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Assessment and treatment of pediatric behavioral sleep disorders in Canada

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ABSTRACT

Objectives/background: This paper outlines the current state of Canadian training, clinical services, research, and advocacy initiatives related to non-respiratory sleep disorders, with a specific focus on insomnia, the most common sleep problem in children.
Methods: Information for this narrative review was collected from peer-reviewed publications, web-resources, and personal communications and experiences.
Results: It is estimated that approximately one-third of Canadian children and youth present with insomnia, and that this is impacting their physical and mental health, as well as learning in school. Training in pediatric sleep is limited and highly inconsistent within and across disciplines. While there are some publicly and privately funded pediatric sleep services available, these are mostly focused on respiratory sleep problems and are not equally accessible across the country.
Conclusions: Pediatric assessment and treatment services for non-respiratory sleep disorders needs to be more integrated into the Canadian health care system.

1. Introduction

The field of pediatric sleep practice and research in Canada, like most other countries, is in its infancy. Pediatric sleep services have historically focused on respiratory-related sleep problems, but recently increased focus has been evident on non-respiratory sleep problems. This paper outlines the current state of Canadian training, clinical services, research, and advocacy initiatives related to non-respiratory sleep disorders, with a specific focus on insomnia, the most common sleep problem in children. In order to provide context for this paper, we first review the Canadian context to help the reader put into perspective issues related to pediatric insomnia.

2. The Canadian context

Based on the most recent census data in 2016 [1,2], Canada is the second largest country but has the 38th largest population in the world, making it one of the most sparsely populated countries. While the majority of people live in large and mid-size cities approximately 15% live in remote and underserviced areas. Canada's population is approximately 35 million, of which about 7.8 million (22.4%) are 19 years or younger. More than 200 ethnic origins were reported in the census, of which 13 exceeded populations of one million. Asia (including the Middle East) was the largest source of immigrants over the last five years [2].

Canada is comprised of 10 provinces and three territories, which differ dramatically in size and population (eg, ~36,000 to ~13.5 million), as well as by variables such as growth rate (eg,

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0–12%) and ethnicities. Canada has two official languages, with 56% of the population indicating English as their first language, and 21% indicating French as their first language.

Canada has a very high Human Development Index (10th out of 188 countries), indicating that Canadians on average experience a long lifespan, high levels of education, and high per capita income [3]. However, Canada also has relatively high and growing income inequality, with one of every seven children living in poverty [4].

Canada has universal health care that is publicly funded through a provincially based system [5]. Medicare is available at no cost (or minimal cost) to all Canadians and accounts for 70% of all health care expenditures (30% is through private insurers or out-of-pocket). Medicare does not cover prescription medication, but provinces may provide partial coverage for children and/or those living in poverty.

Publicly funded services vary across Canada, as health ministries in individual provinces and territories determine which services are funded, and at what level. This results in unequal access for Canadian children to the evaluation of sleep disorders (eg, availability of sleep laboratories and of clinicians with knowledge of pediatric sleep) and treatment, which will be outlined below. The Canadian Association of Paediatric Health Centres (CAPHC), founded in 1968, represents child and youth health service delivery organizations across the continuum of care. Its mission is to improve health service delivery for all Canadian children and youth [6].

Two key issues facing Canadian youth today that have significant implications for pediatric sleep are high rates of mental health disorders and poor adherence to healthy lifestyle behaviors. The Mental Health Commission of Canada (2018) [7] reports that approximately 15% of children and youth in Canada (ie, 1.2 million) are affected by mental illness, but fewer than 20% receive appropriate treatment. In terms of healthy lifestyle behaviors, as reported by ParticipACTION [8], 65% of children and youth in Canada do not meet physical activity guidelines, and 30% are overweight or obese. On average, Canadian children spend 7.5 h a day on screen-based activities. The majority of Canadian children (~75%) have greater-than-recommended sodium intakes due to consumption of processed foods. All of these issues are likely having an impact on sleep in Canadian children.

3. Sleep in Canadian children

No epidemiological data exist on sleep parameters for Canadian children. Recently, two studies have been published regarding sleep duration in representative samples of Canadian youth. Michaud and Chaput [9] used data from three cycles (2007–2009; 2009–2011; 2012–2013) of the cross-sectional Canadian Health Measures Survey (CHMS). The sample was grouped into school-aged children (6–13 years of age; n = 4023) and adolescents (14–17 years of age; n = 1607). The survey was based on parent-report for children 6–11 years of age and self-report for 12–17 year-olds. Both sleep duration over a 24-h period and sleep quality were assessed. From this information, participants were classified as to whether they did or did not meet recommendations for sleep duration (ie, 6–13 years of age: 9–11 h/night; 14–17 years of age: 8–10 h/night). Approximately 20% of children and 30% of adolescents were short sleepers compared to the guidelines, with only 1.6% of children and 2.4% of adolescents being long sleepers. Sleep duration did not differ significantly between males and females. Sleep quality issues were common, as approximately 32% of children and 42% of adolescents had trouble going to sleep or staying asleep. Roughly 11% of children and 31.5% of adolescents reported being significantly sleepy during the day.

