# Vital Link

The journal of the Canadian Association of Naturopathic Doctors

## Feature Articles



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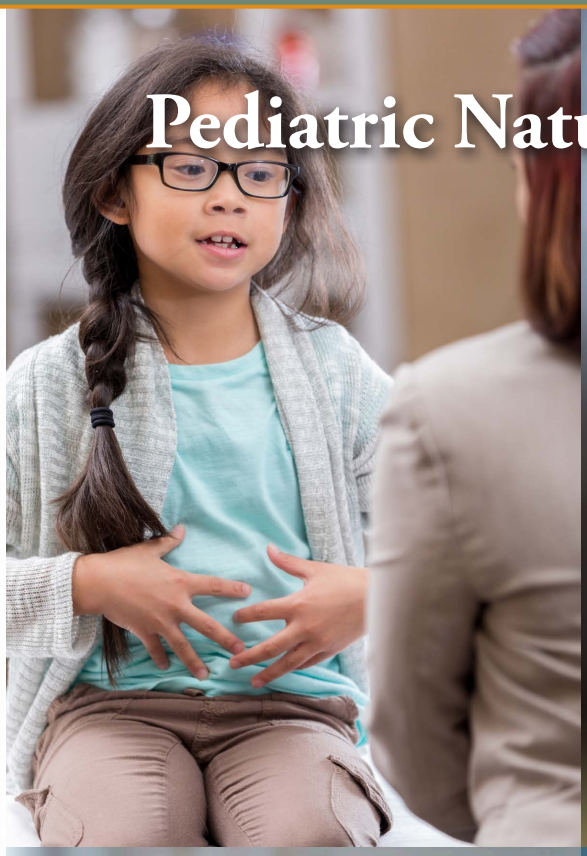

# Pediatric Naturopathic Care

Volume 27, No. 1

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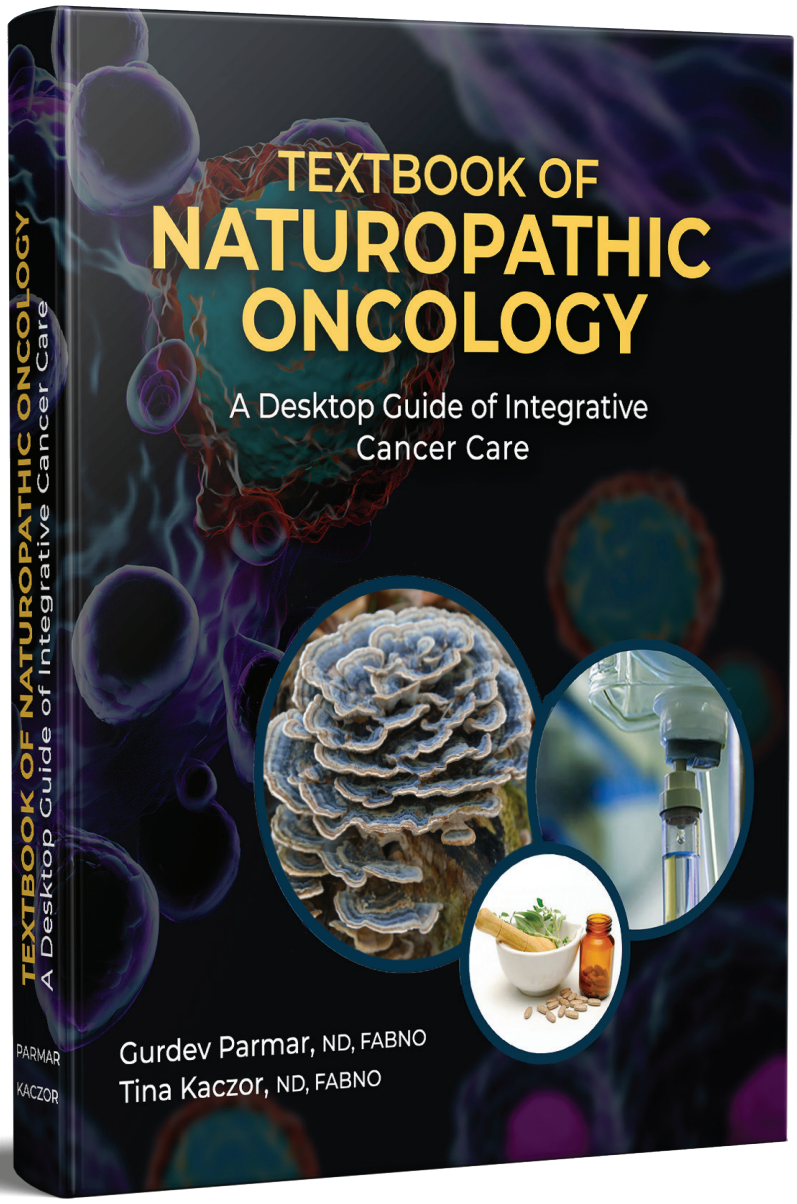


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Vital Link
The journal of the Canadian Association of Naturopathic Doctors

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Volume 27, No. 1



## Featured Articles

# Vital Link

The journal of the Canadian Association of Naturopathic Doctors

**Volume 27, No. 1**
Pediatric Naturopathic Care



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The *Vital Link* is the flagship journal of the Canadian Association of Naturopathic Doctors (CAND). It publishes on a wide variety of topics related to the research and practice of naturopathic medicine in Canada, promoting our profession to Canadians, government, other health care professionals and insurance companies, raising awareness of our unique role in supporting the health of Canadians.

## Forthcoming Themes

**Vol. 27, No. 2** COVID-19 and Naturopathic Practice
**Vol. 27, No. 3** Naturopathic Geriatric care

**Submissions**
As a general naturopathic medical journal, we encourage submissions related to themes of our upcoming editions, and also in our identified core areas of concern including: mental health, health of vulnerable populations, community and planetary health. Contributors should keep in mind that while the main audience for the *Vital Link* is practicing Naturopathic Doctors, we encourage authors from any discipline to submit articles to our editoral team for peer review.
Current Submission Guidelines are available on request from our Editor at dmtrevorrow@cand.ca.

**Circulation**
The *Vital Link* is published three times per year and is distributed to over 2300 qualified Canadian NDs and students of CNME-accredited naturopathic programs in Canada and the U.S. The *Vital Link* is also distributed to the CAND's corporate members and in our media kit. The journal is available in print and e-formats, by paid subscription. Additionally, the *Vital Link* is a tool promoting qualified naturopathic doctors to corporations, insurance companies, and the provincial/territorial, and Federal branches of government in Canada.

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# Supporting the Profession in Challenging Times

**Dr. Mark Fontes,** ND, Chair and **Shawn O'Reilly,** Executive Director

Dear members,
It has certainly been a difficult and challenging start to 2020. In preparation for this year, the CAND Board of Directors identified key goals and work we wanted to accomplish. It included continued support for our core customer groups (ND membership, student membership, corporate partners, federal government, insurance companies and large corporations and unions), enhanced and improved communication with our members, maintaining a strong presence with the federal government and developing a new communication strategy to increase our voice in healthcare and counter the media critics.

However, at the end of January 2020, we had to pivot our focus with the COVID-19 outbreaks starting across Canada. Since that time, and with the staff working remotely, we have prioritized advocating for financial support for the profession with the federal government and ensuring members are up to date on the various financial aid subsidies available.

At the same time, the work we planned for 2020 continues, albeit at a different pace than we expected. We are currently in phase 2 of our new communications strategy, which we look forward to sharing with you at our upcoming Annual General Meeting on June 20th. We launched another successful Naturopathic Medicine week from May 24th-30th, as several provinces were coming out of lockdown. The board also continues to work on developing strategies to support our customer groups, publishes Vital Link and ensures members are supported by the CAND in these turbulent times.

As mentioned earlier, government relations work has become increasingly important during the COVID pandemic. In conjunction with our experts at Hill & Knowlton, we are in regular contact with key members of the federal government including the Ministry of Finance, Health Canada, the Public Health Agency of Canada and the CRA. Our advocacy efforts on behalf of the profession are focused on stressing the importance of support for naturopathic doctors with appropriate financial aid as well as including naturopathic doctors in the designated healthcare professions to aid Canadians at this time.

As you are aware, the CAND has provided ongoing updates in order to provide its members with up-to-date and accurate information. We continue to be available to those of you who have had questions or required clarification on the government's emergency funding measures. The CAND is committed to continuing this important work on your behalf for the foreseeable future.

On behalf of the CAND board of directors, we would like to thank all our members for your continued support.

Thank you,

Dr. Mark Fontes, ND
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# Pediatric Naturopathic Care and COVID-19 Updates

**Dr. Marianne Trevorrow,** MA, ND

We set themes for the *Vital Link* each Fall for the coming year. There are several reasons for this in an association journal; alignment of content with association goals and recruitment of expert reviewers being two of many considerations. Of course, little did we know when we put out our call for articles for this edition last December that our professional and personal lives would be turned upside down with the arrival of the COVID-19 pandemic into Canada a few months later.

Still, we carried on. I took over author and review management (normally Managing Editor duties) in early April while our Executive Director focused on her work with the Federal Government to provide NDs with critical access to Federal financial support programs for clinics and individual doctors. We have also been updating members frequently as new information has come to light from the Federal Government and the Public Health Agency of Canada (PHAC). Additionally, our Board Chair has written to members about the importance of keeping in compliance with PHAC and provincial guidelines to help protect the regulation of the profession and not bring unwanted media or government attention to members at this crucial time.

As we are going to press in early June, several provinces are starting to allow naturopathic clinics to re-open for in-office visits with precautions and social distancing. We are all learning to work with greater levels of infection control including masks, gloves and other personal protective equipment (PPE). We are also preparing to work with patients who will have chronic issues associated with recovery from acute COVID-19 treatments, loss of loved one(s), or exacerbation of long-standing health complaints with the reallocation of medical resources to emergent COVID-19 care. There will be a great need for good, careful naturopathic care over the coming months as we learn to live with the new reality this virus has created in our communities and in our practices.

Along these lines, we are re-arranging our scheduled themes for this year to create an upcoming COVID-19 themed edition, for our 2020 Summer/Fall release. We will be putting out a call for abstracts in the very near future.

So, as we start to adapt to our 'new normal', looking at the care of children and adolescents is a well-timed theme for this edition. We lead off with a guest editorial from Iva Lloyd, the current President of the World Naturopathic Foundation (WNF) and former Chair of the CAND Board. She gives us an update on recent meetings of the WNF as a stakeholder in Traditional & Complementary Medicine (T&CM) with the World Health Organization (WHO), and several initiatives that the WNF has undertaken for the WHO to promote the review of natural treatments for upper respiratory tract infections (URTIs), as well as research into natural medicines as potential treatments for COVID-19.

Our second guest editorial is a supportive letter from Josie Sciortino, current Managing Editor at Canadian Science Publishing, and former ME at several Canadian medical society journals, on the role of journals to help support the goals of associations like the CAND. We felt this letter was a nice sequela to the collective efforts of our members for Naturopathic Medicine Week at the end of May.

Leading our feature articles this edition is a Commentary from Leslie Solomonian, clinical faculty at CCNM and author of a recent textbook on Naturopathic and Integrative Pediatrics. In her article, she makes a case for compelling links between childhood and adult health and longevity, particularly in chronic disease prevention. She appeals to a growing body of evidence that good, basic clinical communication skills support positive health behaviours with real and measurable outcomes; both for developing children and adolescents, and throughout the life span.

Next, we have clinical updates on pediatric mental health conditions that are commonly encountered in ND practice. First, James Conway addresses communication strategies for assessment of childhood anxiety and depression, and recent research on the role of Adverse Childhood Experience (or ACEs) as well as environmental and lifestyle contributing factors. Next, Meyer and Goodall present a Case Study and current evidence for naturopathic therapies in the management of ADHD in children and youth.

In our Practice section, we have two very timely articles this edition. First, Chris Spooner reflects on practice implications of recreational cannabis use in adolescents, with emphasis on vaporization or 'vaping' systems. He argues that with legalization of recreational cannabis in Canada, we are entering a public health 'black box' in terms of understanding both short- and long-term health implications of adolescent cannabis vaping.

Our second article is by Millyard and Gilbert on supporting transgender and gender diverse youth populations in naturopathic practice. They offer background on clinical competency around issues that arise pre- and post-puberty, and guidance on Best Practices for safe, inclusive care with this vulnerable and often neglected population.

Our concluding feature of this edition is a Research Review and Best Practice guide to the long-term sequelae of pediatric Acute Lymphoblastic Leukemia (ALL) treatment by Fontes, Drouin and Eckstrand from CCNM. As they point out, with increasing survival rates of these cancers in very young children, long term sequelae are become more prevalent, and clinicians need to be aware of current literature on safe and effective naturopathic interventions.

One final note for this edition. You may notice new statements at the end of each feature article declaring potentially competing interests. This is a new feature in our Submission Guidelines that aligns us with International Committee of Medical Journal Editors' (ICMJE) standards for peer reviewed publications. We believe that our readers and reviewers have a right to this information, and are pleased to make it a regular feature of *Vital Link*.

As always, please send comments and feedback to drmtrevorrow@cand.ca

Marianne Trevorrow, MA, ND
Editor in Chief.

# WNF: Ensuring the Naturopathic Profession is Part of the Global Healthcare Conversation

**Dr. Iva Lloyd,** BScH, RPP, ND



The World Naturopathic Federation (WNF) was formed in 2015 during a naturopathic conference in Paris France. The aim of the WNF is to support and promote the growth of the naturopathic profession globally.

The WNF encourages naturopathic regulation, accreditation of naturopathic educational programs and naturopathic research. One of the missions of the WNF is to establish official collaboration status with the World Health Organization (WHO) and other international agencies.

In order to support the global profession, the initial years were spent on surveying and researching the profession to determine the naturopathic landscape globally. Our analysis revealed that naturopathy is practiced in about eighty countries and is regulated in thirteen. There are about ninety naturopathic educational institutions and around 10,000 naturopathic doctors / naturopaths. What unites the profession is our philosophies and principles and a core set of modalities. Although there is tremendous diversity in naturopathic educational programs, about 1/3 of them are over 4,000 hours in length.

Over the past 5-years WNF Officers have kept in regular communication with the WHO as we move towards official collaboration status. On March 30th of this year, Dr. Iva Lloyd ND, CAND representative to the WNF and its current President was invited, along with ten other Non-Governmental Organizations (NGOs), to attend a virtual meeting on the role of Traditional and Complementary Medicine in Controlling COVID-19 hosted by Dr. Zhang Qi, Director of Traditional, Complementary and Integrative Medicine (TCI) from the WHO. During that meeting all NGOs presented their professions / organizations ideal approach to COVID-19. Dr. Zhang Qi encouraged all NGOs to provide research specific to respiratory infections to support their recommendations. As a result of that meeting the WNF has undertaken the following initiatives:

## WNF Rapid Review Task Force

Forty naturopathic practitioners and researchers from eight countries have come together to conduct rapid reviews on twelve naturopathic recommendations specific to the prevention or treatment of upper respiratory tract infections (URTIs). The focus of all rapid reviews is limited to human studies.

The aim is to have the rapid reviews completed by the end of May. At that time, they will be shared with the WHO and other governments around the world. They will also be effective in helping to inform naturopathic practice and public health policies. The rapid reviews will be posted on the WNF website and will be officially published.

## Animated Video

The WNF is in the process of creating a ninety-second animated video for the general population. This video focuses on the role of lifestyle factors in providing individuals with a shield to protect them from life's challenges. The disrupting factors include viruses and other pathogens, environmental factors, smoking, junk food and stress.

The video will be available for all naturopathic practitioners and organizations by the end of May. The video is in English with French, Spanish, Italian and Portuguese subtitles.

## Review of Natural Medicine and COVID-19

Naturopathic practitioners around the world have been frustrated as their governments and regulators have instructed them not to make statements about COVID-19. That being said, many integrated health organizations and non-regulated T&CM professions have been quite vocal. The WNF will be conducting a review of the main organizations that have been promoting natural treatments for the prevention and treatment of COVID-19. We will be exploring the range of individual treatments that were recommended and the level of research that was provided.

