Outcomes and Measures:** Power spectral density from EEG was collected at age 18 months. Child attention and executive functions were measured with teacher-reported questionnaires and objective laboratory-based tasks at age 9 years. **Results:** In this sample of 437 children, the mean (SD) age at follow-up was 8.84 (0.07) years, and 227 children (51.9%) were male. The mean (SD) amount of daily screen time at age 12 months



was 2.01 (1.86) hours. Screen time at age 12 months contributed to multiple 9-year attention and executive functioning measures (η^2 , 0.03-0.16; Cohen d , 0.35-0.87). A subset of 157 children had EEG performed at age 18 months; EEG relative theta power and theta/beta ratio at the frontocentral and parietal regions showed a graded correlation with 12-month screen use ($r = 0.35$ - 0.37). In the structural equation model accounting for household income, frontocentral and parietal theta/beta ratios partially mediated the association between infant screen time and executive functioning at school age (exposure-mediator β , 0.41; 95% CI, 0.22 to 0.59; mediator-outcome β , -0.38; 95% CI, -0.64 to -0.11), forming an indirect path that accounted for 39.4% of the association. **Conclusions and Relevance:** In this study, infant screen use was associated with altered cortical EEG activity before age 2 years; the identified EEG markers mediated the association between infant screen time and executive functions. Further efforts are urgently needed to distinguish the direct association of infant screen use compared with family factors that predispose early screen use on executive function impairments.



Association of Habitual Checking Behaviors on Social Media With Longitudinal Functional Brain Development

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Key Points

Question: Is adolescents' frequency of checking behaviors on three social media platforms (Facebook, Instagram, Snapchat) associated with longitudinal changes in functional brain development across adolescence. **Findings:** In this cohort study of 169 sixth- and seventh-grade students, participants who engaged in habitual checking behaviors showed a distinct neurodevelopmental trajectory within regions of the brain comprising the affective salience, motivational, and cognitive control networks in response to anticipating social rewards and punishments compared with those who engaged in nonhabitual checking behaviors. **Meaning:** These results suggest that habitual checking of social media in early adolescence may be longitudinally associated with changes in neural sensitivity to anticipation of social rewards and punishments, which could have implications for psychological adjustment.

Abstract

Importance: Social media platforms provide adolescents with unprecedented opportunities for social interactions during a critical developmental period when the brain is especially sensitive to social feedback. **Objective:** To explore how adolescents' frequency of checking behaviors on social media platforms is associated with longitudinal changes in functional brain development across adolescence. **Design, Setting, and Participants:** A 3-year longitudinal cohort study of functional magnetic resonance imaging (fMRI) among sixth- and seventh-grade students recruited from three public middle schools in rural North Carolina. **Exposures:** At wave 1, participants reported the frequency at which they checked Facebook, Instagram, and Snapchat. **Main Outcome or Measure:** Neural responses to the Social Incentive Delay task when anticipating receiving social feedback, measured annually using fMRI for three years. Participants saw a cue that indicated whether the social feedback (adolescent faces with emotional expressions) would be a reward, punishment, or neutral; after a delay, a target appeared and students responded by pressing a button as quickly as possible; a display of social feedback depended on trial type and reaction time. **Results:** Of 178 participants recruited at age 12 years, 169 participants (mean [SD] age, 12.89 [0.58] years; range, 11.93-14.52 years; 91 [53.8%] female; 38 [22.5%] Black, 60 [35.5%] Latinx, 50 [29.6%] White, 15 [8.9%] multiracial) met the inclusion criteria. Participants with habitual social media checking behaviors showed lower neural sensitivity to social anticipation at age 12 years compared with those with nonhabitual checking behaviors in the left amygdala, posterior insula (PI), and ventral striatum (VS; β , -0.22; 95% CI, -0.33 to -0.11), right amygdala (β , -0.19; 95% CI, -0.30 to -0.08), right anterior insula (AI; β , -0.23; 95% CI, -0.37 to -0.09), and left dorsolateral prefrontal cortex (DLPFC; β , -0.29; 95% CI, -0.44 to -0.14). Among those with habitual checking behaviors, there were longitudinal increases in the left amygdala/PI/VS (β , 0.11; 95% CI, 0.04 to 0.18), right amygdala (β , 0.09; 95% CI, 0.02 to 0.16), right AI (β , 0.15; 95% CI, 0.02 to 0.20), and left DLPFC (β , 0.19; 95% CI, 0.05 to 0.25) during social anticipation, whereas among those with nonhabitual checking behaviors, longitudinal decreases were seen in the left amygdala/PI/VS (β , -0.12; 95% CI, -0.19 to -0.06), right amygdala (β , -0.10; 95% CI, -0.17 to -0.03), right AI (β , -0.13; 95% CI, -0.22 to -0.04), and left DLPFC (β , -0.10; 95% CI, -0.22 to -0.03). **Conclusions and Relevance:** The results of this cohort study suggest that social media checking behaviors in early adolescence may be associated with changes in the brain's sensitivity to social rewards and punishments. Further research examining long-term associations between social media use, adolescent neural development, and psychological adjustment is needed to understand the effects of a ubiquitous influence on development for today's adolescents.