A second study, conducted by Chaput and Janssen [10], examined a representative sample of Canadian youth aged 10–17 years of age. The sample consisted of 24,896 participants from the 2013/2014 Canadian Health Behaviour in School-Aged Children study, who self-reported on their bedtimes and waketimes. Sleep duration was calculated and compared to recommended ranges (ie, 10–13 years of age: 9–11 h/night; 14–17 years of age: 8–10 h/night) to determine the proportion of the sample that slept less or more than recommended. Only a small proportion slept for longer than recommended (ie, less than 2% overall), whereas almost a third slept less (ie, 31% of 10–13 year-olds and 26% of 14–17 year-olds). Differences in sleep duration between the sexes were found to be small and not deemed to be clinically relevant.

Other studies examining sleep in Canadian children have been in geographically defined samples. In a study examining sleepiness in a sample of 2200 Canadian youth from Ontario, Gibson et al. [11] found that 70% of the sample reported less than the recommended duration of sleep, and 40% self-reported high levels of sleepiness, with morning sleepiness being the most prevalent. Sleepiness was associated with lower academic grades, being late for school, fewer extracurricular activities, and missing activities such as social activities, sports, or work. In another study of 5560 grade 5 students (aged 10–11 years) in Nova Scotia [12], parents reported that half of the children were not getting enough sleep. Longer sleep duration was associated with better quality diet, more physical activity, and decreased risk of obesity.

Few studies have examined Canadian children's sleep and healthy lifestyle behaviors. A recent study of 3400 grade 5 students (10–11 years of age) in Alberta found that 64% had access to one or more electronic communication and/or entertainment devices in their bedrooms, which was associated with shorter sleep durations, higher body weights, lower quality diets, and lower physical activity levels [13]. Similarly, a study by LeBlanc et al. [14] found total sedentary time to be negatively associated with sleep duration based on data from over 500 children who were part of the International Study of Childhood Obesity Lifestyle and the Environment study.

Preliminary research has demonstrated that short sleep duration is associated with negative behavioral and emotional outcomes in Canadian children and youth. Carson, Tremblay, Chaput, and Chastin [15] found that, based on data from the CHMS for 4200 children and youth aged 6–17 years, short sleep was associated with increased emotional and behavioral problems. Reid, Hong, and Wade [16] analyzed data from three cross-sectional cohorts of almost 9000 2–3 year-old children from the Canadian National Longitudinal Study of Child and Youth, and found that sleep problems were a strong predictor of emotional and behavioral problems. Touchette et al. [17] found that short sleep in young children was correlated with more externalizing problems and lower cognitive performance at school entry.

One concerning finding for Canadian children and youth is that they are frequently treated with sedative medication for insomnia. A recent survey of Canadian pediatricians and family physicians [18] found that, despite only 19% of respondents being formally trained on treating sleep disorders, 66% of family physicians and 89% of pediatricians had recommended sedating medication to treat insomnia over a 6-month period. The most commonly recommended over-the-counter medications were melatonin (73%) and antihistamines (41%), and the most common prescription medications were antidepressants (37%) and benzodiazepines (29%). These were recommended in patients with mood disorders, developmental delays, and Attention-Deficit/Hyperactivity Disorder (56%, 40%, and 39%, respectively) to address insomnia, bedtime struggles/delayed sleep onset, and circadian rhythm disorders (52%, 48%, and 28%, respectively). Thirty percent of respondents had also recommended medication for otherwise healthy children with sleep problems. Responding to emerging medication use

patterns, the psychiatry section of Choosing Wisely Canada, a national group advocating for reducing unnecessary medical tests and treatments, listed as their first recommendation that physicians not use atypical antipsychotic medications as a first-line treatment for insomnia in children [19].

4. Training for pediatric health care professionals

A recent survey of health care providers in Canada provided data about the rates of screening and diagnosis, evidence-based intervention implementation, and related knowledge bases for pediatric sleep disorders [20]. Participants were 97 health care providers (ie, pediatricians (n = 47), family physicians (n = 35), general practice physicians (n = 9), oncologists (n = 2), nurses (n = 3), and psychologists (n = 1)) attending a continuing medical education (CME) course, who completed a survey that included inquiry about their training in sleep. Only 3% of the sample had received formal training in pediatric sleep. Most health care providers indicated that they got information about pediatric sleep through CME courses, journal articles, experience, and speaking with experts. Although more than 50% of Canadian participants reported attending CME events to obtain sleep training, the mean of the correct responses to questions about sleep and sleep disorders on the survey subscales varied from 41.3% to 74.6%. Most health care providers reported asking questions about children's sleep when conducting examinations for healthy children; however, they also described inadequate screening for sleep disorders [20]. Nearly 50% of providers recommended melatonin as opposed to behavioral interventions as the first-line treatment. Almost one-third of respondents reported providing advice for behavioral sleep problems that could worsen the problem. Unfortunately, no Canadian study reports pediatric sleep training by professional disciplines.

4.1. Physicians

The amount of education about, or clinical exposure to, sleep medicine varies at all levels of medical education, from undergraduate medical school curriculum to residency and fellowship training. No national standard is in place to ensure that medical students and medical trainees (residents and fellows) receive education in this area.