As with all activities conducted by the WNF, our role is to promote the naturopathic profession as experts in natural medicine. COVID-19 will be with us for a while, and the WNF is working to ensure that the role of naturopathic practice becomes part of the conversation.

## About the Author

**Dr. Iva Lloyd, BScH, RPP, ND** has been president of the World Naturopathic Federation since its inception in 2014. She has participated in three WHO Working Groups and the Global Conference for Primary Health Care. She is also the previous Editor in Chief of Vital Link (2002-2015), an adjunct faculty member at CCNM, and is in private practice at Naturopathic Foundations Health Clinic in Markham, Ontario.

**For more information:**
**http://worldnaturopathicfederation.org/wnf-covid-19-task-force/**

# Journals: A Vital Tool for Associations

**Josephine E. Sciortino,** MA, MPS

I have been working in scholarly publishing for about 20 years. In that time, I have mostly worked for specialty societies, and have learned that journals occupy a special place for members. They are regularly ranked as the number one reason why members join associations.

The journal is a tangible way that members see value in their association membership. Also, journals provide a way for members to contribute to the scholarly activity in the discipline. They can act as authors, reviewers, editors, and journal ambassadors. Scholarly and professional associations, like the CAND, play a vital role for its members. Members join associations for many reasons: to keep in touch with colleagues and be aware of their research; to advance their careers; to stay current on updates in the field; and to be more involved in advocacy – all these reasons can be realized through a journal. Journals are not only important educational resources for clinicians, but they provide important data for health policy experts. The impact of the journal on public health is great.

Public health directives are issued in situations when there is a significant risk to the public health. The *Vital Link*, as the voice of naturopathic profession in Canada, is mindful of its impact as a trusted source of information for members, policymakers, and the public. The media also rely on journal articles for their stories; through *The Vital Link*, the CAND has an opportunity to publish and disseminate naturopathic research and clinical guidelines to members. This research can be used by other professionals and can be a building block in the growth of naturopathic medicine.

Apart from being a trusted source for education, journals are also another touchpoint for the association and its members and provide a valuable service to the community.[1] As a recognized stakeholder with the federal government, it would serve CAND well to be relying on published peer-reviewed research in its own journal. This would lend any recommendations legitimacy and credibility.

The scholarly journal is a recognizable product and is a way to promote the association to a wider audience and attract new members to the association and to the profession. Journals are a good way to retain their current and younger members and engage with them.[2] It also serves to raise the profile of their discipline among researchers, policymakers, and the public.

Journal publishing contributes to the growing body of knowledge in a discipline. It's one thing to do a clinical trial or chart-based review, it's another thing to write it out, share it, and to allow others to build on the research. This dissemination role of the journal is crucial – it strengthens the core knowledge of the field. By exposing research to others, *The Vital Link* gives others the opportunity to examine the data and build on it.

The first English language journal was published in London in 1665 as the *Philosophical Transactions of the Royal Society*. Henry Oldenburg, the founder and publisher, produced the journal out of his house – which was common even up until the 1990s. In the 1990s, many journals become professionalized and relied less on volunteers and more on professionals to edit, design, and market content.[3]

Yet with this professionalization and technological sophistication, our mission in scholarly publishing has not changed from Oldenburg's goal: to produce a journal that registered research, certified it (i.e., peer review), disseminated it, and archived it. The journal was considered a "scientific news service" and it still is.

## About the Author

**Josephine E. Sciortino, MA, MPS** has worked with for-profit and not-for-profit journals; most of her career has been in society scholarly publishing working with national, specialty societies. She currently works as Managing Editor at Canadian Science Publishing, Canada's largest not-for-profit journal publisher. She also works as Instructor in the Publishing program at George Washington University, where she recently completed a MA in Publishing. She lives in Pointe-Claire, Quebec with her husband and two teenage daughters.

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# Pediatrics as Health Prevention

**Dr. Leslie Solomonian,** ND

The holistic approach of naturopathic medicine prioritizes promoting optimal health, as opposed to simply managing or preventing disease. However, even with that lens, patient care can be myopic, failing to look further down the road than a few months or even years.

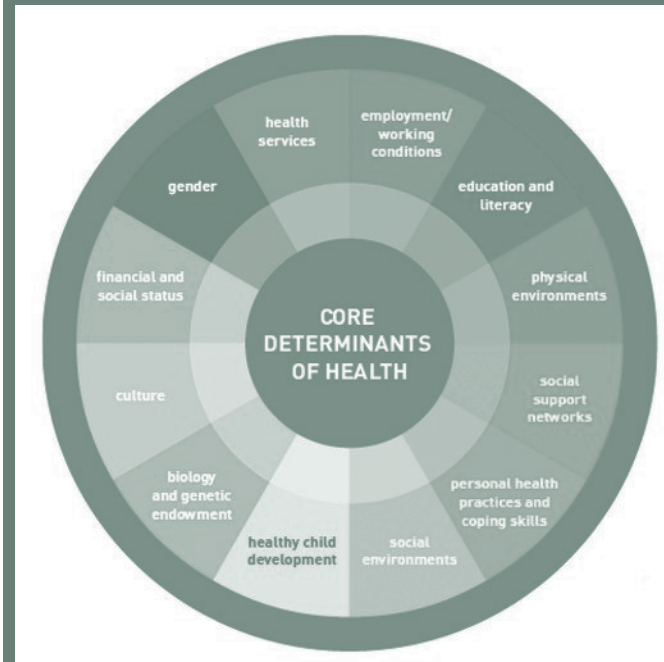
Pediatric practice is the epitome of long term health promotion and disease prevention. Beyond engaging in anticipatory guidance and surveillance regarding the most common causes of morbidity and mortality in childhood, naturopathic doctors have a tremendous opportunity to help families establish a strong foundation of anatomy, physiology and lifestyle behaviours that set children up for a lifetime of positive health,[1] which allows the next generation to self-actualize and contribute to a healthy society. It behooves clinicians and the public health system to optimize determinants of health early in life as a key strategy to reduce morbidity and early mortality in the entire population. This paper offers an overview of some of the most compelling links between childhood and adult health, and reminds readers of key lifestyle strategies key to optimal health from childhood onward.

## Determinants of Health

In the past few generations, particularly in the developed world, pediatric medicine has undergone substantial shifts in priority and focus. Overall morbidity and mortality in childhood has been reduced, in large part due to discoveries and initiatives with respect to hygiene, nutrition, and medical innovation including antibiotics, and immunizations. The vast majority of infections in children are self-limiting, benign in nature, and easily addressed by a functional healthcare system. Conditions that in the past were considered terminal (e.g., polio, type 1 diabetes) are more effectively prevented and managed, extending lifespan and improving quality of life among children. However, there has been an increase in morbidity due to other conditions that are largely a consequence of non-communicable lifestyle and environmental factors (e.g., autism, ADHD, type 2 diabetes).[2,3,4,5] The rates of overweight and obesity among children are staggering;[6] stress-related conditions are increasing but often undiagnosed;[7,8,9] environmental toxin exposure continues to be an unauthorized experiment with extensive consequences.[10] Many children are overfed but undernourished.[11] Noise, light, and air pollution disproportionately affect immature neurological, endocrine, immunological, and metabolic systems.[12,13] Media and electronic devices, as well as parental misperceptions and hypervigilance about neighborhood safety can promote sedentary lifestyles and disengagement.[14,15,16] The emphasis in most North American communities has appropriately shifted from infection management and malnutrition to developmental screening, wellness promotion, and anticipatory guidance.[17] The heaviest burdens of adult disease are also predicted by epigenetically-mediated determinants, most of which have their roots in early life: developmental origins of health and disease.[18,19,20,21]

The World Health Organization, the Public Health Agency of Canada, and the Office of Disease Prevention and Health Promotion in the United States all emphasize the importance of determinants of health, all of which are interwoven with others, underscoring the importance of addressing health from a multifactorial perspective. The Public Health Agency of Canada's model identifies twelve core determinants, of which healthy childhood development is one (see figure 1).[22] The health and behaviors of parents even before a child is conceived have a huge impact on the health of children and the adults they become.

**FIGURE 1: Core Determinants of Health**




Source: Government of Canada[23]

Naturopathic doctors are well versed in the principles of prevention and education, key elements to effective promotion of health in the pediatric population, and are important allies with parents and caregivers. To promote optimal wellness, clinicians must be cognizant of the many determinants of health that impact the ability of a family to provide the best conditions for their child's growth and development. Given the tremendous potential to lifelong health when a healthy childhood is nurtured, working with children and families is the epitome of the principle of *praevenire*; prevention.

It is critical to note that not all of these determinants are fully within the control of individual families; the ability to engage in healthy lifestyle practices is affected by one's housing and neighborhood; family income; level of parents' education; access to nutritious foods; access to physical recreation; genetic makeup; and access to dental and medical care. Poverty and socioeconomic factors contribute to the social determinants of health, affecting nutrition, stress, toxic environmental exposure, access to the outdoors, and access to education.[24,25] Poverty increases the risk of adolescent substance use, earlier sexual debut, involvement in violence, and places a disproportionate burden on poor health.[26,27] Socioeconomic factors impact choice in healthcare, including the ability to access naturopathic services. Even families that make a living wage may struggle to prioritize out-of-pocket healthcare services such as necessary pharmaceutical medications (figure 2). Clinicians have a responsibility to seek means of universally increasing access and keeping costs manageable for families, in keeping with the principle of *Primum non nocere* and the spirit of the WHO's assertion that every human being has the fundamental right to "the highest attainable standard of health".[28]

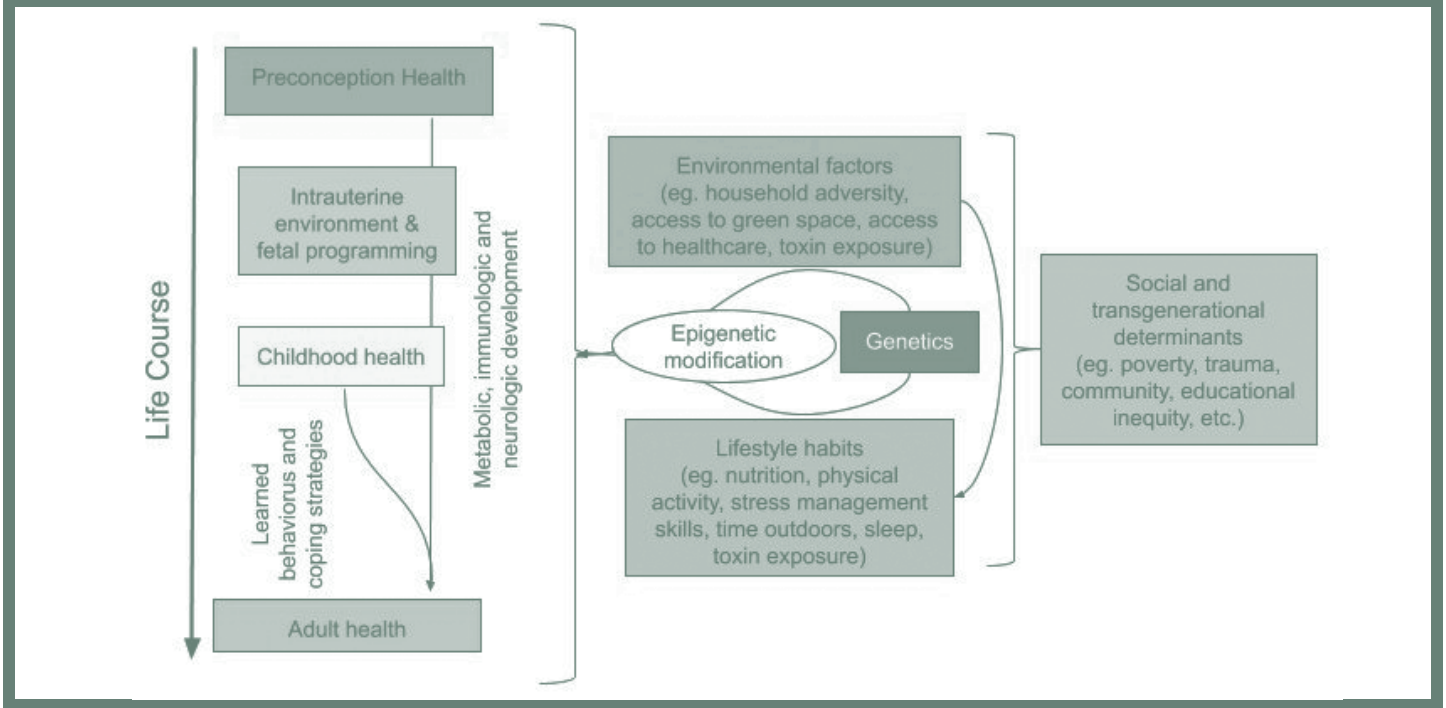
## Selected Diseases of Adulthood and Evidence for their Origins in Childhood

Many diseases of adulthood are influenced by factors occurring during childhood, most by common pathways.[33] Not all are demonstrated through longitudinal studies or randomized control trials, both of which have significant issues of cost, feasibility and ethics. However, the totality of the evidence is highly compelling that promoting optimal conditions in childhood has broad-spanning benefits to adult morbidity and mortality via normalization of these pathways, with minimal adverse effects. Not only do environmental and lifestyle factors directly affect the developing anatomy and physiology of a growing body, but many behaviours are established in early life and tend to track into adulthood, affecting health outcomes across the life course (figure 2).[34,35]

### *Cardiometabolic Conditions*

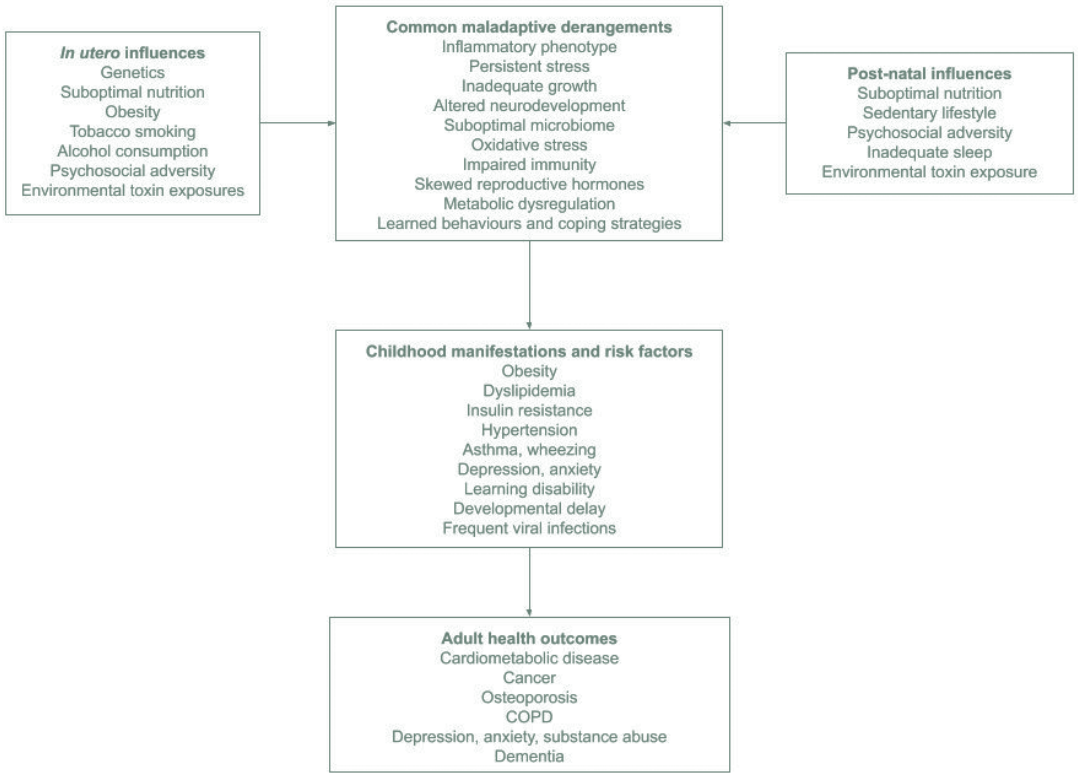
David J. Barker was the first to describe the developmental (originally "fetal") origins of adult disease with his observations of associations between birth weight and later cardiometabolic conditions.[36] Since then a great deal of exploration into epigenetic mechanisms has ensued (with 644 hits on a PubMed search for "Barker hypothesis"). It does appear very clear that lifestyle factors in early development is a strong predictor of the evolution of adult cardiometabolic conditions such as obesity, type II diabetes, and metabolic syndrome.[37,38,39] Childhood obesity seems to have received the greatest amount of attention in terms of demonstrated connections, as obesity tends to track into adulthood along with its cardiometabolic derangements.[40,41,42] These derangements (such as dyslipidemia, hypertension, dysbiosis, dysglycemia and a proinflammatory