Screen Time at Age 1 Year and Communication and Problem-Solving Developmental Delay at 2 and 4 Years

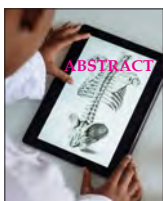
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Abstract

Importance: Whether some domains of child development are specifically associated with screen time and whether the association continues with age remain unknown. **Objective:** To examine the association between screen time exposure among children aged 1 year and 5 domains of developmental delay (communication, gross motor, fine motor, problem-solving, and personal and social skills) at age 2 and 4 years. **Design, Participants, and Setting:** This cohort study was conducted under the Tohoku Medical Megabank Project Birth and Three-Generation Cohort Study. Pregnant women at 50 obstetric clinics and hospitals in the Miyagi and Iwate prefectures in Japan were recruited into the study between July 2013 and March 2017. The information was collected prospectively, and 7097 mother-child pairs were included in the analysis. Data analysis was performed on March 20, 2023. **Exposure:** Four categories of screen time exposure were identified for children aged 1 year (<1, 1 to <2, 2 to <4, or ≥4 h/d). **Main Outcomes and Measures:** Developmental delays in the 5 domains for children aged 2 and 4 years were assessed using the Japanese version of the Ages & Stages Questionnaires, Third Edition. Each domain ranged from 0 to 60 points. Developmental delay was defined if the total score for each domain was less than 2 SDs from its mean score. **Results:** Of the 7097 children in this study, 3674 were boys (51.8%) and 3423 were girls (48.2%). With regard to screen time exposure per day, 3440 children (48.5%) had less than 1 hour, 2095 (29.5%) had 1 to less than 2 hours, 1272 (17.9%) had 2 to less than 4 hours, and 290 (4.1%) had 4 or more hours. Children's screen time was associated with a higher risk of developmental delay at age 2 years in the communication (odds ratio [OR], 1.61 [95% CI, 1.23-2.10] for 1 to <2 h/d; 2.04 [1.52-2.74] for 2 to <4 h/d; 4.78 [3.24-7.06] for ≥4 vs <1 h/d), fine motor (1.74 [1.09-2.79] for ≥4 vs <1 h/d), problem-solving (1.40 [1.02-1.92] for 2 to <4 h/d; 2.67 [1.72-4.14] for ≥4 vs <1 h/d), and personal and social skills (2.10 [1.39-3.18] for ≥4 vs <1 h/d) domains. Regarding risk of developmental delay at age 4 years, associations were identified in the communication (OR, 1.64 [95% CI, 1.20-2.25] for 2 to <4 h/d; 2.68 [1.68-4.27] for ≥4 vs <1 h/d) and problem-solving (1.91 [1.17-3.14] for ≥4 vs <1 h/d) domains. **Conclusions and Relevance:** In this study, greater screen time for children aged 1 year was associated with developmental delays in communication and problem-solving at ages 2 and 4 years. These findings suggest that domains of developmental delay should be considered separately in future discussions on screen time and child development.



Short Sleep Duration: Children's Mental, Behavioral, and Developmental Disorders and Demographic, Neighborhood, and Family Context in a Nationally Representative Sample, 2016-2019

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Abstract

Introduction: Many children and adolescents experience insufficient sleep, which poses risks for their short- and long-term health and development. This study examined the concurrent associations of contextual factors, including child, demographic, neighborhood, and family factors, with short sleep duration. **Methods:** We combined data on children aged 3 to 17 years from the 2016-2019 National Survey of Children's Health (N = 112,925) to examine the association of parent-reported child short sleep duration (ages 3-5 y, <10 h; 6-12 y, <9 h; 13-17 y, <8 h) with mental, behavioral, and developmental disorders (MBDDs); selected physical health conditions; and demographic, neighborhood, and family factors. **Results:** Overall, 34.7% of children experienced short sleep duration. The prevalence was highest among children aged 6 to 12 years (37.5%); children from racial and ethnic minority groups, especially non-Hispanic Black children (50.0%); children from low-income households (44.9%); children with an MBDD (39.6%); children experiencing negative neighborhood factors (poor conditions and lack of safety, support, and amenities, 36.5%); and family factors such as inconsistent bedtime (57.3%), poor parental mental (47.5%) and physical health (46.0%), and adverse childhood experiences (44.1%). The associations between sleep and demographic, neighborhood, and family factors, and MBDD remained significant after controlling for all other factors. **Conclusion:** This study identified several individual, family, and community factors that may contribute to children's short sleep duration and can be targeted to improve healthy development, particularly among children with an MBDD, from households with low socioeconomic status, or from racial and ethnic minority groups who are at increased risk for short sleep duration.