Canada has 17 undergraduate medical schools (14 English and three French). Curricula across the country incorporating sleep disorder medicine vary widely (personal experience of author SW). In a study published in 2011, surveys were sent to 409 medical schools across 12 countries to evaluate the education about sleep during undergraduate medical education. The response rate was 25.9%, and the results showed that the average time spent teaching about sleep was 2.5 h, with 27% responding that no time was spent on this area. Canadian results were combined with results from the United States of America (USA); responses from these two countries and Australia were the only ones to endorse spending more than 3 h on sleep education [21].

In post-graduate training, there may be national standards regarding curriculum in sleep disorder medicine depending on the specialty. In a study by Mindell et al. [22]; surveys were completed by directors of 152 pediatric residency programs in 10 countries. The average time spent on sleep education was 4.4 h. It was not possible to evaluate the results in Canadian residency programs in this survey, as, again, combined responses from program directors in the USA and Canada were reported together [22].

The standards for Objectives in Training (OTR) are set by the Royal College of Physicians and Surgeons of Canada (RCPSC) for all physicians in training, except for family physicians, whose training is overseen by the College of Family Physicians of Canada (CFPC). In some specialties in which a consultant logically would be required to have knowledge of sleep disorder medicine, there are OTR standards. The OTR vary across specialties depending on their typical focus. Overall, a lack of formal integration of respiratory and non-respiratory sleep disorder medicine education exists across subspecialties, although some programs have addressed this by having post-graduate trainees participate in clinics where sleep problems are assessed and treated.

As of 2018, the RCPSC offers a diploma under the auspices of the Area of Focused Competence. The diploma is awarded following a one-year program in sleep disorder medicine, and is available to both adult and pediatric fellows who have completed training in respirology, psychiatry, neurology, developmental paediatrics, or otolaryngology. A structured curriculum is followed, and evaluation is by portfolio assessment. A Practice Eligibility Route to recognition of Area of Focused Competence will also become available in the future. This standardization of training in sleep medicine across Canada will emphasize developing comprehensive clinical knowledge of all sleep disorders (respiratory and non-respiratory), learning how to direct a sleep laboratory, as well as building competence in sleep medicine research.

4.2. Nursing

Although 88% of Canadian undergraduate nursing programs include sleep content in their curricula, only 68% of programs include content on pediatric sleep, with an average of 72 min allotted to pediatric sleep topics [23]. Twice as much time is allocated to content about “normal” sleep and sleep problems in the adult population. Delivery of pediatric-specific content depends on having a faculty member with relevant clinical and research expertise and, given the lack of formal training opportunities in pediatric sleep, such faculty members are uncommon in nursing.

Findings from the USA support lack of undergraduate nursing students' exposures to sleep; more than 50% of programs have offered only 1 h or less of instruction both on normal sleep for children and sleep disturbances [24]. A publication by expert nurses in the field of sleep and circadian rhythm disorders recommended curricular elements and clinical experiences about sleep for all undergraduate and graduate nursing programs [25]. They provided a conceptual model of impaired sleep and important learning objectives and expected competencies for undergraduate nursing students and advanced practice graduate nursing students (eg, nurse practitioners or clinical nurse specialists). The authors provided no specific objectives related to pediatric sleep and the clinical examples provided involved adult patients experiencing acute physical illness and mental health problems. Lack of uptake of these curricular and competency-based recommendations might be overcome by lobbying regulatory bodies to include pediatric sleep content in entry-to-practice competencies.

With regard to post-graduate sleep education, nurses, like other health care professionals, can access evidence-based information about children's sleep through pediatric conferences and workshops. To the best of our knowledge, Canadian post-graduate nursing courses dedicated to pediatric sleep and sleep problems or Canadian-based nursing conferences focused on pediatric sleep are lacking. Content elements regarding pediatric sleep may exist in advanced practice nursing programs that are not easily identified from website information, although studies from the United States would suggest that is not the case [24].

4.3. Psychology

Training to be a practicing psychologist in Canada (eg, clinical psychologist, school psychologist, or counseling psychologist)

typically involves course-based instruction, practica, and an in-depth internship/residency placement. Currently, no data are available regarding the extent of training in pediatric sleep and its disorders across Canadian psychology programs. Training in sleep is not required as a competency in applied psychology graduate programs. Typically, pediatric sleep content is only included in the curriculum based on faculty member interest. Some students may learn about pediatric sleep during practicum experiences, but, again, this is not mandated.

Similarly, training in pediatric sleep during psychology internships/residencies is not mandated. Meltzer, Philips, and Mindell [26] surveyed 212 internship program directors in clinical psychology from Canada and the USA, and found that 59% of the programs offered some sort of clinical training in the assessment, diagnosis, or treatment of sleep disorders. Faculty members who specialized in sleep or circadian rhythms were present in only 17% of programs, with 19% of these faculty members focusing exclusively on pediatric sleep, 38% on adult sleep, 3% on geriatric sleep, and 40% on a combination of age groups. These numbers indicate that clinical psychology training in pediatric sleep lags behind needs. Practicing psychologists commonly need continuing education credits/experiences as part of maintaining their licensure, but there is no mandate to include training on sleep. Psychologists interested in building competencies for assessing and treating sleep problems in children would require workshops, supervised practice, or other training opportunities.