**FIGURE 2: An integrated model of the developmental origins of adult health and disease**




Courtesy of the author; informed by references[29,30,31,32]

**FIGURE 3: Common adverse childhood influences and mechanisms with significant effect on adult morbidity and mortality.**




Courtesy of the author

phenotype) seem to be more harmful in younger individuals, and when they occur in childhood, increase the risk later in life.[43,44,45] The lifestyle predictors of obesity and poor cardiometabolic health in childhood are well-known (most notably physical activity, sleep, diet and smoke exposure), although these are notoriously difficult to modify.[46,47,48,49,50,51] The links between environmental toxicity and cardiovascular health are becoming more clear;[52,53,54] given the unique vulnerability of children to environmental toxicity, attention must be paid to these connections. Social and economic adversity in childhood also linearly associated with the risk of developing cardiometabolic disease in adulthood and should not be neglected as a key determinant, both because of elevated psychological stress, but also because of the greater risk of maladaptive health behaviours and environmental exposures.[55,56,57,58]

### *Chronic Respiratory Conditions*

Not surprisingly, insults to respiratory and immune system development in early life predispose to chronic respiratory conditions, specifically chronic obstructive pulmonary disease (COPD), in later life.[59,60] Notably these include prematurity and low birth weight, exposure to tobacco *in utero* and as a child, environmental air pollution, and frequent viral infections. The development of asthma in childhood also predicts COPD;[61] asthma itself is predicted by poor pre- and postnatal nutrition,[62,63] lack of breastfeeding,[64,65] as well as low socioeconomic position. Childhood adversity is an independent predictor of adult COPD.[66] There is an association between obesity and asthma, as well as between obesity and COPD;[67,68] mechanisms and causation are uncertain, but links mediated via inflammatory pathways and the microbiome are plausible. Optimal diet appears to be protective against both asthma and COPD.[69,70,71]

### *Osteoporosis*

Because bone mass peaks in the third decade of life, the emphasis on strong bones should be in the years of childhood, adolescence and young adulthood as opposed to in late life. The (American) National Osteoporosis Foundation recommends that bone strengthening activities be done at least three days a week. These are defined as "dynamic, moderate to high in load magnitude, short in load duration, odd or nonrepetitive in load direction, and applied quickly".[72] Rates of physical activity are abysmal for most children and adolescents due to a decline in active transportation, independent outdoor play, and increasing sedentary activity. Families should be encouraged to provide children with the space and opportunity to jump, climb, hop, run, bounce and skip; this tends to occur more readily among children who spend time outside, one excellent advantage of outdoor, unstructured play.[73] It is difficult for peak bone mass to be achieved in an environment of persistent inflammation or stress.[74] Dietary and psychosocial factors that elevate this environment may have a detrimental impact on the development of strong bones. Adequate nutrition is clearly essential, both key macro and micronutrients, including bioflavonoids that reduce inflammation and the need for calcium to act as a pH buffer in the bloodstream.[75]

***Mental Health and Cognitive Function***

Poor nutrition and early life adversity appear to be two of the strongest predictors of both childhood and adult mental illness.[76,77,78,79,80,81,8283,84,85,86] Nutrition and early life exposures have a tremendous influence on the health of the microbiota, which in turn has a bidirectional relationship with cognitive and mental health.[87,88] Physical activity, time in nature, and adequate sleep are also protective against mental illness, habits of which are established early in life.[89,90,91,92,93] Because mental health challenges tend to emerge during adolescence and young adulthood, and are chronically under identified, many go untreated and persist or deteriorate into adulthood.

Environmental exposures have been shown to increase the risk of neurodegenerative conditions such as Alzheimer disease.[94] Although the links are not all completely clear, lead and aluminum toxicity may be of particular concern.[95,96,97] Traumatic brain injury is also emerging as an important risk factor for neurodegeneration, including Alzheimer's, occurrences of which are common in childhood, particularly among some childhood athletes.[98] Although there is a dearth of studies that have longitudinally followed a cohort to look for an association between lifelong physical activity and the development of dementia, it does appear clear that physical activity in later life is protective against cognitive decline; again, habits of physical activity are established in early life.[99,100] Optimal body growth in childhood appears to be protective against dementia, likely as a proxy for optimal brain growth as a result of optimal nutrition and other conditions for health.[101,102] Optimal nutrition, including the Mediterranean diet, appears to be correlated with better cognitive function.[103] Greater educational and occupational attainment seem to reduce the risk of developing dementia.[104] Early life learning disabilities and delays can interfere with such attainment, and have also been associated with the development of dementia. Early identification of developmental and learning delays may prevent vulnerable students from being left behind, thus increasing their risk. Socioeconomic position is a potent predictor of cognitive development, and must be considered as an integral determinant of brain health and development.[105] In a very related way, early life adversity in general appears to increase the risk of developing dementia, likely through complex mechanisms.[106]

***Cancer***

A reduced risk of many types of cancer are associated with physical activity,[107,108] healthy diet,[109,110,111] and healthy body composition.[112,113] Through the establishment of healthy habits, the immunologic and metabolic phenotype established in early life, and epigenetic modification of the genome at vulnerable points in development[114] may contribute to this inverse association. Certainly there is ample evidence that exposure to environmental toxins increases the risk of various types of cancers,[115] some of which may have a long lead time after early life exposure.

## Promoting Health and Preventing Disease

The encouraging news is that the most common noncommunicable chronic diseases in adulthood can be positively influenced by common lifestyle factors that can be fostered in childhood, notably physical activity.[116] sleep, diet, mitigation of psychosocial stress, reduction of environmental toxins, and time spent in a natural environment. By developing a therapeutic relationship with families, clinicians can identify vulnerabilities early on, and provide individualized education and preventative strategies. Regular well-child visits allow more thorough health promotion and sequential monitoring of healthy growth and development. However, every visit is an opportunity for surveillance, anticipatory guidance and health promotion.

Routinely inquiring about lifestyle and socio-environmental factors in a developmentally-appropriate way can help identify areas that may need support. It can be helpful to have families presenting for a well-check complete a standard "lifestyle log" for the week prior to the visit, including diet, sleep, physical activity, outdoor time and screen use.

Tools to assess for environmental exposures can reveal hazards that may affect development; resources can be found at **https://www.healthyenvironmentforkids.ca/content/resources-professionals**.

Having families complete an objective developmental screen for younger children helps clinicians to identify developmental vulnerabilities and provide early intervention (**https://firstwords.ca/nipissing-district-developmental-screening-tool/**). Most delays are preventable, and are greatly affected by social determinants of health.

Screening for depression, anxiety and substance misuse should be done routinely for all adolescents (**http://www.shared-care.ca/toolkits**); early identification intervention can reduce the risk of persistence and harmful outcomes of mental health struggles.

Addressing socioeconomic conditions can have widespread benefits for children's development.[117] By inquiring about a family's ability to make ends meet, to ensure food security and to provide a safe environment for growth, a naturopathic doctor has the capacity to help families address foundational factors for lifelong health.[118,119] Inquiring about adversity is critical, including screening caregivers for mental health problems, substance use, or conflict in the home.

Physical examinations and labs are used to monitor risk factors for chronic diseases, most notably cardiometabolic conditions such as hypertension and diabetes. Basic newborn screening can identify

Tools to screen for evidence of adversity and resilience factors in the home are available at **https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/resilience/Pages/Clinical-Assessment-Tools.aspx**.

conditions before they manifest, allowing early intervention to reduce the impact of genetic conditions such as sickle cell anemia or cystic fibrosis. Height/length, weight and blood pressure should be assessed at least annually after the age of one, with further investigations as indicated.[120,121] Assessing for iron status is worth considering (though not universally indicated) since iron-deficiency anemia is common in childhood and can have lifelong impacts.[122]

Healthy habits are fairly universal in their positive influence on optimizing lifelong health and wellbeing. (Please see Table 1 below for pediatric guidelines for the most common lifestyle factors affecting lifespan health.) Motivational interviewing strategies (and other collaborative approaches)[123] are helpful to support caregivers and older children in making behaviour changes, though require practitioner training to improve effectiveness.[124,125] Group visits can be useful to accessibly deliver comprehensive education; this approach can promote accountability, normalization, and empowerment.[126] Advocating for upstream changes is critical to affect change on the community/environmental level since not all determinants of health are within individual control;[127,128,129] please see the excellent commentary by Bem and Small for a primer on viewing pediatric health through an ecological lens.[130]

## Conclusion

Habits, conditions and choices made in the early part of an individual's life have long lasting effects on health through the lifespan. A relatively small number of key determinants of health have a tremendous effect on the most significant causes of morbidity and mortality in Canada. Naturopathic doctors have the opportunity to substantially and positively impact the lifelong health of an individual by promoting optimal conditions through the pediatric years.

## About the Author

**Leslie Solomonian, ND** uses naturopathic principles to help individuals, communities and the planet reach their full potential. Her work emphasizes the importance of social and ecological determinants of health, and she deeply values investing in pediatric health for the benefit of future generations. Leslie has been a faculty member at CCNM since 2005 and is pursuing a Masters of Public Health. She is also an active board member of the Pediatric Association of Naturopathic Physicians (PedANP), co-chair of Naturopathic Doctors for Environmental and Social Trust (NEST), author of the Textbook of Naturopathic and Integrative Pediatrics (CCNM Press)

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**TABLE 1: Integrated guidelines for healthy lifestyle factors for children**

| PILLAR | GUIDELINES | ADDITIONAL RESOURCES |
|---|---|---|
| Nutrition | Plant based<br>Fruit/vegetable rich<br>Whole foods<br>Mediterranean style | Castro-Quezada I, Román-Viñas B, Serra-Majem L. The Mediterranean diet and nutritional adequacy: a review. *Nutrients*. 2014;6(1):231–248. |
| Physical activity and sedentary time | 0-5 year: At least 180 minutes of active play<br>5-17 years: 60 minutes per day of moderate to vigorous activity including 3 days/week of bone building activity | Solomonian L. Physical Activity in Children and Youth: Benefits, Barriers and Recommendations. *NDNR*. September 2014.<br>http://csep.ca/CMFiles/Guidelines/CSEP_PAGuidelines_0-65plus_en.pdf |
| Sleep | 4-12 months: 12 to 16 hours per 24 hours (including naps)<br>1-2 years: 11 to 14 hours per 24 hours (including naps)<br>3-5 years: 10 to 13 hours per 24 hours (including naps)<br>6-12 years: 9 to 12 hours per 24 hours<br>Teenagers 13-18 years: 8 to 10 hours per 24 hours | https://aasm.org/resources/pdf/pediatricsleepdurationconsensus.pdf |
| Screen use | 0-2 years: no screen use<br>2-5: less than one hour/day; "minimize, mitigate risks and be mindful"<br>5+: "manage screen use, encourage meaningful use, model healthy use, and monitor for signs of problematic use" | https://www.cps.ca/en/documents/position/screen-time-and-young-children<br>https://www.cps.ca/en/documents/position/digital-media?utm_source=Media&utm_medium=News%20Release&utm_campaign=Digital%20Media |
| Time in nature | No clear guidelines; encourage at least 30 minutes of outdoor time daily | *Issues Ment Health Nurs*. 2014 Dec;35(12):975-8. Communing with nature. Flaskerud JH. |
| Reducing maladaptive stress | Screen for adversity and promote proactive stress management skills<br>Advocate for families experiencing adversity | Meyer, C and Solomonian L. Pediatric Mental Health Update. *The Pulse.* Winter 2019.<br>Bougea, A., Spantideas, N., & Chrousos, G. P. (2018). Stress management for headaches in children and adolescents: A review and practical recommendations for health promotion programs and well-being. *Journal of Child Health Care,* 22(1), 19–33. |
| Reducing toxic burden | Routine audits of household habits and practices to seek opportunities to reduce exposure to chemicals; encouraging lifestyle practices to promote detoxification | Children's Vulnerability to Environmental Toxins and Strategies to Minimize Exposure. *Vital Link*. Spring 2013. |

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# Assessing Anxiety and Depression in Young Populations:

## An Inventory of Environmental Risk Factors and Adverse Childhood Events

**Dr. James R. Conway,** ND

Abstract: Anxiety and depressive disorders in children and adolescents affect social, physical, and emotional development necessitating thorough screening and assessment. Mood disorders in younger populations have known risk factors that are typically categorized as either psychological, biological, or environmental in origin. This article highlights environmental factors correlated with anxiety and depression during childhood and adolescence with an emphasis on adverse childhood events.

## Introduction: Mood Disorders in Children and Adolescents

Anxiety and depression are recognized as the two most common internalizing disorders in childhood and contribute to frequent disruption to the interpersonal and academic functioning in youth and children.[1] Internalizing disorders are correlated with an increase in school drop-out, substance use, and potentially suicide.[2] The Ontario Child Health Study (OCHS) in 2014 revealed that the past 6-month prevalence rates of all mood disorders range from 18% to 22%.[3] Mood disorders in children often go undetected and untreated despite advances in diagnostic criteria.[4,5]

Identifying and ameliorating emotional distress in children continues to be a challenge. Insufficient awareness about the importance of early recognition has been hypothesized as contributing to inadequate detection of mood disorders in youth.[6] Symptoms and diagnostic criteria are different in children and adolescents compared to adults and progress is being made to improve the assessment criteria for juvenile patients.[7] In addition to presentation of symptoms, the assessment process also depends on a detailed health history and screening for risk factors and underlying causes. The assessment process may be augmented by considering the diverse risk factors—biological, psychological, and environmental—in combination with symptom presentation.[8]

## Assessment Overview

The fundamental purpose of clinical assessment is to formulate a thorough understanding of the case that will effectively guide management, referral and intervention.[5] A challenge is obtaining dependable, congruent, corroborative details from the juvenile patient and other informants. In the context of childhood emotional disturbances, information is typically obtained from multiple sources (i.e. the patient, parents, caregivers, and teachers). A perceived mutually beneficial relationship between the child, family and healthcare provider may clarify the facts. The child who recognizes that there is a joint effort to understand and address their emotional concerns may be less guarded.[5] Figuratively placing the young patient in the context of psychosocial experiences may strengthen the clinician's understanding of origins, urgency, and prognosis.[5] Understanding pervasive childhood risks—and employing unprejudiced, trauma-informed inquiry—may unmask deep seated factors contributing to the child's current experiences. A trauma-informed approach has been postulated as having the fundamental shift to asking 'What happened to you?' rather than 'What is wrong with you?'.[9] Being able to develop this type of therapeutic alliance in the primary care setting may prove helpful for assessment but does not replace the clinical expertise of qualified practitioners. Judicious referral is compulsory.[7] Healthcare professionals should reference referral criteria to gauge when a referral to a more qualified practitioner should be made. Mild mood changes and depression without comorbidities can typically be managed by the primary care provider. Referral is warranted in circumstances of significant depression and where there are multiple risk factors; psychotic depression; mild depression that has not responded to interventions after 2-3 months; unexplained self-neglect for at least 1 month's duration that could be harmful to physical health; recurrent depression; active suicidal ideas or plans; or when a referral is requested by a young person or their parents or caregivers.[7] Other features that may necessitate referral are episodes of panic; compulsions; and aggressive behaviour. Guidelines on the role of the primary care provider and psychiatric intervention and management are available for reference (e.g. NICE Guidelines).[7]

## Assessment: Determining Presence and Severity of Symptoms

A thorough history can be obtained by screening through symptom-based questionnaires, paying attention to organic dialogue, and drawing out plausible exacerbating or contributing factors by noting psychosocial influences.[5] Physical examination and lab testing (when appropriate) may be indicated to rule out comorbid medical conditions.[10] Anxious and depressive symptoms may co-exist, and screening for features of both is prudent in the context of children suffering from mood concerns.[11]

When assessing children with anxiety, differentiation between anxious symptoms and developmentally appropriate worries and fears as well as appropriate reactions to stressful stimuli is warranted. If anxious symptoms are present, the clinician must determine if stressors or trauma are contributing to the occurrence or maintenance of the symptoms.[12] The use of standardized tools such as Spence Children's Anxiety Scale (SCAS) (ages 8-15) or possibly the Screen for Child Anxiety Related Disorders (SCARED) questionnaire may be helpful in deciphering severity of symptoms. The Preschool Feelings Checklist can be used in the primary care setting for very young children.