Brain cancer after radiation exposure from CT examinations of children and young adults: results from the EPI-CT cohort study

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Abstract

Background: The European EPI-CT study aims to quantify cancer risks from CT examinations of children and young adults. Here, we assess the risk of brain cancer. **Methods:** We pooled data from nine European countries for this cohort study. Eligible participants had at least one CT examination before age 22 years documented between 1977 and 2014, had no previous diagnosis of cancer or benign brain tumour, and were alive and cancer-free at least 5 years after the first CT. Participants were identified through the Radiology Information System in 276 hospitals. Participants were linked with national or regional registries of cancer and vital status, and eligible cases were patients with brain cancers according to WHO International Classification of Diseases for Oncology. Gliomas were analysed separately to all brain cancers. Organ doses were reconstructed using historical machine settings and a large sample of CT images. Excess relative risks (ERRs) of brain cancer per 100 mGy of cumulative brain dose were calculated with linear dose-response modelling. The outcome was the first reported diagnosis of brain cancer after an exclusion period of 5 years after the first electronically recorded CT examination. **Findings:** We identified 948,174 individuals, of whom 658,752 (69%) were eligible for our study. 368,721 (56%) of 658,752 participants were male and 290,031 (44%) were female. During a median follow-up of 5-6 years (IQR 2-4-10-1), 165 brain cancers occurred, including 121 (73%) gliomas. Mean cumulative brain dose, lagged by 5 years, was 47-4 mGy (SD 60-9) among all individuals and 76-0 mGy (100-1) among people with brain cancer. A significant linear dose-response relationship was observed for all brain cancers (ERR per 100 mGy 1-27 [95% CI 0-51-2-69]) and for gliomas separately (ERR per 100 mGy 1-11 [0-36-2-59]). Results were robust when the start of follow-up was delayed beyond 5 years and when participants with possibly previously unreported cancers were excluded. **Interpretation:** The observed significant dose-response relationship between CT-related radiation exposure and brain cancer in this large, multicentre study with individual dose evaluation emphasises careful justification of paediatric CTs and use of doses as low as reasonably possible.



Longitudinal Associations Between Use of Mobile Devices for Calming and Emotional Reactivity and Executive Functioning in Children Aged 3 to 5 Years

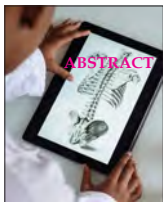
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Abstract

Importance: Mobile devices are often used to keep young children occupied or calm, but it is not known whether this practice influences child development. **Objective:** To examine the longitudinal, bidirectional associations between the parent-reported frequency of using mobile devices to calm young children and children's executive functioning (EF) and emotional reactivity, testing moderation by child sex and temperament. **Design, Setting, and Participants:** This prospective cohort study included a community-based convenience sample of English-speaking parents of typically developing children aged 3 to 5 years. The study duration was from August 2018 to January 2020, with baseline (T1), 3-month follow-up (T2), and 6-month follow-up (T3) waves. **Exposures:** Parent-reported frequency of use of mobile devices to calm children when upset (5-point Likert scale). **Main Outcomes and Measures:** At each wave, the child's EF was assessed with the Behavior Rating Inventory of Executive Function—Preschool Version Global Executive Composite and emotional reactivity with the Child Behavior Checklist Emotional Reactivity subscale. Structural equation models were built to examine cross-lagged associations of the use of devices for calming, EF, and emotional reactivity, testing for moderation by child sex or temperament (Child Behavior Questionnaire—Very Short Form surgency score, median split). **Results:** Of 422 eligible parents with data at T1, 375 (88.9%) provided data at T2 and 366 (86.7%) at T3. At baseline, the mean (SD) age of the 422 children was 3.8 (0.5) years, the number of boys in the sample was 224 (53.1%), the number of individuals of non-Hispanic White race and ethnicity was 313 (74.2%), and among the parents, 254 (60.2%) had a college degree or higher. Among the boys, the use of devices to calm at T2 was associated with higher emotional reactivity at T3 (r [standardized regression coefficient]=0.20; 95% CI, 0.10-0.30), while higher emotional reactivity at T2 had a nonsignificant association with increased device use for calming at T3 (r =0.10; 95% CI, -0.01 to 0.21). Among children with high temperamental surgency, the use of devices to calm at T2 was associated with increased emotional



reactivity at T3 ($r = 0.11$; 95% CI, 0.01-0.22), while higher emotional reactivity at T2 was associated with increased device use for calming at T3 ($r = 0.13$; 95% CI, 0.02-0.24). **Conclusions and Relevance:** The findings of this study suggest that the frequent use of mobile devices for calming young children may displace their opportunities for learning emotion-regulation strategies over time; therefore, pediatric health care professionals may wish to encourage alternate calming approaches.