4.4. Allied health professionals

Allied Health Professionals (AHP) are professionals who work in the health care system who are not physicians, nurses, pharmacists, or psychologists The knowledge and resources necessary to assume an active role in sleep-related therapy is inconsistent across therapists and training programs [27,28]. A survey of Canadian occupational therapists [29] revealed that, most of the study participants understood that restorative sleep is important for patients requiring rehabilitation, but lacked the resources and training to feel confident in their ability to intervene. Participants identified that sleep physiology and intervention strategies were not part of their pre-entry to practice training and that their knowledge came primarily from continuing professional development activities and self-directed reading.

Rehabilitation therapy professional bodies have developed and disseminated role statements and frameworks establishing sleep as a domain of practice to guide curriculum planning and educational program accreditation [30]. These professional communication tools facilitate therapists' efforts to educate other stakeholders about patients' need to access sleep-related interventions. Although sleep is not part of most rehabilitation professionals' curricula, there is a growing awareness that sleep is foundational to good physical and emotional health and functioning, and a number of universities are offering electives or embedding lectures on sleep in other courses. To bridge the gap between formal pre-entry to practice sleep education, build research collaborations, and foster mentorship opportunities, therapists typically join multidisciplinary organizations such as the Canadian Sleep Society [31], consult core sleep textbooks specific to their disciplines (for example, Refs.[32,33]), and participate in online communities of practice (eg, Ref. [34]).

5. Pediatric sleep treatment services

Children in Canada may access sleep assessment and treatment strategies through a range of services, some which are covered through Medicare, and some of which are not. As noted previously, health and education are both provincially regulated, resulting in significant variability in service availability across Canada. Given that treatment for behavioral insomnia does not usually occur in Canadian sleep laboratories, which mostly focus on children with sleep-related breathing problems, and that the services of these sleep laboratories is described in another paper in this special issue, we will not cover this information in the current paper. However, it is important to note that polysomnography may at times be relevant to the assessment and treatment of insomnia, particularly when evaluating for differential diagnoses and comorbidities. Below is the state of access to sleep services for behavioral insomnia in Canada.

5.1. Primary care

Primary health care (PHC) is the foundation of Canada's health care system. In most circumstances, Canadian PHC is limited to family physician or nurse practitioner care. However, the goal is to move to a model of community PHC offering integrated, interdisciplinary care, which includes nurses, physicians, and a mix of other professionals (eg, social workers, occupational therapists, pharmacists, dieticians, public health practitioners, and psychologists) [35,36]. PHC is the first point of contact with the rest of the Canadian health care system. Given the prevalence of behavioral pediatric sleep problems in the population, we would expect that treatment would be common within PHC. Unfortunately, we have little data on pediatric sleep and PHC; available data pertain exclusively to care by physicians.

A recent internet-based study of parents from Canada, the USA, and Australia found that 80% of parents would contact their primary care provider first (among professionals) for help with their child's sleep problems [37]. However, data from the baseline assessment of a clinical trial conducted with parents in PHC whose children had sleep problems found that only 11.5% of parents had talked to their family physicians about their children's sleep [38]. In contrast, 82% of health providers who were surveyed about their management of pediatric sleep, of which about 45% were primary care providers, reported that they routinely asked parents about children's sleep [20]. Parents reported that the most common physician response was to provide some general advice. The next most common response was to provide support and reassurance without any advice. Less frequently reported was making a referral, suggesting an over-the-counter or herbal product, or providing a prescription. When physicians were asked about practices, they reported discussing ways to help young children fall asleep and asking about discipline [20]. A survey of family physicians and pediatricians in southwestern Ontario found that 30% recommended medications or an over-the-counter product to help healthy children with sleep problems [18].

Although most parents and their children will have contact with PHC, from the limited data available it appears that few receive help for sleep problems. When they do, it is questionable whether advice or recommendations are evidence-based, and too often non-evidence-based management practices (eg, use of medications) occur. It is likely that nurses, social workers, and psychologists working in PHC also provide sleep advice to parents and their children; however, data are needed about these providers' sleep problem intervention practices. Complex cases are often referred to larger centres or specific programs, where available.

5.2. Public health

There is a worldwide public health commitment to support healthy child and youth development [39]. Because public health is a shared responsibility of Canadian federal, provincial, and

territorial governments, municipalities, and Indigenous Peoples' organizations, programs are delivered differently in diverse Canadian jurisdictions [40]. Canadian public health nurses have several key roles including health promotion; health protection, which involves identifying issues that need attention and offering solutions to governments or districts; and population health assessment [40]. There is limited data available about public health programs assisting parents to manage children's behavioral insomnia.

Some Canadian parents have indicated that they engage with public health nurses to manage pediatric sleep problems. In a survey of 512 Ontario parents (with children aged 0–6 years), about 55% indicated that they would consult the internet for information about child development and parenting, 60% indicated that they would access information from a health care provider (eg, nurse, nurse practitioner), 30% indicated that they would access parenting programs, and 23% identified directly accessing public health units to obtain assistance [41].