The diagnostic criteria for depression in adolescents and adults is the same though symptom presentation may differ. Hopelessness, anhedonia, boredom, hypersomnia, weight changes, alcohol or drug use, and suicide attempts are possible experiences of adolescents with depression.[8,13] Younger children struggle to convey their mood and may appear sad and more likely to present with somatic complaints, separation anxiety, and phobias. [8,13] The Children's Depression Inventory (CDI) (ages 7-17) and the Beck Depression Inventory for Primary Care for adolescents 12 to 18 years of age are useful tools.[14,15]

There is a notable lack of healthcare providers who are adequately trained to treat depression in children and youth.[11] Developing prevention and treatment strategies is an ongoing endeavour in the healthcare and research sectors.[11] Though diagnosis of anxiety and depressive disorders is reserved for qualified practitioners, referencing criteria in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) is helpful for screening and referral purposes.

## Assessment: Risk Factors

There are numerous influences that may play a role in mood disorders in children and adolescents, typically categorized as biological, psychological and environmental. Biological risk factors include family history of anxiety or depression, medical illness, pubertal and hormonal changes, female sex, low birth weight, maternal age younger than 18 years, and obesity.[8,12] Psychological risk factors comprise emotional dependence, history of suicide attempts, ineffective coping skills, low self-esteem, negative body image, negative thinking styles, and self-consciousness. [8,12] Environmental risk factors—elaborated on in the remainder of this paper—include adverse childhood experiences, certain family dynamics, negative social interactions, low socioeconomic status, poor academic performance, overeating, and substance use. [8,12] Nutrient deficiencies and diet and lifestyle factors are briefly discussed as possibly contributing to mood, but more research is needed.

## Environmental Factors: Adverse Childhood Experiences

Adverse Childhood Experiences (ACEs) are unfavourable events occurring in younger populations (0-17 years of age) including violence (experienced and/or witnessed), trauma, abuse (maltreatment), neglect and having a family member attempt or die by suicide.[16,17] Other ACEs occurring in the household that may destabilize the child's sense of security and social engagement are substance use, mental health concerns, and fragmented family dynamics (e.g. family members being incarcerated and parental conflict and/or separation).[16,17] ACEs are correlated with development of neurobiological alterations (functional and volumetric changes in certain brain structures) and psychological disorders often leading to lifelong negative effects on health, well-being, and opportunity.[16,17] The majority of environmental risk factors for mood disorders in young populations could fit categorically under the ACE umbrella term. The remaining environmental factors are lifestyle factors that may exist alongside ACEs or as sequalae of ACEs.

## ACE: Abuse

Abuse occurs in various forms and can significantly impact the wellbeing of the victim. Emotional maltreatment has a strong association with dysfunction in social anxiety disorder (SAD).[18] Literature tends to focus on the anxiety and mood outcomes associated with physical and sexual abuse. It has been speculated that since these forms of abuse are inherently more egregious, they are often viewed as more injurious. Some research indicates that emotional mistreatment and neglect (but not other forms of abuse) predispose the cognitive state that advances development and morbidity of anxiety disorders.[18] Women who experienced childhood sexual abuse were found to have an increased risk for developing chronic and major depression.[19,20] Gender-diverse and sexual-minority youth have an increased risk of experiencing depression or anxiety than straight or cisgender youth.[21] Attentiveness to the prevalence and sequalae of abuse—in all its forms—may be supportive when screening for mood disorders.[9,18]

## ACE: Bullying

Bullying, a serious social concern, is correlated with history of ACEs. Both perpetration and victimization are linked to ACEs indicating the need for proper screening while maintaining trauma-informed practice.[22] Bullied children tend to have more anxiety. Bullies—while equally or less anxious than their peers—may experience higher rates of depression.[23] Traumatic experiences are known to exist in conditions such as post-traumatic stress disorder (PTSD) and may be implicated in other mood disorders such as anxiety and depression.[24]

## ACE: Family Dynamics

Family dynamics such as parental conflict and divorce are associated with increased risk for worsening of depression later in life. For adolescent patients already struggling with depression, experiencing a parental separation was found to increase the risk of bipolar disorder as an adult.[25] Parental conflict contributes to an increase in emotional insecurity in children.[26]

## ACE: Negative Social Interactions

Environmental factors including digital media, school stress, and social activities may contribute to mood disorders. Internet use has either a positive or negative influence on depression depending on how it is used. Using the internet for health purposes is associated with an increased risk of depression (attributable to rumination and hyper-focus on health concerns) whereas using internet for communication with friends and family has been shown to lower levels of depression.[27] There is mounting evidence supporting the notion that digital media

contributes to mood concerns such as anxiety and depression. Current areas of inquiry include: the role of technology-based negative social comparison in anxiety and depression; substituted digital media use and poor emotional-regulation, social anxiety from avoided social interactions, and anxiety due to fear of insufficient connectedness. Victimization through cyberbullying may have significant implications in anxiety, depression and suicide.[28] Social events and even routine activities such as school can trigger anxiety in certain children.

## ACE: Substance Use

The overuse of substances such as alcohol, smoking, and illicit drugs may contribute to symptoms of anxiety and depression in teens. Early onset of alcohol use and frequent consumption and intoxication correlates with worse depressive symptoms; the association was stronger for girls than for boys when considering early onset alone.[29] Similarly, frequent/heavy drinking among girls was related to anxiety disorders, but not among boys.[30] More severe anxiety disorders (e.g. agoraphobia, OCD) were found to be significantly associated with drug use for girls.[30]

## Environmental Factors: Nutrient Deficiencies

Iron deficiency amongst children is common and may be implicated in mental health concerns. A deficiency in iron increases the risk of psychiatric and mood disorders.[31] Brain iron status influences energy metabolism and neurotransmitter homeostasis. These functions have been shown to influence both mood and behaviour.[32] Vitamin D deficiency and insufficiency are pervasive in adolescents with severe mood disorders. Vitamin D has been hypothesized as either a mediator for or result of illness severity—possibly both.[33] Supplementation with vitamin D for depression, however, has shown limited beneficial effects.[34] Other nutrient deficiencies that may be linked with mood disorders are, vitamin B12,[35] magnesium,[36] and zinc.[37]

## Environmental Factors: Lifestyle Factors

Health risk behaviours such as poor sleep habits, lack of adequate physical activity, and overeating may contribute or exacerbate mood disorders in children.[38,39,40] While sleep disturbances are a symptom of depressive disorders, altered sleep patterns have been implicated to upturn risk for mood imbalances.[38] Longitudinal research has shown a link between the level of physical activity and decrease in depressive symptoms in children.[39] Frequent aerobic activity induces positive physiological effects and is linked with lower sympathetic nervous system tone.[41] Overeating and obesity have the potential to contribute to depressive symptoms or extend a depressive episode.[40] Negative self-image and depressive feelings are associated with obesity.[42]

## Conclusion

The prevalence and morbidity of childhood anxiety and depression warrants thorough screening and assessment. The consequences of environmental risk factors including adverse childhood events are ominous and a trauma-informed practice model should be considered. A deep understanding of the many contributions to mood disorders in younger populations facilitates accurate assessment and gives direction to therapeutic interventions.

## About the Author

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# Current Trends in the Treatment of Pediatric ADHD: A Case Study

**Dr. Caroline Meyer,** ND and **Maddie Goodall** (CCNM Student)

Abstract: Pediatric patients presenting with Attention-Deficit Hyperactivity Disorder (ADHD or ADD) are a common occurrence in naturopathic practice. While the state of the research is evolving, there is evidence supporting the use of naturopathic treatments like omega-3 fatty acids and pycnogenol as well as novel uses of supplements like vitamin D and saffron.

This review will cover the diagnosis of ADHD, current evidence for lifestyle and naturopathic therapies for ADHD prevention and treatment, as well as a case study to illustrate ADHD management in a naturopathic setting.

## Diagnosis

The diagnosis of ADHD in children is achieved using the DSM-5 Criteria. It evaluates symptoms (inattention, hyperactivity and impulsivity), the impact of these symptoms, timing of symptom onset, and requires excluding other psychiatric disorders.[1] These diagnostic criteria were updated in September 2019, with an emphasis on ruling out differentials and screening for co-morbidities, as well as broadening the age range of applicability for the DSM-5 criteria.[2]

## Prevention: Prenatal Health Factors to Consider

As we learn about the impact of prenatal health on pediatric health outcomes, an awareness of the maternal risk factors that can increase the likelihood of offspring ADHD is important.

A history of maternal anxiety, depression, or disordered sleep correlates with ADHD in offspring.[3] Working to improve these issues before conception may help to reduce the future risk of ADHD diagnosis. Exposure to certain substances is another important consideration during pregnancy. Correlations have been made between smoking during pregnancy and ADHD symptoms in the offspring[4], although these results have not been consistent across studies.[5] The use of acetaminophen during pregnancy has shown more consistent results, with use during any term of pregnancy increasing ADHD risk.[6-9]

Additional prenatal considerations include the assessment and monitoring of nutrient deficiencies including iron and vitamin D. Maternal iron-deficiency anemia within the first 30 weeks of pregnancy has correlated with increased risk of ADHD in their children,[10] thus assessing for and correcting deficiency is recommended. Maternal blood 25-hydroxyvitamin D [25(OH)D] levels are associated with ADHD risk; a recent meta-analysis of 25 articles found that those with the highest levels (>50nmol/L) had significantly decreased risk of ADHD in their offspring compared to those with the lowest levels (<10ng/mL) (RR 0.72, CI 0.41-0.82).[11] Studies on micronutrient deficiency and ADHD risk are observational and thus cannot determine causation; a lack of intervention trials means it is not certain whether supplementation will reduce risk. Regardless, as micronutrient adequacy is important for overall fetal and maternal health, it should be maintained throughout the entirety of the pregnancy.

Negative maternal postnatal mental health has been correlated with an increased incidence in their children.[12] Providing mothers with the appropriate care could potentially improve outcomes. Further postnatal considerations are methods and duration of breastfeeding. A short duration of breastfeeding (with some studies establishing the cutoff at under three months, and some at under six) has been associated with an increased risk of ADHD in offspring, as has non-breastfeeding.[13,14] To decrease risk, mothers should be encouraged to surpass the six month mark while breastfeeding, when possible.[13,14] However any maternal breastfeeding is likely to decrease risk compared to none at all.[15]

## Recent Research Findings on the Naturopathic Treatment of ADHD

For children diagnosed with ADHD, there are a number of options to decrease symptoms. Lifestyle factors including exercise, meditation, and yoga have demonstrated therapeutic benefit in reducing symptoms of ADHD, are generally health promoting practices, and thus are an ideal first-line treatment.[16,17] Exercise in particular has been extensively researched with positive outcomes, and should be incorporated into the lifestyles of ADHD patients.[16-18] Dietary changes have been studied in depth, with these interventions showing conflicting results.[19] Research has looked into many variations of diet plans, including elimination diets, artificial food-colouring free diets, the impact of sugar, and more.[20-22] A reduction in sugar and additives may be suggested to promote overall health in general, however due to the conflicting research, dietary changes should not act as a sole therapy for ADHD symptoms.

While lifestyle recommendations of exercise and proper nutrition may act as a foundation for ADHD treatment, supplementation and botanical treatment can be of benefit when these are not sufficient to reduce symptoms.

***Vitamin D:***

Decreased serum levels of vitamin D have been noted in children with ADHD compared to those without.[23] Studies have shown positive results regarding symptom reduction when restoring these levels, using doses ranging from 3000IU/day for 8 weeks, up to 50000IU/week for 6 weeks.[24,25] Assessing 25(OH)D levels and supplementing for those that are deficient may provide improvements in cognitive function.[24,25]

***Omega-3:***

Omega-3 fatty acids can assist in minimizing symptoms of ADHD by reducing inflammation, which is a proposed contributor to the etiology of ADHD.[26] A recent study demonstrated that children with ADHD consume significantly less omega-3 containing foods than children without.[27] The evidence for supplementation to minimize symptoms is conflicting, and further studies are required to validate them as a therapy for ADHD.[28-30] Nonetheless, with multiple studies demonstrating symptom improvement and safety, omega-3 may be a suitable therapy for some patients.[31,32]

***Bacopa monnieri:***

While studies of the use of *Bacopa* in ADHD children are mostly small in size and limited in number, the evidence that exists examining *Bacopa*'s cognitive impact has been positive.[33,34] One small, open label trial found significant improvements in symptoms with the use of *Bacopa*.[33] Children with ADHD were administered 225mg of a standardized *Bacopa* extract per day, over the course of 6 months.[33] The results displayed a reduction in restlessness in 93% of children taking an extract of *Bacopa monnieri*, with improvements in self control in 89%, and attention deficit symptoms reducing in 83%, of which all are above the average response rate to pharmaceutical treatment.[33,34]

***Saffron:***

Two small studies released over the last year have studied the effects of Saffron on reducing ADHD symptoms. More research is required, however both showed promise in Saffron's ability to relieve ADHD symptoms to a comparable level of pharmacologic treatment.[35,36] These studies demonstrated statistical significance in parent reported symptom reduction with the use of saffron extract, as well as displaying no significance between treatment with saffron extract versus that of methylphenidate.[35,36]

***Pycnogenol:***

Pycnogenol - an extract of French Maritime Pine bark - has been shown to reduce oxidative stress, as well as regulate the raised catecholamine levels seen in children with ADHD.[37,38] Catecholamine excretion in urine has been shown to be higher in children with ADHD, with norepinephrine levels correlating positively to their hyperactivity symptoms.[38] One randomized control trial displayed a trend of decreased norepinephrine in children given Pycnogenol, as well as regulated catecholamine levels.[38] A second RCT showed positive results on symptom reduction in children with ADHD after 1 month of treatment, demonstrating statistically significant reductions in hyperactivity, concentration, coordination, and inattention.[37] Statistically significance was maintained across multiple scales submitted both by parents and by teachers.[37] Both RCTs used a dose of at a dose of 1 mg/kg of body weight.[37,38]

## Case Report: Crissy 10 year old girl

Crissy presents to the clinic with her mother after being expelled from school for 2 days for violent behaviour. Allegedly, Crissy ran after and tackled a kindergarten student during recess. Crissy told me that there was no apparent reason for this behaviour, that she just 'lost control' and wanted to run into another child. The mother reports that Crissy has been sent to the office several times for biting and pushing classmates, as well as interrupting classroom lessons by standing up and telling jokes. In the previous year, Crissy has had an assessment with an educational psychologist, who diagnosed her with Attention Deficit-Hyperactivity Disorder (ADHD) combined type, along with being gifted and the possibility of oppositional defiant disorder (ODD). Crissy was started on a course of methylphenidate, but it was discontinued within 6 months. While the medication had a moderately positive effect on her behaviour, Crissy developed intense and persistent insomnia and anorexia. Her mother expressed desperation in helping Crissy behave at school and with homework with no or minimal methylphenidate. She is also concerned about Crissy being labelled a bully, and how that may affect her school experience.

Crissy's mother describes her daughter as spirited and extremely clever. She can recite entire passages of books she reads and can recall detailed dialogues from films. Her teachers describe her as two people; namely, the bright and compassionate 10 year old, and a destructive, violent menace to the other students. Her teachers and administrative staff express a genuine fondness for Crissy but are baffled by how erratic her behaviour is, and how to help her.

Crissy tells me that she loves candy as her favourite food. She could eat candy all day long, as well as meat. She often eats only the meat in her meals, and eschews vegetables of all kinds. She prefers her meat to be nearly raw or smoked like salami or hot dogs.

Crissy has difficulty getting to sleep and staying asleep. Three to five nights per week, she has nightmares of monsters and killers chasing her. The disrupted sleep predated the methylphenidate, but seems more frequent since starting the medication, and never returned to baseline.

Completing the physical exam is challenging, as Crissy is always in motion and exploring the treatment room. There is nothing remarkable on the physical exam of taking vitals, abdominal, head and neck and cardiovascular exams. I do witness an intense argument with the patient and her mother in which the parent is refusing to share her smartphone with Crissy. Crissy hits her mother and yells at her.

***Initial Treatment Plan***

- With Crissy's involvement, she agrees to eat a vegetable, raw carrots or cucumber, every day until her next visit
- For sleep and nervous system support, magnesium bis-glycinate powder at 200mg and GABA tablet at 100mg taken before before bedtime are recommended.
- For overall nervous system support and inflammation reduction, Omega-3 fish oil at 2000mg combined EPA+DHA and 1000IU Vitamin D daily are recommended
- Of course, I plan to teach Crissy a few mindfulness techniques, but I need to support her nervous system first as her behaviour in my office indicated she was not ready for mindfulness yet.

***Follow Up & Treatment after 4 weeks:***

- Crissy reports that she is sleeping throughout the night on most days, and feels energetic in the morning. She has been able to eat more vegetables and restrict her intake of candy
- Crissy, her mother and I plan for the patient to start after school karate lessons
- Prescribe homeopathic remedy *Anacardium* 1M in a single sublingual dose

***2nd Follow Up & Treatment after another 4 weeks:***

- Crissy is calm in the office, sitting in her chair for 20 minutes, and answering my questions directly.
- Crissy's mother shows me that the patient has had only one complaint from teachers in the past two weeks. Crissy has been enjoying the karate lessons and tells me "I am not a bad kid anymore!"
- Decide on no redose of *Anacardium* 1M at this time, but keep the initial treatment plan for another 2 months, with reassessment at that time.

## About the Authors

**Dr. Caroline Meyer, ND** has a busy private practice in Toronto, Canada with a clinical focus on mental health, pediatrics, and mindfulness. She graduated from the Canadian College of Naturopathic Medicine (CCNM) in 2005 where she currently is a part-time academic and clinical faculty member. She leads lectures and has been published extensively on topics related to natural health in North America, including contributing to the textbook Naturopathic and Integrative Pediatrics (CCNM Press).

**Maddie Goodall** is a naturopathic intern at the Robert Schad Naturopathic Clinic, in her final year of studies at the Canadian College of Naturopathic Medicine. She has a strong interest in pediatric care, particularly regarding mental and social health and wellbeing.

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# Cannabis Vaping – What Teens, Their Parents and Their Naturopathic Doctors Need to Know

**Dr. Chris Spooner,** ND

Abstract: Cannabis is the most commonly used illicit drug globally, and Canada has among the highest use rates.[1] In 2014, 10% to 15% of general-population adults and 25% to 30% of adolescents or young adults report current (i.e., past-year) cannabis use.[2] Arguably, the legalization of cannabis in Canada can be regarded as one of the most significant public health policy changes in the last 50 years. The stated aim of legalization of cannabis was to protect youth and eliminate the criminal element from the cannabis industry, and it has been challenging, as the government attempts to navigate the creation a new industry that can compete with the well-established illicit market.

Medicinal use of cannabis was legalized in Canada, on July 30, 2001under the *Marihuana for Medical Purpose Regulations* (MMPR). There have been subsequent regulations over the years with the federal *Cannabis Act* coming into effect on 17 October 2018 and made Canada the second country in the world, after Uruguay, to formally legalize the cultivation, possession, acquisition and consumption of cannabis and its by-products. At this time, recreational use of cannabis no longer violated criminal law. The process removed cannabis possession for personal consumption from the *Controlled Drugs and Substances Act*, and created regulations similar to that of alcohol in Canada, limiting home production, distribution, consumption areas and sale time as well as implementing taxation and strengthening punishment of those convicted of either supplying cannabis to minors, or of impairment while driving a motor vehicle. The implementation of the cannabis laws has not been without its problems. There have been missteps, delays and frustration which was not unexpected given that this is an industry that just launched and is becoming more adept at navigating the need to balance consumer education consumer experience while operating in a tightly regulated market.

The illicit cannabis market is used to operating below the radar and adapted quickly to the new laws. With lower costs of production and a wider variety of products these producers have managed to capture substantial market share by not being encumbered by the regulations. Consequently, it can be very difficult for consumers to distinguish legal from illegal products; while the higher concentration products appear to still be available through illicit channels, they are not appearing in the legalized recreational market. Additionally, longer term market forces in the illicit market have resulted in an abundance of products that emphasize higher THC content, which has more hallucinogenic effects. This has diverged from the regulated medical cannabis market, which uses cannabis strains with higher CBD, CBG and other therapeutic constituents.

Canada's legal recreational cannabis industry is still in its very early stages. Cannabis 1.0 regulation legalized combustible cannabis, cannabis oils, and cannabis plants and seeds and everyone is still navigating this new landscape. Cannabis 2.0 regulation, which includes edibles and extracted products, such as vape cartridges, has just begun.

With the rollout of the Cannabis 2.0 legalization in December 2019, Canadian cannabis consumers are currently diverging into two broad segments. The first segment include novice or 'cannabis-curious' consumers, which tend to be older and more conservative in their use, preferring lower dose edible or tea formats and occasional use (1x/month or less). The second segment includes younger, more consistent users, who gravitate to the inhaled flower products, higher THC dosages, and seek to consume cannabis several times a week.[3]

Market research by the CAND has indicated that Naturopathic doctors occupy a unique niche in the minds of many patients, and the health care system as a whole. This may help the profession play an effective role in patient education regarding cannabis. The public health burden of cannabis use has been smaller than for alcohol, tobacco, and other illicit drugs,[4,5] however, the strongest evidence exists for the following associations: acute cognitive and psychomotor impairments, motor-vehicle accidents (MVAs), brain development and chronic functioning, dependence and psychosis, pulmonary or bronchial system problems, and poorer pregnancy outcomes.[6,7,8,9,10]

It is in the younger, higher volume segment that cannabis use–associated harms are most likely to manifest. The literature suggests that a substantial proportion of these problems occurs in users who initiated use in adolescence or continued to use it frequently into adulthood.[11,12,13,14,15] The harms themselves - or at least their severity - are influenced by modifiable behavioral factors or user choices and it is important to educate patients on these topics.

This article will discuss the vapourization of cannabis, (vaping) in youth, potential hazards regarding product manufacturing, specifically e-cigarette vaping associated lung injury (EVALI), in the context of legal vs illegal products and present low risk guidelines that can be discussed with patients.

## The Endocannabinoid System

To set the stage for this discussion, a brief overview of the endocannabinoid system (ECS) is warranted. The ECS is an ancient, evolutionarily conserved, and ubiquitous lipid signaling system found in all vertebrates, and which appears to have important regulatory functions throughout the human body. Health Canada's *Information for Health Care Professionals: Cannabis (marihuana, marijuana) and the cannabinoids* statement collates and documents the evidence that dysregulation of the ECS contributes to many human diseases including pain, inflammation, psychiatric disorders and neurodegenerative diseases.[1] Dysregulation of the ECS has also been observed to impact a wide range of physiological and pathophysiological processes including nervous system development, immune function, inflammation, appetite, metabolism and energy, homeostasis, cardiovascular function, digestion, bone development and bone density, synaptic plasticity and learning, pain, reproduction, psychiatric disease, psychomotor behavior, memory, wake/sleep cycles, and the regulation of stress and emotional state/mood.[16]

The ECS acts through several non-cannabinoid receptors. Besides the well-known CB1 and CB2 receptors, a number of different cannabinoids are believed to bind to a number of other molecular targets which include the third putative cannabinoid receptor GPR55 (G protein-coupled receptor 55), the transient receptor potential (TRP) cation channel family, and a class of nuclear receptors/transcription factors known as the PPARs, as well as 5-HT1A receptors, the α2 adrenoceptors, adenosine and glycine receptors.[17]

McPartland et al. have noted that many randomized controlled trials identified in this systematic review have been conducted on lifestyle modifications (e.g., exercise, maintenance of ideal body weight) and CAM interventions (e.g., dietary supplements, stress modification, acupuncture, massage, and manipulation). In our opinion these are sensible methods of enhancing the ECS.[18]

Russo has published extensively on non-cannabis modifiers of the ECS, noting that it has been conventional wisdom until recently that only cannabis contained active agents affecting the endocannabinoid system. "In recent decades, a widened search has identified numerous additional plants whose components stimulate, antagonize, or modulate different aspects of this system. These include common foodstuffs, herbs, spices, and more exotic ingredients: kava, chocolate, black pepper, and many others".[19] Many core naturopathic botanical and dietary therapies act through the ECS; adding an ironic twist to the current exclusion of naturopathic doctors from the list of Health Canada authorized prescribers.

## What is Vaping?

Vaping refers to the act of inhaling an aerosol (e.g., nicotine, marijuana, tetrahydrocannabinol, tetrahydrocannabinol concentrates, cannabinoids, synthetic cannabinoids, flavorings, or other substances) produced by a vaping product (e.g., electronic nicotine delivery system (ENDS), electronic cigarette (e-cigarette), vaporizer, vape(s), vape pen, dab pen, or other device). 'Dabbing' refers to inhaling very hot vapours from heating cannabis oils, concentrates, or extracts.

It's important to note that vaping can refer to either dried cannabis flower or prefilled oil cartridges, commonly referred to as 'carts'. Vaping can also refer to the use of non-cannabis, electronic cigarettes (also known as 'e-cigarettes' or EC), which advocates claim is a harm reduction approach to curb consumption of conventional cigarettes given the fact that most of the carcinogens in cigarettes are formed as a result of combustion.

Similarly, vaping cannabis is promoted as having health benefits by reducing harm from ingesting toxic smoke.[20] Vaping is perceived and being sold as a safer way to use cannabis, despite the lack of data on the health effects of chronic vaping. Other perceived benefits include better taste, more efficient and intense effects, and greater discretion which allows for use in more places.

A typical EC is powered by a rechargeable battery connected to a reservoir containing an 'e-liquid' that the user periodically refills. The user activates the heating coils by holding down a push button during inhalation. The e-liquid is rapidly vaporized by being wicked through one or two coils and aerosolized as the user inhales the vapor and dilution air through a mouthpiece. There are thousands of e-liquids on the market, most of which contain nicotine in varying concentrations (typically up to 30 mg/ml) in addition to flavorings and other additives dissolved in propylene glycol (PG), vegetable glycerin (VG), or a various mixture.[21]

Many Public Health experts have increasingly raised concerns about potential harms of ECs. There is concern, for instance, that ECs may serve as a gateway to tobacco addiction for a new generation of users and contribute to the relegitimization and glamorization of tobacco-containing products.[22] The promoted benefits of ECs and vaging in general could also result in an increasing likelihood of experimenting with cannabis at a younger age, and facilitate more frequent use, increasing the probability of problematic use.

Multiple studies indicate that reductions in perceived risk of harm may lead to earlier initiation of use of many types of substances

including cannabis, increased frequency or quantity of use, and decreased motivation to quit or reduce use.[23,24] All these issues are being played out in the EC literature, which is indicating that EC manufacturers are recruiting adolescents with lower-risk profiles than tobacco smokers.[25] Several studies suggest that ECs may be failing to deliver on initial hopes that these products would greatly reduce or eliminate the use of combusted products among habitual smokers.[26,27]

Data from Public Health England's *Evidence review of e-cigarettes and heated tobacco products 2018* report suggested that the rates of EC use varies with previous smoking experience. For 11-16 y.o. EC use is concentrated in young people who had already smoked while remaining very low (0.1% to 0.5%) in those who have never smoked. Data for 17-18 y.o. are consistent with the data for 11 to 16 y.o. with never-smokers' weekly EC use being negligible and never smokers' EC experimentation being around 9% since 2016.[28]

## Key findings from the PHE

- ECs cannot be legally sold to young people under the age of 18 in most parts of the UK except for Northern Ireland. Purchasing does occur including from sources rarely used for tobacco such as online suppliers.
- Despite some experimentation with these devices among never smokers, ECs are attracting very few young people who have never smoked into regular use.
- ECs do not appear to be undermining the long-term decline in cigarette smoking in the UK among young people.
- Never smokers in the UK who try ECs are more likely to have tried smoking subsequently than those who have not tried ECs.
- A causal link has not been established and neither has progression to regular smoking. The 'common liability' hypothesis seems a plausible explanation for the relationship between ECs and smoking experimentation.

Given these findings, it would not be an unreasonable conclusion that youth with a history of smoking cannabis would be more likely to try vaping cannabis while those that have never smoked cannabis are less likely to vape. Cassidy et al. concluded that individuals with the greatest risk of initiation of vaping cannabis during the first year of college are those with a prior history of other cannabis use and other electronic nicotine delivery system (ENDS) use and who have peers in their network who initiate cannabis vaping.[29]

Several recent studies have measured harmful pollutants in vapor generated by ECs, including fine and ultrafine particles,[30,31,32] reactive oxygen species (ROS),[33] and toxic compounds associated with flavorants.[34] Increased attention is being paid to the presence of aldehydes associated with irritation of the respiratory tract and/or carcinogenicity, such as formaldehyde, acetaldehyde, and acrolein.[35,36]

There is evidence that vaping may achieve higher blood levels for THC. Spindle, et al. reported a comparison of acute effects of smoked vs vaporized cannabis at two different doses. Subjective drug effects, cardiovascular effects, and impaired cognitive and psychomotor function were observed, with greater effects and higher blood cannabinoid concentrations achieved from vaporization. Vaporized low-dose cannabis produced a greater number of measurable impairments than smoked high-dose cannabis in a sample of infrequent users. These findings have implications for novice users, trying for the first time the multitude of products available legally, and believing vaporization to be a safer route of administration.[37]

## Additives

Consumers have used disposable vaporizer cartridges with standard additives—propylene glycol, vegetable glycerin, or medium-chain triglyceride (MCT) oil—for many years. However, officials at the US Food and Drug Administration proposed adding propylene glycol as a respiratory toxicant to its list of "*Harmful and Potentially Harmful Constituents in Tobacco Products*." FDA officials have also proposed regulating all EC ingredients by 2022.[38]

Cannabis is a complex plant that produces a vast array of medicinal and bioactive compounds, over 1000 at last count. These include highly lipophilic compounds, volatile terpene compounds and numerous flavonoids. As a result, the cannabis extraction process and vape cartridge production is quite complicated. The resulting concentrate from cannabis extraction is a thick tar like substance that does not flow easily and requires either further processing or admixtures to decrease viscosity so that the material can be loaded into cartridges. Cutting agents refer to chemicals added to vape cartridges that dilute the cannabis oil inside. The primary reason cutting agents are used is to increase the final volume available for sale by the producer of the vape cartridge. Cutting agents don't materially change the appearance, flavour or effect of the product when added and are often present without the consumer's knowledge or understanding.

In the Candian regulatory environment, it is essentially impossible for the average consumer to tell whether the oil in their cartridge has been "cut" with off-label chemicals. It will be important to monitor the situation as legal, regulated vaping products enter the market. The concern being that the unregulated illicit market will then attempt to introduce unregulated vapes into the market.