5.3. Private practices

5.3.1. Regulated health care practitioners

In Canada, provision of pediatric sleep services occurs predominantly within a hospital clinic or sleep laboratory setting. Regulated health care practitioners who deliver pediatric sleep services within a private practice setting are predominantly registered psychologists, but also can include physicians (usually a developmental pediatrician) with expertise in sleep medicine, registered nurses, and AHP such as physiotherapists, occupational therapists, and social workers. Few professionals in private practice focus only on pediatric sleep problems; rather, they provide services to children that address a broad range of concerns. Therefore, a potential barrier to accessing treatment is families' lack of awareness that a provider's scope of practice might include the ability to address pediatric sleep problems. Provincial health care coverage does not typically include psychological services or services from nurses or AHP outside hospitals or public mental health clinics. Therefore, the ability to pay for such services is limited to Canadians with sufficient economic resources or private health insurance plans, work-place benefits, or employee assistance plans.

5.3.2. Sleep consultants

Sleep consultants are typically individuals who provide families with advice on sleep concerns for infants and toddlers, and, less frequently, school-age children and adolescents. The most common sleep problems addressed by sleep consultants are frequent night waking and bedtime resistance, but many consultants also address transition out of the crib, daytime napping, and prevention of later sleep problems for newborns. Services provided vary widely, but most often include an individual consultation, either in-person, by phone, or internet-based, along with a period of follow-up. The cost of these services ranges from hundreds to thousands of dollars; as they are not covered by provincial health plans or private insurers, the costs are borne by the family.

Although some sleep consultants are regulated health care professionals, the majority are not regulated by a governing body, nor do they follow a code of ethics. Families therefore have no assurance of the sleep consultant's professional conduct or competency to provide advice related to pediatric sleep problems. Several educational programs lead to sleep consultant "certification," but these are not standardized or regulated, and vary widely in qualifications of instructors, amount and nature of the content, mode of delivery, and mentoring offered. Two associations for sleep consultants exist (International Association of Child Sleep Consultants and the Association of Professional Sleep Consultants) and each has a code of ethics for members but no regulatory ability to govern sleep consultant activities with the public other than revocation of membership if a concern is reported [42]. The recent proliferation of sleep consultants [42,43], and parents' willingness to pay unregulated providers for such care attests to both the need and limited access to health care professionals who can provide pediatric sleep assessment and treatment.

There are a number of risks associated with receiving service from sleep consultants who are not regulated health professionals, and as such there is no overseeing body that can ensure evidence-based practice. Concerns include the fact that proper training in sleep assessment and treatment is not guaranteed, and consultants may miss or provide wrong diagnostic information related to co-morbid sleep disorders, may not have the needed knowledge to provide differential diagnoses (eg, nocturnal seizure disorder versus night awakenings), do not have the expertise to identify and treat parental mental health issues that could be affecting the child's sleep (eg, post-partum depression), and lack the ability to offer treatment beyond simple sleep education.

5.4. School system

Gariépy, Janssen, Sentenac, and Elgar [44] published the first Canadian study evaluating school start times and the association of these with students' (aged 10–18 years) sleep duration and daytime sleepiness. The average school start time across 362 schools (~30,000 students) was 8:43 am, which is consistent with the recommended school start time of 8:30 am based on the American Academy of Pediatrics [45]. Gariépy et al. [44] reported that 60% of students met the recommended sleep duration, yet 60% of these students reported feeling sleepy in the morning. Based on regression models, later start times were associated with more students meeting recommended sleep durations and fewer students reporting morning tiredness. There is no national or provincial/territorial mandate to change school start times, but some school boards have implemented later start times and have informally reported on the success of this strategy.

As noted previously, education is provincially regulated and as such, there is no single national health curriculum. However, the Public Health Agency of Canada supports school health through the Pan-Canadian Joint Consortium for School Health [46], a partnership established in 2005 among federal and provincial/territorial governments (including Ministries of Health/Public Health and Ministries of Education). The consortium strives to promote the health, well-being, and achievement of students through the Comprehensive School Health (CSH) model. CSH is an international framework that "addresses school health in a planned, integrated, and holistic way in order to support improvements in student achievement and well-being" [46]. This consortium has generated novel provincial/territorial initiatives, as well as development of tools and toolkits for use across Canada. Unfortunately, no national initiative has been developed about sleep or sleep education.

As Gruber [47] clearly articulated in her review and analysis of school-based sleep education programs, there currently exists a knowledge-to-action gap in that sleep education is not being widely taught in Canadian schools despite the large body of research that demonstrates the impacts of poor sleep on health, well-being, and achievement. After reviewing the existing 15 published studies evaluating school-based sleep health promotion programs (none of which were conducted in Canada), Gruber identified mixed findings demonstrating changes in students' knowledge about sleep and changes in sleep behaviors or other health outcomes. However, by applying a knowledge-to-action framework to evaluate the studies' strengths and weaknesses, Gruber provided recommendations to enhance the effectiveness of

these programs (eg, adapting the program to the place in which it will be implemented, tailoring to users' needs).