## Vaping-induced Acute Lung Injury (EVALI)

Triantafyllou, et al[39] describe the features of six cases seen this past summer at the University of Pittsburgh Medical Center. These cases were young men who presented with respiratory and gastrointestinal complaints who reported regular use of vaporized cannabis and nicotine products. The patients showed evidence of a systemic inflammatory response with leukocytosis, and chest imaging showed bilateral, multifocal ground-glass opacifications. The patients were treated with IV antibiotics and corticosteroids. Two patients required mechanical ventilation, but they, like the others, subsequently recovered and were discharged. The case descriptions from the University of Pittsburgh team are similar to those of a larger case series published earlier this year from Illinois and Wisconsin.[40]

One common finding in the two published case series is the prevalence of use of a cannabis product known as 'Dank Vape'. According to the CDC, Dank Vapes are the most prominent in a class of largely counterfeit brands, with common packaging that is easily available online and used by distributors to market THC-containing cartridges.[41]

Triantafyllou, et al. describe several possible mechanisms by which vaping can lead to acute lung injury.[11] The common vehicles of the nicotine-containing extracts are propylene glycol and glycerin, which have been shown to induce airway remodeling.[42] Nicotine vapor itself has been shown to induce macrophage activation,[43] and flavoring additives, including the known respiratory toxin diacetyl, lead to the generation of by products that directly injure the airway epithelium.[44] It should be no surprise then that chemically complex extracts heated to the point of vaporization will generate toxic agents.[45] A recent paper from the Mayo Clinic that described the pathological examination of lung biopsies from 17 patients with vaping associated lung injury reported findings more consistent with airway-centered chemical pneumonitis from one or more inhaled toxic substances, rather than lipoid pneumonia.[46]

There are multiple known contaminants in illicit vape cartridges, that could cause lung injury. But on Nov. 8, 2019, the CDC announced a "very strong culprit of concern" — vitamin E oil, (tocopheryl-acetate). Lung fluid analyses of 29 victims from 10 states tested positive for the substance. "The samples," said CDC Dr. Anne Schucat, "provided evidence of vitamin E acetate at the primary site of injury in the lungs. No other potential toxins were detected".[47] According to the CDC, laboratory data show that vitamin E acetate, an additive in some THC-containing ECs or vaping products, is strongly linked to the EVALI outbreak.[48]

A recent study analyzed samples from 51 EVALI cases from 16 states and a comparison group of samples from 99 comparison individuals without EVALI for vitamin E acetate, plant oils, medium chain triglyceride (MCT) oil, coconut oil, petroleum distillates, and diluent terpenes. Vitamin E acetate was identified in bronchoalveolar lavage (BAL) fluid samples from 48 of the 51 EVALI patients, but not in the BAL fluid from the healthy comparison group. No other toxicants were found in BAL fluid from either group, except for coconut oil and limonene (1 EVALI patient each).[49]

New York health authorities have confirmed that synthetic vitamin E (tocopheryl-acetate) is tainting most seized vape carts in that state.[50] Pen makers report using it because it's a cheap thickener.[51]

Wu and O'Shea[52] demonstrated that the vaping of vitamin E acetate has the potential to produce exceptionally toxic ketene gas, which may be a contributing factor to the upsurge in pulmonary injuries associated with using EC/vaping products. Additionally, the pyrolysis of vitamin E acetate also produces carcinogen alkenes and benzene for which the negative long-term medical effects are well recognized.

As of Feburary 4th, 2020, 2,758 confirmed and probably cases of severe acute respiratory distress syndrome (ARDS) were reported to the US CDC.

'In Canada, as of February 11th, 2020, 17 cases of vaping-associated lung illness have been reported to the Public Health Agency of Canada.[53] Four patients presented with respiratory symptoms only (shortness of breath, cough), while thirteen presented with a combination of respiratory, gastrointestinal, and/or constitutional symptoms, such as fever or weight loss.

In many cases, symptoms and treatment mirror a condition called lipoid pneumonia,[54] previously found in patients who inhaled mineral oil. Subsequent biopsies of 17 victims indicated "airway-centered chemical pneumonitis[55] from one or more inhaled toxic substances rather than exogenous lipoid pneumonia as such, but the agents responsible remain unknown." A third biopsy series looked similar to the first two, adding organizing pneumonia[56] to the diagnosis cluster.

## Effects on Youth

These incidences of lung injury due to vaping in young, apparently healthy patients should be a cautionary tale to clinicians and the general public about the safety of these products and their use. With the increased visibility of legalized cannabis for use in vaping systems has raised concerns regarding EC use by youth were being expressed before cannabis legalization.

In 2016, the Office of the Surgeon General issued a report warning youth against e-cigarettes. Vaping "has the potential to create a whole new generation of kids who are addicted to nicotine," said Vivek Murthy, M.D., then the U.S. surgeon general, in issuing the report in December 2016.

Key findings included:

- In 2014, current (past-month) use of ECs by young adults 18–24 years of age surpassed that of adults 25 years of age and older.
- ECs are now the most commonly used tobacco product among youth.
- Vaping is also strongly associated with the use of other tobacco products among youth and young adults, including combustible tobacco products.
- The use of products containing nicotine poses dangers to youth, pregnant women, and fetuses. The use of products containing nicotine in any form among youth, including in ECs, is unsafe.
- The aerosol from ECs is not harmless. It can contain harmful and potentially harmful constituents, including nicotine.
- Nicotine exposure during adolescence can cause addiction and can harm the developing adolescent brain.
- ECs are marketed by promoting flavors and using a wide variety of media channels and approaches that have been used in the past for marketing conventional tobacco products to youth and young adults.

Permitting tobacco company–funded companies to market flavored EC pods has led to the nicotine addiction of thousands of children. Data from the 2019 Monitoring the Future Survey conducted annually by the National Institute on Drug Abuse showed a doubling of the percentage of teens who reported vaping, with 25% of high school seniors reporting use in the last month.[57]

With regards to cannabis, in addition to the issues relating to lung injury, the greater efficiency of delivery afforded by vaporization may result in stronger effects with collateral impairment. Increased availability of cannabis of higher potency combined with increasing use raises public safety concerns around impairment and acute intoxication. The greater cognitive and psychomotor effects of vaporized cannabis relative to smoked cannabis reported by Spindle et al[16] at a dose substantially lower than that of products available in cannabis dispensaries, further amplify these concerns around impairment. In a placebo-controlled crossover trial conducted in healthy adults who infrequently use cannabis, Spindle and colleagues report a comparison of acute effects of smoked versus vaporized cannabis at 2 different doses. Dose-orderly subjective drug effects, cardiovascular effects, and impaired cognitive and psychomotor function were observed, with greater effects and higher blood cannabinoid concentrations achieved from vaporization. The authors warn that even relatively low-potency cannabis can adversely affect inexperienced users.[58]

## Lower-Risk Cannabis Use Guidelines (LRCUG)[59]

Extensive data suggest that many cannabis use–associated harms—or at least their severity—are influenced by modifiable behavioral factors or user choices and these present opportunities for interventions to modify cannabis users' behavior toward improved public health outcomes. Health Canada's *Lower Risk Cannabis Use Guidelines* (LRCUG) may be a worthwhile public health intervention for cannabis, particularly following legalization of use. LRCUG are primarily aimed at individuals, initially in the context of Canada, who have made the choice to use cannabis, as a knowledge-based tool to lower their risk of harms.[60]

The **LRCUG are as follows:**

**Recommendation 1:** The most effective way to avoid any risks of cannabis use is to abstain from use.

Those who decide to use need to recognize that they incur risks of a variety of—acute and long-term—adverse health and social outcomes. These risks will vary in their likelihood and severity with user characteristics, use patterns, and product qualities, and so may not be the same from user to user or use episode to another.
***[Evidence Grade: None required.]***

**Recommendation 2:** Early initiation of cannabis use (i.e., most clearly that which begins before age 16 years) is associated with multiple subsequent adverse health and social effects in young adult life.

These effects are particularly pronounced in early-onset users who also engage in intensive and frequent use. This may be in part because frequent cannabis use affects the developing brain. Prevention messages should emphasize that, the later cannabis use is initiated, the lower the risks will be for adverse effects on the user's general health and welfare throughout later life.
***[Evidence Grade: Substantial.]***

**Recommendation 3:** High THC-content products are generally associated with higher risks of various (acute and chronic) mental and behavioral problem outcomes.

Users should know the nature and composition of the cannabis products that they use, and ideally use cannabis products with low THC content. Given the evidence of CBD's attenuating effects on some THC-related outcomes, it is advisable to use cannabis containing high CBD:THC ratios.
***[Evidence Grade: Substantial.]***

**Recommendation 4:** Recent reviews on synthetic cannabinoids indicate markedly more acute and severe adverse health effects from the use of these products (including instances of death).

The use of these products should be avoided.
***[Evidence Grade: Limited.]***

**Recommendation 5:** Regular inhalation of combusted cannabis adversely affects respiratory health outcomes.

While alternative delivery methods come with their own risks, it is generally preferable to avoid routes of administration that involve smoking combusted cannabis material (e.g., by using vaporizers or edibles). Use of edibles eliminates respiratory risks, but the delayed onset of psychoactive effect may result in the use of larger than intended doses and subsequently increased (mainly acute, e.g., from impairment) adverse effects.
***[Evidence Grade: Substantial.]***

**Recommendation 6:** Users should avoid practices such as "deep inhalation," breath-holding, or the Valsalva maneuver to increase psychoactive ingredient absorption when smoking cannabis, as these practices disproportionately increase the intake of toxic material into the pulmonary system.
***[Evidence Grade: Limited.]***

**Recommendation 7:** Frequent or intensive (e.g., daily or near-daily) cannabis use is strongly associated with higher risks of experiencing adverse health and social outcomes related to cannabis use.

Users should be aware and vigilant to keep their own cannabis use—and that of friends, peers, or fellow users—occasional (e.g., use only on 1 day/week, weekend use only, etc.) at most.
***[Evidence Grade: Substantial.]***

**Recommendation 8:** Driving while impaired from cannabis is associated with an increased risk of involvement in motor-vehicle accidents.

It is recommended that users categorically refrain from driving (or operating other machinery or mobility devices) for at least 6 hours after using cannabis. This wait time may need to be longer, depending on the user and the properties of the specific cannabis product used. Besides these behavioral recommendations, users are bound by locally applicable legal limits concerning cannabis impairment and driving. The use of both cannabis and alcohol results in multiply increased impairment and risks for driving, and categorically should be avoided.
*[**Evidence Grade: Substantial**.]*

**Recommendation 9:** There are some populations at probable higher risk for cannabis-related adverse effects who should refrain from using cannabis.

These include individuals with predisposition for, or a first-degree family history of, psychosis and substance use disorders, as well as pregnant women (primarily to avoid adverse effects on the fetus or newborn). These recommendations, in part, are based on precautionary principles.
*[**Evidence Grade: Substantial**.]*

**Recommendation 10:** While data are sparse, it is likely that the combination of some of the risk behaviors listed above will magnify the risk of adverse outcomes from cannabis use.

For example, early-onset use involving frequent use of high-potency cannabis is likely to disproportionately increase the risks of experiencing acute or chronic problems. Preventing these combined high-risk patterns of use should be avoided by the user and a policy focus.
*[**Evidence Grade: Limited.**]*

*Note*. A detailed rationale for each evidence grade is provided as a supplement to the online version of this article at http://www.ajph.org.

## Summary

The legalization of cannabis in Canada will no doubt be regarded as one of the most significant public health policy changes in the last 50 years. The decades of illicit cannabis consumption certainly provide us with epidemiological data that is hard to quantify due to its illegal status, however the impact of large-scale commercialization and the subsequent innovation in all aspects, from cultivation to processing and delivery methods, will have numerous unexpected consequences.

While the stated aim of recreational legalization was to protect youth from criminally cultivated product, the change in market demand generally towards products with higher THC content, and the increasing social prevalence of adolescent vaping, could very likely have unintended consequences to the short and long term health of youth who access cannabis illicitly. Pre-legalization epidemiological data is of little use in this regard, due to the difficulty of studying illegal recreational use on a population basis, and the recent advent of widespread adoption of vaping over combustion use of cannabis.

Many cannabis use–associated harms—or at least their severity—are influenced by modifiable behavioral factors or user choices and it is important to educate adolescent patients on these topics. Given that a substantial proportion of both acute and chronic problems are appearing in younger users with high frequency vaping of higher THC products, this is critical, even if adolescent patients are reluctant to discuss illicit underage use. *Lower-Risk Cannabis Use Guidelines,* as discussed, are a worthwhile Public Health intervention strategy for cannabis use in this population in a naturopathic clinical setting

Additionally, there are vaping-related factors that also need to be discussed with adolescent patients who are using this delivery method. In particular, there is increasing evidence of acute and long-term lung injury related to the effects of cannabis additives that the patient may not even be aware of.

Vaping is one of the modes of consuming cannabis that can cross over between medical and recreational markets. Vaping can use dried flower or extracted oil products in cartridges (carts). Vaping has the advantage of rapid onset and shorter duration of effect than oral forms so it is considered in more acute situations such as pain, spasticity, nausea, anxiety and insomnia. In addition, vaping dried flower has several advantages as the plant material is not burned so many of the negative aspects of combustion are not a factor. It is important to differentiate vaping dried flower vs carts.

One of the major concerns with vaping has been the use of ingredients that may not be appropriate for their intended use. With dried flower there is concern over the use of pesticides in the illegal market that will be inhaled. In legal product, there is concern about mold. Vape cartridges have these issues as well as the use of emulsification agents that are not meant for use in inhaled products. Cannabinoids are highly lipophilic, and extraction and suspension can be complicated and can involve numerous solvents and additives. Vape cartridges are an example. The use of emulsification agents such as mineral oil and vitamin E acetate are examples of 'work arounds' where an ingredient is inappropriately used. In this case, delicate lung tissue is exposed to highly inflammatory substances, leading to a public health crisis.

Other issues beyond the LRCUG that NDs may wish to inquire about and discuss with patients include:

1. A discussion around the differences between legal and illegal products and how to distinguish between the two.
2. The type of product - Are they vaping dried flower or an extracted oil in a cartridge?
3. If not purchased from a licensed producer, where was it obtained, and how well do they know their supplier?
4. What was the variety or strain?
5. How was it manufactured and are there any additives?

It has been my experience that patients feel much more comfortable discussing cannabis with their naturopathic doctor than with their MD. Given that under 18 youth are still prohibited from using recreational cannabis in Canada, this is even more likely to be the case This means that the profession can have an important role in Public Health and education around cannabis. It is important for NDs to apply their knowledge of general phytotherapy to educate and inform patients. Our profession understands phytotherapeutics and works daily with complex herbal formulations. NDs also understand the value of standardized herbal formulations and how to apply them holistically. In fact, many of the widely use herbal medicines appear to act through the endocannabinoid system. All these facts make us uniquely qualified to speak to the therapeutics that act via the endogenous endocannabinoid system and this includes recreational phytocannabinoids in vaping systems.

## About the Author

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# Supporting Transgender and Gender Diverse Youth in Naturopathic Practice

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## The state of transgender and gender diverse healthcare for youth in Canada

In Canada, transgender and gender diverse youth (see glossary of terms at the end of this article) report higher rates of bullying, discrimination, violence, psychological distress, self-harm, major depressive episodes, suicidal ideation, and suicide attempts compared to their cisgender peers.[1]

Up to 95% of transgender teens report feeling unsafe at school and 90% of them report being verbally harassed because of their gender expression.[2] According to one study, 65% of transgender teens age 14-18 had considered suicide in the past year compared to 13% of cisgender teens. Seventy five percent of transgender teens had engaged in self harm in the past year compared to 16.5% of cisgender teens.[3] Difficulties with body image, disordered eating, and substance use rates are also higher in transgender youth compared to their cisgender peers.[4]

Statistics on the risks and mental health challenges that transgender youth face are alarming. However, protective factors such as social support and lived experiences can make all the difference.[5] Youth report better mental health when they have strong social support and experience fewer incidents of enacted stigma (ie. experiences of discrimination, harassment, and/or violence due to transphobia, homophobia, sexism, etc…). Social supports such as family, friends, and school connectedness are associated with fewer mental health problems in transgender and gender diverse youth. Parental support is the single most effective preventative protective factor.[6,7] Similar protective factors also have inverse associations with rates of disordered eating and substance use.[4,8] Gender-affirming therapies and supported social transition in childhood also correlate with improved psychological functioning and decreased risk of mental health conditions, self-harm, disordered eating, and substance use.[9]

Research studies on transgender and gender diverse youth examining the impact of enacted stigma experiences and protective factors point to a clear need to reduce the stigma, prejudice, discrimination, and violence these youth face on a regular basis.

Healthcare providers can offer care that is both transgender friendly and transgender competent by providing support and reducing stigma. Healthcare providers can assist transgender and gender diverse youth to access safe and inclusive healthcare, extend supports for families, and advocate for social and policy-based changes.[10]

## Gender development in children

The World Health Organization defines gender as "the roles, behaviours, activities, attributes and opportunities that any society considers appropriate for girls and boys, and women and men". They note that "gender interacts with, but is different from, the binary categories of biological sex".[11] These binary categories are 'male' and 'female' – classifications that are themselves not completely rigid, due to significant normal variation in chromosomes, hormones, and anatomy that occurs in humans.

Research on toddlers and children of all gender identities has shown that children start to develop a consistent understanding of their own gender identity, as well as their gender own expression (e.g. preferences for toys, clothing, and same-gender peers), by the age of 2-3 years.[12,13] This identification with one's own gender identity has been shown to be independent of parents' views of gender[14], and happens at the same time and to the same degree in cisgender and transgender children.[15] That is to say, we know that transgender children are not influenced by their parents to be transgender. They simply identify with their gender identity and not their sex assigned at birth.

## Talking to pediatric patients about gender

Naturopathic doctors may be the first point of contact for transgender and gender diverse pediatric and adolescent patients. Since transgender and gender diverse youth often face discrimination in healthcare settings, they may present to naturopathic doctor offices seeking safe, inclusive care. Naturopathic doctors are well suited to open up a conversation about pubertal changes in a way that is inclusive of patients of all kinds of bodies, genders, and sexualities to cultivate a healthcare environment that represents the diversity of human experiences.

When naturopathic doctors conduct routine well child checks, it is a great opportunity to nurture a therapeutic relationship that fosters open communication and encourages discussion of personal issues,

including gender identity and sexual orientation.[16] Best practices for kids and teens who are transgender and gender diverse do not widely differ from guidelines for other children. Like all adolescents, well child visits every one to two years are an opportunity to check up on expected growth and development, nutrition and lifestyle, behaviour, and safety issues, as well as friends, school, and other activities. It is also a good idea to give teens time alone with a health professional to discuss any concerns they may have that they are less comfortable raising with a parent or guardian in the room.

When talking about puberty, clinicians should take care to use gender-neutral language and physiological terms in place of gendered ones.[17] For example, when explaining puberty, clinicians can explain that bodies with ovaries usually produce estrogen and progesterone, while bodies with testicles typically produce testosterone. Clinicians can describe the many pathways to adult bodies, including both endogenous hormone production and exogenous hormone therapy. Talking about variations in human physiology normalizes differences in height, body shape, hormone levels, and other experiences of puberty that both cisgender and transgender teens may relate to. When children and teens recognize patterns rather than rules, they better understand diversity and are less likely to feel that there is something wrong with themselves or to marginalize others due to gender-based differences. Using gender-neutral clinical language can help ensure that all children and youth see themselves represented in the language of puberty.[18] If patients express an interest to explore their gender identity and expression further, naturopathic doctors can look to best practices in working with gender diverse youth and the gender-affirmative care model, as described below.

## Gender-affirmative care

The gender-affirmative care model has been embraced by multiple major organizations, including the American Academy of Pediatrics, and is used at almost all leading pediatric transgender care centers.[19–22] The major premises of this model are as follows:

- Variation in gender identity and expression variations is normal, not disordered;
- Gender is influenced by biology, development, and culture;
- Gender may be fluid, and is not binary, both at a particular time and over an individual's lifetime;
- Any mental health issues related to gender are more often due to enacted stigma (e.g., discrimination and/or violence due to transphobia, homophobia, sexism) rather than from within the child.

Also central to the gender-affirmative care model is the statement that not all children who exhibit gender-diverse behaviours are transgender. It is not up to the practitioner to determine which children are and which are not, but rather to help children explore their gender identity and make choices that allow them to live comfortably as themselves.

That said, many researchers and clinicians describe children who are "persistent, consistent, and insistent" that their gender identity is not the one they were assigned at birth as transgender.[19] The latest edition of the Diagnostic and Statistical Manual of the American Psychiatric Association (DSM-V) currently uses a diagnosis of gender dysphoria to describe distress experienced by a mismatch between gender identity and gender assigned at birth. Although this diagnosis often serves to facilitate access to and provincial coverage for hormonal and surgical treatments, many transgender and gender diverse people as well as clinicians agree that the presence of this diagnosis within the context of mental illness serves to pathologize gender identity and expression.[23] As it is misaligned with the recommended informed consent model of care, the WHO is transitioning to a diagnosis of gender incongruence (adults) and gender incongruence of childhood (children & youth), relocating it to a new chapter "Conditions Related to Sexual Health".[24,25]

## Informed consent model and the role of the naturopathic doctor

Most naturopathic doctors in Canada do not have the scope of practice to prescribe gender-affirming hormonal treatments or directly refer for surgeries, with the exception of some naturopathic doctors, who may be in a position to prescribe feminizing hormone treatment.[26] This puts naturopathic doctors in a uniquely advantageous position where they do not have the ability to provide or deny access to these therapies, but can still facilitate a conversation with the patient (and their family) about their gender identity and expression, and what kinds of treatments might be desired and appropriate.

Patients are often wary of health care practitioners who act as gatekeepers to gender-affirming treatment, making an assessment (often based on DSM criteria for gender dysphoria) of whether the patient should receive treatment or not, and then holding the authority to provide or deny treatment.[27–29] Because of this, transgender patients, including youth, often feel pressure to communicate their own narrative or identity in a way that is the most palatable, or the most likely to be approved.[30] In talking to a naturopathic doctor, patients should have the freedom to talk frankly about their own experience of gender. Therefore, the goals of treatment with transgender or gender-diverse children should be:

- Establish a trusting therapeutic relationship where patients can discuss their gender.
- Help the patient live in a way that makes them the most comfortable.
- Provide information about available treatments, including social transition, gonadotropin-releasing hormone analogues (GnRHa), feminizing or masculinizing therapy, surgery, and/or naturopathic interventions.[21]
- If the clinician has received sufficient training to do so, discuss likelihood and magnitude of benefit, risks and costs, alternatives, and consequences of not treating for each indicated intervention – i.e. an in-depth informed consent discussion.

- Achieve any goals that may be achieved through naturopathic interventions (e.g. non-transition related health goals, see section on "Adjunctive and supportive naturopathic care" below).
- Refer to primary care provider and/or specialized clinics (see listings in resources below) for medical transition and/or mental health supports with a qualified gender-affirming healthcare provider.

An in-depth informed consent discussion is the patient-centred response to the issue of gatekeeping. In this model, the patient is given the information they need to make their own health-related decisions, and given the support and space to make this choice, rather than the practitioner having the power to determine eligibility for treatment.[31] With pediatric patients, this support and discussion will most likely need to be more involved, as younger patients' critical- and future-thinking skills are not fully developed. This discussion may also include the patient's family. All of the usual principles of pediatric informed consent apply here, with the responsibility lying with the practitioner to assess whether the patient and/or their family have the capacity to provide informed consent, if given the necessary information in a way that is understandable to them.[32]

## Gender-affirmative care and medical management

Some gender diverse youth may seek social and/or medical transitions. Social transition consists in a change of gender expression and role. It may include changes to a child's name, clothing, appearance, and/or pronouns. Early research indicates that social transition can profoundly improve a child's overall happiness and wellbeing.[33] Use of a chosen name (a name different than one's legal name, often a proxy for gender affirmation in transgender and non-binary youth) is associated with decreased risk of depression, suicidal ideation, and self-harm.[34] Naturopathic doctors, and other healthcare providers, can support transgender and gender diverse youth by using chosen names and pronouns at all times and talking to children and youth.[10]

Some children, in particular as they approach anticipated changes with puberty, may seek medical transition to better align their physical body with their gender identity and expression. Gonadotropin-releasing hormone analogues (GnRHa) can be used to suppress puberty and delay the development of secondary sex characteristics. This reversible treatment can be used during puberty (Tanner stages 2-5) and offers significant advantages for some teens and their families: it can alleviate stress associated with physical, irreversible pubertal changes and social stigma; it facilitates identity exploration by decreasing stress; it allows for additional time to make future decisions; and it facilitates more satisfactory outcomes than post-puberty medical transition.[35] If GnRHa are discontinued, endogenous puberty resumes. If, however, complete hormonal and/or surgical transition is desired, hormone treatment can begin.[36,37] Long-term research studies conducted in the Netherlands suggest that early transition is associated with increased satisfaction, quality of life, and mental health. Additionally, post-transition dissatisfaction and regret is more common with late transition compared to early transition.[38,39] In Canada, several specialized medical facilities exist to provide this treatment to adolescents and support their families (see resources section).

## Adjunctive and supportive naturopathic care

Naturopathic doctors can support transgender and non-binary youth patients and their families by providing adjunctive and gender-affirming care. Although currently available research is limited, pubertal suppression with GnRHa may have adverse effects on bone metabolism and fertility.[40–43] While evidence suggests that bone mineral density returns to levels consistent with cisgender peers approximately one year after puberty blockers are discontinued or exogenous hormone therapy has been initiated, there is some evidence that low bone mineral density even after 12 months of hormone therapy is associated with vitamin D deficiency.[43–46] Taking this research into consideration, patients, in consultation with their medical or naturopathic doctors, may choose to test serum vitamin D levels and supplement accordingly. Naturopathic doctors can also assist by encouraging adequate calcium intake through diet, weight-bearing and cardiovascular exercise, and refraining from smoking while patients are undergoing puberty suppression to help prevent increased bone turnover or decreased bone density. Other naturopathic treatments should address individual health concerns and/or best practices for all youth regardless of gender.

Naturopathic doctors may be the first point for transgender and gender diverse youth. Clinicians should avoid making assumptions about patients and neutralize their language describing the physiological changes associated with puberty. When working with transgender and gender diverse pediatric and adolescent patients, naturopathic doctors should be aware of relevant human rights legislation in their jurisdictions, support patients and their families using the informed consent model, and refer for gender-affirming primary care where appropriate.

### GLOSSARY OF TERMS

**Cisgender:** refers to someone whose gender identity aligns with the one they were assigned at birth.

**GAAB:** gender assigned at birth

**Gender diverse:** an umbrella term for individuals who broaden their own culture's definitions of gender identity, expression, roles and/or norms; includes transgender and non-binary identities, as well as those who stretch society's notion of gender in some way.

**Gender expression:** the way that individuals present their gender in the world, including behaviours and outward appearance such as dress, hair, make-up, body language and voice and how society, culture, community, and family perceive an individual's gender.

**Gender identity:** a deeply held, internal sense of self as masculine, feminine, a blend of both, neither, or something else. Identity also includes the name used to convey gender. Gender identity can correspond to, or differ from sex and/or gender assigned at birth.

**Non-binary:** an umbrella term for gender identities that are not exclusively masculine or feminine.

**SAAB:** sex assigned at birth

**Transgender:** sometimes used as an umbrella term for those whose gender identity differs from their assigned sex/gender at birth. More specifically, it refers to someone whose gender identity is across or opposite the gender binary from the one they were assigned at birth.

Adapted from: https://www.genderspectrum.org/the-language-of-gender/ and http://www.ohrc.on.ca/en/gender-identity-and-gender-expression-brochure

## SPECIALIZED CLINICS

**The Gender Clinic at the BC Children's Hospital (Vancouver, BC)**
http://www.bcchildrens.ca/our-services/clinics/gender

**Pediatric Endocrine Clinic at the Alberta Children's Hospital (Calgary, AB)**
https://www.albertahealthservices.ca/findhealth/Service.aspx?id=1861&serviceAtFacilityID=1023720#contentStart

**Gender Dysphoria Assessment and Action for Youth (Winnipeg, MB)**
https://www.gdaay.ca/

**Transgender Youth Clinic at Sick Kids (Toronto, ON)**
http://www.sickkids.ca/adolescentmedicine/programs/transgender-youth-clinic/transgender-youth-clinic.html

**Gender Diversity Clinic for Children and Youth at the Children's Hospital for Eastern Ontario (Ottawa, ON)**
https://www.cheo.on.ca/en/clinics-services-programs/gender-diversity-clinic.aspx

**Gender Variance Program at Centre de Santé Meraki (Montreal, QC)**
https://centremeraki.com/programs/gender-variance-program/

## OTHER RESOURCES

**Neutralizing Clinical Language**
https://cyndigilbert.ca/neutralizing-clinical-language-2/

**Rainbow Health Ontario**
https://www.rainbowhealthontario.ca/

**Gender Creative Kids Canada**
http://gendercreativekids.ca/

**Society of Obstetricians & Gynaecologists of Canada**
https://www.sexandu.ca/lgbttq/gender-identity/

**American Academy of Pediatrics**
https://www.healthychildren.org/English/ages-stages/gradeschool/Pages/Gender-Identity-and-Gender-Confusion-In-Children.aspx

**Gender spectrum**
https://www.genderspectrum.org/

## About the Authors

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# Supportive Naturopathic Management of Long-Term Effects of Acute Lymphoblastic Leukemia Treatment

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With the number of childhood cancer survivors rising steadily each year,[1] it is important that physicians are adept at managing long-term sequelae of treatment.[2] Advances in cancer treatments have significantly increased childhood cancer survival rates since the 1970's.[1,3] Recent research estimates that 67% of childhood cancer survivors will develop at least one late-onset treatment related adverse effect and in 25% of survivors that side effect may be life-threatening.[2] Leukemia is the most commonly diagnosed childhood cancer (32% of all cases), specifically acute lymphocytic leukemia (ALL), which most commonly occurs before the age of five.[1,3] This article will discuss the importance of monitoring long-term sequelae from the treat-ment of survivors of ALL and review current literature on safe and effective naturopathic interventions for managing side effects of conven-tional ALL treatment and potential long-term complications.

Health problems occurring months to years after cancer treatment are termed "late effects." Late effects are dependent upon the primary malignancy and its corresponding treatment.[4] Importantly, the incidence of late effects increases over time. Reducing acute side effects while undergoing treatment may help minimize late effects or potentially reduce incidence rates. Regular follow-up assessment and management is central to monitoring and treating late effects and can provide a better overall outcome and quality of life. Education surrounding healthy habits of diet and exercise for survivors is a primary component of supporting patients.

Current survivorship guidelines published by the Children's Oncology Group for Long-Term Follow-Up of Childhood, Adolescent and Young Adult Cancers serves as a resource for healthcare professionals working with survivors. The guidelines are intended to help support a better quality of life and minimize complication-related health care costs for pediatric cancer survivors.[5] These guidelines also provide standardized follow-up care with the goals of:

a) Promoting a healthy lifestyle

b) Providing ongoing monitoring

c) Facilitating early identification of late effects

d) Providing timely intervention for late effects[5]

These guidelines are not meant to provide follow-up for the survivor's primary malignancy. Patients are assumed to be asymptomatic and healthcare professionals who do not regularly care for survivors of pediatric cancers are encouraged to seek out care from a pediatric oncology long-term follow up center.[5] The guidelines were initially released in 2002 and are updated with current literature at least every 5 years.

The Children's Oncology Group lists potential harms of the guidelines as, "increased patient anxiety related to enhanced awareness of possible complications as well as potential false-positive screenings" leading to unnecessary further testing.[5] Informed consent and individualized guidelines based on clinical judgement is expected within the context of these guidelines as well.[5]

Guidelines for monitoring late effects of *any* cancer treatment (Table 1) include screening for mental health disorders, risky behaviours, psychosocial disabilities due to pain, adverse psychosocial/quality of life effects, dental abnormalities, limitations in access to health care and insurance as well as fatigue and sleep problems.[5]

Recent statistics estimate that 985 Canadian children, aged 0 to 14 years, are diagnosed with ALL each year.[6] Based on the most common treatment protocols outlined below, the guidelines can be utilized to provide better quality of life to the patient and monitoring of late effects.