Using the recommendations generated in the 2017 review article, Gruber developed and implemented the first Canadian school sleep education program, Sleep for Success™ [48]. This program was developed collaboratively between researchers and educators and offered a six-week curriculum to be delivered in the classroom. The program was evaluated using a community-based participatory research approach in three schools with 71 students. Significant improvements in the treatment group were found for sleep duration, sleep efficiency, and sleep onset latency (based on actigraphy), as well as improved grades in Math and English. Although these results are very promising, generalizability was constrained by a non-randomized and non-blinded trial design. Nonetheless, Sleep for Success™ represents an important step forward toward sleep education for Canadian children.

Canadian pediatric sleep researchers and clinicians must continue to advocate for sleep education in Canadian schools. Evidence is growing that sleep, as one of four healthy lifestyle behaviors (along with physical activity, diet, and screen time), uniquely and additively contributes to overall health and academic achievement [49]. Given this, it will be important to work collaboratively with those researching and promoting other healthy lifestyle behaviors to develop integrated health curricula for Canadian schools.

6. Important Canadian initiatives in pediatric sleep

Below, we highlight four important initiatives regarding pediatric non-respiratory sleep problems that are having an impact on this field in Canada.

6.1. Canadian Institutes of Health Research Sleep Programs

Research is funded in Canada through three national granting agencies ("Tri-Agencies"), including CIHR, the Social Sciences and Humanities Research Council of Canada (SSHRC), and the Natural Sciences and Engineering Research Council of Canada (NSERC), along with various provincial, institutional, and charitable organization funders. Sleep research has traditionally been funded across all national agencies depending on the focus (ie, health, social sciences, natural sciences). Within CIHR, sleep has been funded across many of the 13 interdisciplinary, virtual institutes, which are focused on specific areas and link and support researchers with common goals (eg, neurosciences and mental health, psychosocial aspects of children's health), and across four pillars (ie, biomedical, clinical, health systems and services, and the social, cultural, and environmental factors that affect the health of populations). The lack of a specific funding base caused the sleep research community to question whether the funding of sleep research and the creation of scientific knowledge related to sleep was disadvantaged.

After a decade of advocacy by sleep researchers such as Drs. Benjamin Rusak and Jacques Montplaisir, who recommended the coordination of funding of sleep research and identified the research themes that could become the focus of a strategic initiative, CIHR issued a call for "Team Grants in Sleep & Circadian Rhythms," led by the Institute of Circulatory and Respiratory Health in partnership with the Institute of Human Development Child and Youth Health and the Institute of Neurosciences Mental Health and Addiction. The program emphasizes the production of new knowledge and translation of research findings into improvements in the health of populations and health care systems.

Four CIHR Team Grants in Sleep & Circadian Rhythms were awarded in 2010. Three of the four funded projects focused on adult sleep, and one on pediatric sleep: *Better Nights/Better Days: Improving Psychosocial Health Outcomes in Children with Behavioural Insomnia* (PI: Penny Corkum). This was a major initiative to advance pediatric sleep research in Canada.

6.2. Better Nights, Better Days

The CIHR-funded team grant titled *Better Nights/Better Days: Improving Psychosocial Health Outcomes in Children with Behavioural Insomnia* brings together leading Canadian researchers and clinicians in the field of pediatric sleep and internationally recognized senior researchers in other areas of sleep, clinical trial design, eHealth, and knowledge translation. This team is joined by a national Knowledge Translation Advisory Board with representation from a number of associations involved in children's health (http://betternightsbetterdays.ca/). The primary objectives of this research project are to:

1) Develop a multi-component, eHealth sleep treatment program, in both English and French, for the treatment of insomnia in children from 1–10 years of age.
2) Evaluate the intervention through the use of a Randomized Controlled Trial (RCT) designed to determine the impact of the intervention on children's sleep and children's and parents' psychosocial health.
3) Widely disseminate the intervention in order to reduce the symptoms of insomnia and the negative impacts of this disorder on the many children in Canada with insomnia.

To date, the eHealth intervention, Better Nights, Better Days® (BNBD) has been developed taking a user-centred approach and positioning sleep as a healthy behavior needed for positive child health outcomes. The content of the five sessions of BNBD is delivered primarily via engaging videos and interactive activities. Parents complete sleep diaries throughout the program to provide them with feedback and to track progress toward the goals they established at the beginning of the program. A pan-Canadian RCT is in progress with 533 participants enrolled in the trial to evaluate the program. Sleep of the children and the psychosocial health and daytime functioning of the children and parents are being assessed using objective measures (ie, actigraphy) and subjective measures (ie, sleep diaries, parent, and teacher completed questionnaires) at baseline, and 4 months and 8 months post-randomization [50]. The trial will be completed in October 2018 and the results will be subsequently analyzed and published.

Through this project, the researchers have used the established networks to promote more awareness of insomnia in children, the impact of these problems, and the importance of intervention (eg, social media posts), to train health care providers on how to recognize and treat pediatric insomnia (eg, workshops at conferences), and to advocate for changes in the health care system to better address pediatric sleep problems (eg, CAPHC webinars and conference presentations). The team has also provided a multidisciplinary training program for trainees of all levels (undergraduate students to post-doctoral fellows) that includes monthly webinars and financial support for research translation efforts. The success of this project was instrumental to being awarded funding through the Kids Brain Health Network (http://kidsbrainhealth.ca/) to modify BNBD to develop a transdiagnostic intervention for use with children with neurodevelopmental disorders (BNBD-NDD; http://ndd.betternightsbetterdays.ca/). The BNBD-NDD intervention has been built and the RCT will be starting in January 2019. A training program is also an integral component of this project.