The most common treatment for children with ALL is chemotherapy, which is provided in 3 phases:

1. Induction
2. Consolidation (also called intensification)
3. Maintenance[7]

**TABLE 1: Common Late Effects Associated with Cancer Treatment**

| LATE EFFECT | ASSESSMENT | CONVENTIONAL THERAPIES |
|---|---|---|
| **Mental Health Disorders**<br>• Depression<br>• Anxiety<br>• PTSD<br>• Suicidal Ideation | Annual Screening | • Psychological consultation in patients with emotional difficulties related to cancer experience including physical deformities or chronic disabilities[5]<br>• Appropriate psychotropic medications[5]<br>• Evaluation of parent of PTSD[5] |
| **Risky Behaviors**<br>Behaviors known to increase likelihood of subsequent illness of injury<br>• Smoking<br>• Underage or excessive drinking<br>• Drug use<br>• Eating disorders<br>• Sedentary lifestyle<br>• Unprotected sex<br>• Excessive UV radiation exposure | Annual Screening | • Smokefree.gov[5]<br>• Cancer.org/healthy/stay-away-from-tobacco[5]<br>• Cognitive Behavioural Therapy |
| **Psychosocial Disabilities due to pain** | Annual Screening | • Psychological consultation in patient with chronic pain[5]<br>• Appropriate psychotropic medications[5]<br>• Referral to pain rehabilitation clinic[5] |
| **Adverse Psychosocial / QoL Effects**<br>• Social Withdrawal<br>• Educational problems<br>• Relational problems<br>• Underemployment / Unemployment<br>• Dependent Living | Annual Screening | • Psychological consultation in patients with emotional difficulties related to cancer experience including physical deformities or chronic disabilities[5]<br>• Social work consultation[5]<br>• Refer as indicated to school liaison in community or cancer center (psychologist, Social worker, school counselor) to facilitate acquisition of education or vocational services[5]<br>• Refer as indicated for neuropsychological evaluation[5] |
| **Dental Abnormalities** | Annual Oral Exam, Dental Exam and Cleaning every six months | • Regular dental care including fluoride applications[5]<br>• Baseline panorex prior to dental procedure to evaluate root development[5] |
| **Limitations in Health Care Assess and Insurance** | | • Social work consultation[5] |
| **Fatigue and Sleep Problems** | Annual Psychosocial Assessment | • Screen for physical sources of fatigue such as anemia, sleep disturbances, nutritional deficiencies, cardiomyopathy, pulmonary fibrosis, hypothyroidism or other endocrinopathy[5]<br>• Referral to specialties such as endocrinology, sleep lab / study, or nutrition as needed[5]<br>• Referral to psychology for behavioral intervention for emotional difficulties contributing to sleep and fatigue[5] |

The duration of treatment is typically 2 years for girls and 3 years for boys, with the most intense treatment being in the initial induction phase.[7] Children with ALL are often classified by risk groups to ensure the correct types of chemotherapeutic drugs and doses are given.[7] The treatment groups are divided into the following three groups: Standard Treatment for uncomplicated ALL, High Risk, or patients that are positive for the Philadelphia Chromosome. Depending on which risk group a patient is placed in, treatment can be more or less intense with the Philadelphia Chromosome group receiving the most intense treatment.[7]

More than 95% of children with ALL enter remission after one month of induction treatment.[7] The next, and usually more intense, consolidation phase of chemo starts once the leukemia is in remission and typically lasts for several months (Table 3).[7]

If the leukemia remains in remission after induction and consolidation then maintenance therapy is initiated (Table 4). Higher risk patients may receive more intense maintenance chemotherapy and intrathecal therapy.[7]

**TABLE 2: Induction Phase Treatment of Children with Acute Lymphocytic Leukemia (ALL)**

| INDUCTION PHASE | ALL STANDARD TREATMENT | HIGH RISK GROUP | PHILADELPHIA CHROMOSOME (+) | LATE EFFECTS DUE TO TREATMENT |
|---|---|---|---|---|
| **Drugs** | • L-asparaginase<br>• Vincristine<br>• Dexamethasone | Add:<br>• Daunorubicin (anthracycline)<br>Possible<br>• Methotrexate and/or 6-mercaptopurine | Add:<br>• Imatinib (Gleevec) | **L-asparaginase** - no known late effects[5]<br>**Vincristine** - peripheral sensory or motor neuropathy, vasospastic attacks (Raynaud's phenomenon), increased risk of skin cancer (10 years post treatment)[5]<br>**Dexamethasone** - Decreased Bone Mineral Density, Osteonecrosis (avascular necrosis), cataracts[5]<br>**Daunorubicin (anthracycline)** - Heart failure (more likely at dosages above 250 mg/meter squared)[10]<br>**6-mercaptopurine** - Hepatic dysfunction[5]<br>**Imatinib (Gleevec)** - Further Study needed[8] |
| **Intrathecal Chemotherapy** | Methotrexate | Add<br>• Hydrocortisone<br>• Cytarabine (ara-C) | | **Methotrexate** - Hepatic dysfunction, Neurocognitive deficits, Clinical leukoencephalopathy[5]<br>**Cytarabine (ara-C)** - cognition, learning and memory difficulties, reduced fertility or infertility in men and women, Hepatic dysfunction[9] |
| **Radiation** | | May be given radiation therapy to brain although not as common.[7] | | Delayed cognitive ability and growth even at small doses, metabolic syndrome.[7]<br>Stroke and osteonecrosis[13]<br>Second cancers[16] |

**TABLE 3: Consolidation Phase of ALL Treatment**

| CONSOLIDATION PHASE | ALL STANDARD TREATMENT | HIGH RISK GROUP | PHILADELPHIA CHROMOSOME (+) | LATE EFFECTS DUE TO TREATMENT |
|---|---|---|---|---|
| **Drugs** | Regimen differs among cancer centers<br>• Methotrexate 6-mercaptopurine (6-MP)<br>• Vincristine<br>• L-asparaginase and/or prednisone | Add:<br>• L-asparaginase<br>• Doxorubicin<br>• Etoposide<br>• Cyclophosphamide<br>• Cytarabine (ara-C)<br>• Dexamethasone is substituted for prednisone | Add:<br>• Imatinib (Gleevec) | **Doxorubicin** - cardiovascular damage and dysfunction, secondary cancers.[5]<br>**Etoposide** - increased risk for myelodysplastic syndrome and acute myeloid leukemia.[5]<br>**Cyclophosphamide** - increased risk for myelodysplastic sy ndrome and acute myeloid leukemia, hepatic dysfunction, increased risk for bladder cancer (10 years post treatment).[5]<br>**Cytarabine** - see above<br>**Methotrexate, mercaptopurine, vincristine, L-asparaginase, prednisone** - see above |
| **Intrathecal Chemotherapy** | Continued intrathecal chemotherapy | Continued intrathecal chemotherapy<br>May require second round of chemotherapy treatment | Continued intrathecal chemotherapy | **Methotrexate** - Hepatic dysfunction, Neurocognitive deficits, Clinical leukoencephalopathy[5]<br>**Cytarabine (ara-C)** - cognition, learning and memory difficulties, reduced fertility or infertility in men and women, hepatic dysfunction[9] |
| **Stem Cell Transplant** | | Optional Stem Cell Transplant especially if sibling is a match | | Hepatic dysfunction[5] |

**TABLE 4: Maintenance Phase of ALL**

| DRUGS | LATE EFFECTS DUE TO CANCER TREATMENT |
|---|---|
| Daily: 6-mercaptopurine (6-MP) | 6-mercaptopurine - see above |
| Weekly: methotrexate often along with vincristine (IV) | Methotrexate – see above. Vincristine – see above |
| Steroid (prednisone or dexamethasone)<br>• Given for brief period every 4-8 weeks | Prednisone or dexamethasone - see above |

## Supportive naturopathic treatment options for ALL patients

ALL is the most common pediatric cancer.[11] Due to improved therapies, the five year survival rate for children with ALL is nearly 90%.[11] However, 67% of those develop at least one treatment-related late effect. The severity and intensity of these late effects is largely dependent on the type of treatment received (i.e. chemotherapy, radiation, immunotherapy).[11] Adult survivors of pediatric cancer are more prone to chronic illness and have an 80.5% risk of having at least one disabling or life-threatening condition by the age of 45.[12] The most common late effects observed in ALL survivors is cardiovascular disease, peripheral or sensory neuropathy, bladder and skin cancers (10 years post-treatment), decreased bone mineral density, cognitive learning and memory difficulties, obesity, dental abnormalities, and fatigue and sleep problems.[5] Monitoring for mental health disorders should also be considered along with limitations in health care access and insurance.[5]

Naturopathic medicine utilizes individualized patient-centered care. Treatment and follow-up care will differ depending on the patient's age, specific conventional therapies, personal medical history, as well as the side effects they experienced as a result of conventional treatment. Following the conclusion of their conventional cancer treatment, patients should have an annual thorough physical exam and medical history intake. This visit should incorporate pertinent bloodwork and imaging.[4,13] Patients should also be monitored for the following: any previous health concerns before the cancer diagnosis, organ and tissue damage, changes in bodily function from the cancer or its treatment, developmental abnormalities, mood changes, abnormal behavioral changes, learning disabilities, nutritional status and any second cancers.[4,13] ALL survivors should be counselled on nutrition, exercise, maintaining a healthy weight and encouraging as well as monitoring regular dental appointments.[4,13]

The role of naturopathic medicine within oncology has grown in recent years. The Oncology Association of Naturopathic Physicians (OncANP) was formed in 2004 with the goal to improve survival and quality of life for cancer patients.[14] In 2016, the OncANP developed a Principles of Care (POC) guideline to help provide patient-centered care within the areas of assessment, treatment planning, care management, interprofessional collaboration, and survivorship care.[14] There have also been significant advances in published research demonstrating the safety and efficacy of natural and supportive care.[14]

In keeping with the POC guidelines, the care management for survivors of ALL should incorporate best-practice recommendations supported by evidence-based research and include the totality of the patient's circumstances.[14] The patient's personal preferences and values are discussed while ensuring appropriate referrals are recommended as needed.

Of long-term survivors, 90% report receiving some form of medical care for treatment related adverse effects, of which only 18% receive screening tests or counselling, which may help to reduce their specific risks of cancer.[15] This highlights the need for naturopathic medicine. Promoting healthy lifestyle behaviors with a focus on diet and physical activity for the ALL survivor helps to mitigate or prevent late-term effects.[15] Adult survivors of ALL are at an increased risk of obesity, dyslipidemia, hypertension and insulin resistance. This may lead to earlier onset cardiovascular disease, which is the leading cause of non-relapse deaths in survivors of childhood cancer.[16] Early intervention to alter body composition, in order to maintain a healthy BMI and decrease insulin resistance, may contribute significantly to decreasing the risk of premature morbidity and mortality.[16] It is important to follow proper screening guidelines in order to prevent cardiovascular disease in high risk pediatric ALL survivors, including referrals for ECG's and testing for biomarkers.[17]

Decreased physical activity levels among ALL pediatric survivors have been linked to the development of metabolic syndrome.[18] A recent meta-analysis showed that obesity is prevalent in ALL survivors, independent of patient characteristics and treatment approaches.[18] Disorders of the skeletal, musculoskeletal, neuromuscular, cardiopulmonary and cardiovascular systems, as well as metabolic disorders are all reported to be positively impacted by a number of different studies ranging from 3 weeks to 12 months.[19] Counselling pediatric ALL survivors on increasing their physical activity may be beneficial as a part of their naturopathic treatment plan with the above disorders.

Diet and nutrition may play an important role when it comes to reducing the risk of developing secondary malignancies and cardiovascular disease.[20,21,22] For pediatric ALL survivors, educating patients and parents on evidence-based nutritional protocols is crucial for their long-term health in preventing post-treatment obesity.[20,23] An example of an evidence based approach to nutrition in this case is the Mediterranean diet. This nutritional protocol consists of high amounts of diverse vegetables and fruit, nuts, seeds, poultry and fish, uses olive oil as a fat source, and recommends limiting red meat and processed food.[21,22] It also promotes a balanced ratio of omega 6 and omega 3 fatty acids, high fibre and antioxidant intake.[21,22] The NOURISH-T study by Stern et al. demonstrated benefits when pediatric cancer survivors consumed a diet high in vegetables and fruit as well as whole grains along with avoiding foods high in fat.[23]

Naturopathic doctors should also counsel pediatric ALL survivors to minimize the risk of comorbidities and ALL recurrence.[4] These behaviors include smoking, excessive alcohol intake, drug use, excessive UV radiation exposure and a sedentary lifestyle.[4,24] Increased frequency of follow up appointments may be necessary to support patients who have already engaged in these unhealthy habits.[25]

Bone mineral density (BMD) is also a long term concern for survivors of pediatric cancer.[5,12,19,26] A 2013 report from the St. Jude Lifetime Cohort Study discovered that approximately 10% of young adult pediatric cancer survivors whose conventional

cancer therapy included dexamethasone and methotrexate developed osteoporosis.[5,12,26] Male patients and those who received conventional cancer treatment during adolescence are at higher risk of low BMD.[26] It is important to follow appropriate screening guidelines, which include bone density evaluation (DXA) in order to avoid low BMD.[27] Vitamin D and calcium supplementation, as well as weight-bearing exercises used to increase lean muscle mass, may help increase BMD in pediatric cancer survivors.[26]

Vitamin D deficiency is common in pediatric ALL patients and supplementation may improve this deficiency within a short period of time.[27] Protection from UV exposure to help prevent skin cancer, which is a long-term risk factor for patients who had vincristine chemotherapy, may contribute to the development of vitamin D deficiency.[5] Low serum vitamin D levels are associated with developing secondary cancers, cardiovascular disease as well as low BMD in ALL survivors.[28,29] A 2017 study by Demirsoy et al. demonstrated that patients who were not supplemented with vitamin D or calcium had the lowest BMD scores at 8 and 24 months post-diagnosis; therefore, supplementation with vitamin D and calcium is important for long term prevention and treatment of low BMD.[30]

The risk of secondary effects increases with increasing age of the adult survivor as well.[31] Follow up care should be initiated early and throughout their lifetime. In the Childhood Cancer Survivor Study Cohort, childhood cancer survivors are at significantly higher risk for second neoplasms.[31] A twenty-five year follow-up study of 5760 participants of ALL survivors who were treated between 1970-1986 were compared to the general population and a sibling cohort. They were found to have a higher cumulative mortality of 13% at 25 years from diagnosis, mostly from recurrent ALL and secondary neoplasms.[32] If the pediatric ALL survivor had undergone radiation therapy, or was younger than 5 years old during treatment or experienced a relapse of leukemia, they were at increased risk for adverse long-term outcomes.[32,33] Patients who were in the high risk group undergoing cyclophosphamide chemotherapy may be at an increased risk for acute myeloid leukemia, hepatic dysfunction and bladder cancer as well.[5]

Pain is also an important consideration when treating pediatric cancer survivors. Research conducted by Lu et al. analyzing the results from the Childhood Cancer Survivor Study showed that pediatric cancer survivors experienced more pain than their cancer-free sibling counterparts.[34] Regular acupuncture sessions may be useful for pediatric ALL survivors experiencing pain as a long term sequelae.[35] Female patients were also found to be at an increased risk of pain among pediatric cancer survivors.[34] Another risk factor of having long term post-treatment pain may be having experienced chemotherapy induced peripheral neuropathy (CIPN), which is common in childhood ALL survivors who received vincristine, paclitaxel or cisplatin chemotherapy.[35,36,45] A number of therapies have been researched for CIPN; however, more research is required for this specific patient subset.[45]

Psychosocial treatment, such as counselling, also plays a very important role as there are many mental/emotional aspects of receiving cancer treatment as a child or teenager, such as anxiety of recurrence and eating disorders.[24] Support for these issues can have a profound influence on recovery.[24] For depression, Cognitive Behavioral Therapy (CBT) is an effective treatment for depression and patients should be referred if deemed necessary.[44] Physical exercise has been shown to attenuate depressive symptoms, interpersonal problems, and negative self-esteem issues as well in pediatric cancer survivors.[19]

Fatigue is also a common side effect of pediatric cancer survivors and referrals for psychological and behavioural interventions as well as following proper screening guidelines should be done as there are many underlying health conditions that could be contributing to it.[5] Nutrition and physical exercise may play a role in the severity of fatigue and overall wellbeing for pediatric cancer survivors and should be properly addressed.[5,20]

There have been significant advances in research for naturopathic supportive options for adult survivors of pediatric ALL. However, more research is required on supportive therapies and recommendations that may reduce long-term side effects as a result of treatment.

As part of the patient's healthcare team, naturopathic doctors supporting adult survivors of ALL should establish early and regular communication with the patient's oncologists, family doctors, nurses and/or pharmacists in order to inform them of all of the naturopathic treatments they are receiving in order to ensure safety and efficacy. This collaborative effort among all members of the patient's healthcare team provides optimal patient-centered and focused care.

## About the Authors

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