The plan to ensure long-term sustainability of BNBD and BNBD-NDD is to commercialize these products. These interventions would be accessible to parents of children with insomnia (which

represents approximately one-third of Canadian parents of children ages 0–10 years of age) and would be one of the first steps of a stepped care model of treatment for pediatric insomnia. Using eHealth interventions to bridge the evidence-to-practice gap for pediatric insomnia in Canada is particularly fitting given that over 90 percent of Canada's total population has internet access [51].This delivery model can provide evidence-based intervention to remote and underserviced areas of Canada and in Canada's two official languages.

6.3. Pediatric sleep guidelines

Dr. Reut Gruber, child clinical psychologist and professor at McGill University, spearheaded the development of a Canadian position paper on pediatric sleep, which was the outcome of a CIHR-funded meeting of over 30 thought leaders representing a range of professional organizations (ie, pediatrics, psychology, psychiatry, public health, and schools), and a number of academic institutions [52]. The position paper was broad in that it described a range of pediatric sleep problems including insomnia, sleep-related breathing disorders, hypersomnias, circadian rhythm sleep disorders, parasomnias, and sleep-related rhythmic movement disorders.

The position paper aimed to: 1) describe the role of sleep in physical and mental health, 2) specify the impact of sleep deprivation on children and youth, 3) provide health care providers with interventions to prevent sleep deprivation, and 4) describe evidence-based tools and guidelines that can be use in the assessment and intervention of pediatric sleep problems by health care providers. The position paper was published in the Journal of the Canadian Academy of Child and Adolescent Psychiatry, and was also endorsed by the Canadian Sleep Society (CSS), CPCF, and the Canadian Academy of Child and Adolescent Psychiatry. The report is also posted on the CSS website. These represent the first published guidelines regarding pediatric sleep in Canada.

6.4. ParticipACTION's 24 h guidelines

In 2015, Dr. Mark Tremblay, Director of Healthy Active Living and Obesity Research, Children's Hospital of Eastern Ontario, initiated a working group of experts in the fields of exercise, sedentary behavior, and sleep (comprised predominantly of Canadians, with international representatives) to develop 24-h movement guidelines for Canadian children and youth. As stated by Tremblay, Carson, and Chaput [53] "*There is great desire to optimize the healthy active living behaviours of Canadian children and youth (aged 5–17 years). The way school-aged children and youth spend their time over a 24-h period has important health implications. It is becoming clear that behaviours along the movement continuum (ie, physical activity, sedentary behaviour, sleep) cluster and interact such that their combined effects extend beyond the individual contributions of each behaviour.*"

The guidelines were published in 2016 and disseminated widely to the Canadian public by ParticipACTION [8]. The guidelines are based on evidence that has also been published by the working group [54]. These are the first Canadian national guidelines that incorporate exercise, sedentary activity (eg, screen time), and sleep. These guidelines provide suggestions about living an active lifestyle with an appropriate balance of sleep, sedentary behavior, and physical activities. The specific sleep recommendations in these guidelines are: uninterrupted 9–11 h of sleep per night for those aged 5–13 years of age; 8–10 h per night for those aged 14–17 years of age; and consistent bed and wake-up times [10]. There are now also Canadian guidelines for children aged 0–4 years of age: 14–17 h for those aged 0–3 months and 12–16 h for those aged 4–11 months of good-quality sleep, including naps [55].

7. Barriers and facilitators for the assessment and treatment of behavioral sleep disorders

A few studies have examined barriers and facilitators for the assessment and treatment of behavioral sleep disorders in Canada. The studies address clients' and health care providers' views about the current state of sleep interventions in Canada.

7.1. Parents' perspectives on barriers and facilitators

A study in western Canada surveyed a random sample of parents (n = 359) of children less than 6 years old [39]. Sleep issues were rated as a somewhat or very important topic by 95.8% of parents. Of these parents, 40.7% identified lack of knowledge about available services and programs as a barrier to accessing information and support. Almost 37% identified lack of time, and 36% identified lack of child care as barriers. For modes of delivery, parents preferred the internet and public health drop-in programs [39]. A multinational study (n = 407) that included Canadian (82.1%), Australian (4.2%), and American (13.7%) parents of 2–10-year-old children reported that parents sought help for children's sleep problems from informal sources (partners, friends, family members), the internet, books, pamphlets, or a primary care provider (family doctor, pediatrician, nurse, psychologist, other AHP, or sleep consultant) [56]. Parents identified barriers to help-seeking that included help being too costly, unavailable, or difficult to access. Assistance provided by psychologists and AHP are not covered by provincial health plans and can cost between $500 and $1000. Canadian parents (n = 25) reported on barriers and facilitators for an internet-based sleep intervention for 1–10-year-olds with sleep problems [57]. Facilitators included the helpful tone of the information and videos, including expert testimonials. Barriers included length of sessions (too long), technical challenges, and unhappiness with lack of one-on-one emotional support.

7.2. Professionals' perspectives on barriers and facilitators

From health care professionals' perspectives, many factors are barriers to providing assessment and treatment of non-respiratory pediatric sleep disorders in the Canadian context. A significant barrier is lack of formal pediatric sleep education for health care providers during their training. A Canadian study of non-sleep-specialist health professionals (124 physicians, nurses, psychologists, and social workers) who regularly work with healthy children aged 1–10 years reported on barriers and facilitators to providing assessment and treatment for behavioral insomnias of childhood [58]. The most commonly identified barriers were lack of knowledge, skills, and training, lack of time, and institutional/systems-level and practice setting constraints [58]. Some providers also indicated that pediatric sleep was outside of their scopes of practice, they had limited access to resources and materials about sleep, they experienced a lack of consistency between their approaches and parents' perspectives, and they lacked access to sleep specialists and sleep services. Evidence-based assessment and treatment of pediatric behavioral insomnia were facilitated by knowledge, skills, techniques and training, institutional/system-level and practice settings, and experience with children with sleep problems [58]. Facilitators on an individual level were commitment to addressing sleep problems, belief in the value of sleep, enjoyment of providing support for parents, access to resources and materials, parents' willingness to engage, access to sleep services and specialists, and time. Canadian professionals (n = 30) who responded to an internet-based sleep intervention for 1–10-year-old children identified facilitators as high-quality and user-friendly content, and barriers as excessive length, lack of balance between short-term

challenges for parents and long-term gains, and technical issues [57].

8. Future directions

This overview of Canadian sleep assessment and treatment of behavioral sleep disorders highlights the lack of education and training about sleep in the Canadian university system. Thus, a future direction must be the incorporation of curricular elements about healthy pediatric sleep and pediatric sleep problems in all undergraduate and graduate health care professional education. Moreover, Canadian graduate programs are needed to train a range of providers as specialists in pediatric sleep. Targeting one group for postgraduate certification will not address barriers, such as parents' lack of access to support while managing sleep problems and health care providers' lack of time to address pediatric sleep problems in primary care settings. Moreover, only providing education about healthy pediatric sleep and common sleep problems will not address the complexity of behavioral sleep problems for children with developmental and mental health disorders. Education is necessary for physicians specializing in pediatrics and for the range of health care professionals who work with these client populations.

Canadian researchers have argued that PHC systems require strengthening by building stronger collaborations with public health [59]. To assess and treat behavioral sleep disorders effectively, more integrated systems are needed to promote children's healthy sleep and rapid access to behavioral interventions. Future directions should also include developing pathways for sleep services, such as efficient referral for physically-based sleep disorders and more complex sleep disorders to sleep specialists in hospital-based clinical systems. Integration would broaden access, support a timely system of care provision by the right providers, and prevent unnecessary referrals to sleep specialists with their higher cost and long wait-times [58].

Canadian PHC providers may resist providing assessment and treatment for children with behavioral sleep disorders because they are concerned about their inability to diagnose problems that require specialist expertise and regard access to such providers as a major problem. One of the critical elements of improving integration and interdisciplinary collaboration is communication [59]. Many health care providers are unaware of other disciplines' contributions to pediatric sleep assessment and treatment for non-respiratory pediatric sleep disorders (eg, public health nurses, psychologists, and occupational therapists).

Public health engagement is particularly important in Canada, because people in rural and remote settings have limited access to the specialist services that may exist in major centers. Health care equity and access remain an issue [59]. Lack of time as a barrier may partially reflect health care provider payment systems (fee for service) that encourage high through-put of patients. Short appointments with providers undermine efforts to manage pediatric insomnia and other non-respiratory sleep problems in children. Considerable time is required to conduct thorough assessments, determine parents' perceptions about children's sleep and their willingness to engage with treatment, and to provide psychoeducation. Psychologists can provide time to assess and treat pediatric sleep problems, but their work is not supported by many provincial health care plans and may be unaffordable for families. Sleep consultants are unregulated providers whose services are also often unaffordable. Families who are most at risk of difficulty understanding healthy sleep for children and identifying management solutions will suffer most from inequitable access to providers who use evidence-based approaches. A Survey of Parental Knowledge about Early Brain Development ($n = 512$) demonstrated that single parents, and those with less income and education, were less likely to identify correct strategies promoting brain development, including sleep [41].

Further research is necessary to examine Canadian systemic or institutional barriers to the provision of adequate and evidence-based assessment and treatment for behavioral sleep disorders. Public policy engagement is important to raise the profile of pediatric sleep problems. Although the Canadian government takes the position of a strong emphasis on health promotion for Canadian children, information about healthy sleep and children's sleep promotion is notable by its absence on the public health website (https://www.canada.ca/en/public-health/services/health-promotion.html#ch) [60]. Authentic recognition of sleep disorders as a high-prevalence public health issue [61], with major implications for the well-being of infants, children, youth, and parents, should be followed by widespread education of the public and care providers, and improved services. Research to design better ways to accomplish these goals and to measure the impact will be critical to success. We look forward to a future in which the Canadian landscape of behavioral pediatric sleep will be characterized by access to high quality care and continuity of care.

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Conflict of interest

None declared.

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