Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep

Guideline Development Report

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The *Guideline Development Report* has been prepared by members of the 24-Hour Movement Guidelines Leadership Group, a working group consisting of representatives from each of the guidelines supporting partners, assisted by the guidelines methodology consultants.

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# Table of Contents

SUMMARY .................................................................................................................. 5
Guideline Questions ...................................................................................................... 5
  Physical Activity ........................................................................................................ 5
  Sedentary Behaviour ................................................................................................ 5
  Sleep .......................................................................................................................... 5
  Physical Activity, Sedentary Behaviour, and Sleep .................................................. 5
Target Population ......................................................................................................... 5
Key Evidence – Sources ............................................................................................... 5
Methods – Systematic Reviews .................................................................................... 6
Methods – Compositional Analyses ............................................................................. 6
Methods – Synthesis of Evidence and Guideline Development .................................... 6
Key Evidence – Results ............................................................................................... 6
  Physical Activity ........................................................................................................ 6
  Sedentary Behaviour ................................................................................................ 7
  Sleep .......................................................................................................................... 7
  Physical Activity, Sedentary Behaviour, and Sleep .................................................. 7
  Compositional Analyses ............................................................................................ 7
Final Canadian 24-Hour Movement Guidelines for Children and Youth ...................... 8
  English Version ......................................................................................................... 8
  Version française ....................................................................................................... 10
Changes from Previous Guidelines ............................................................................. 12
References from Applied Physiology, Nutrition, and Metabolism ............................. 13
Copyright ..................................................................................................................... 14
Disclaimer .................................................................................................................... 14
FULL REPORT ............................................................................................................... 15
Guideline Questions ...................................................................................................... 15
  Physical Activity ........................................................................................................ 15
  Sedentary Behaviour ................................................................................................ 15
  Sleep .......................................................................................................................... 15
  Physical Activity, Sedentary Behaviour, and Sleep .................................................. 15
Introduction and Background ...................................................................................... 15
METHODS – STAGE 1: Scientific Guideline Development .................................... 16
  1. Guideline Consensus Group Formation ............................................................... 17
  2. Planning Meeting ................................................................................................. 17
  3. Evidence Identification and Synthesis .................................................................. 18
  4. Consensus Meeting: Draft Guideline Development ............................................. 18
    Evidence to Recommendation Synthesis .............................................................. 18
  5. Stakeholder Consultation Process (External Review) .......................................... 19
  6. Guideline Revision .............................................................................................. 19
METHODS – STAGE 2: Develop Visual Identity, Creative Concept, and Marketing Plan ............................................................................................................. 24
METHODS – STAGE 3: Dissemination and Implementation ...................................... 25
METHODS – STAGE 4: Evaluation Plan ..................................................................... 26
Guideline Uptake Surveillance .................................................................26
Marketing Plan Evaluation ..................................................................26
FUTURE RESEARCH ..............................................................................27
UPDATING THE GUIDELINES .................................................................28
FINAL GUIDELINES ................................................................................29
GLOSSARY ............................................................................................31
LIST OF ABBREVIATIONS .......................................................................31
REFERENCES ........................................................................................31

APPENDICES
APPENDIX A. GUIDELINE CONSENSUS GROUP ................................................36
APPENDIX B. EVIDENCE ...........................................................................40
APPENDIX C. SEARCH STRATEGIES FOR SYSTEMATIC REVIEWS ......................55
APPENDIX D. STAKEHOLDER SURVEY .........................................................62
APPENDIX E. FINAL GUIDELINES ...............................................................81
APPENDIX F. AGREE II REPORT ................................................................83
APPENDIX G. REFERENCES FOR APPENDICES ............................................87
SUMMARY

Guideline Questions

Physical Activity

- What are the relationships between objectively-measured physical activity (PA) [overall (total PA; e.g., accelerometer counts/min, sum of minutes at all intensities, steps/day) and by intensity (light, moderate, moderate-to-vigorous, vigorous)] and relevant health indicators in children and youth aged 5-17 years?
- What are the associations between various patterns of PA [sporadic PA and bouts of PA as well as adherence to current PA guidelines (e.g., 60 minutes of moderate-to-vigorous PA each day)] and health indicators?

Sedentary Behaviour

- What are the relationships between objectively and subjectively measured sedentary behaviours and improved health indicators in children and youth aged 5-17 years?
- What types of sedentary behaviours (e.g., TV, computer, homework) are associated with improved health indicators?
- What doses (i.e., total amount, interruptions, bout durations) are associated with improved health indicators?

Sleep

- What are the relationships between objectively and subjectively measured sleep duration and a broad range of health indicators in children and youth aged 5-17 years?

Physical Activity, Sedentary Behaviour, and Sleep

- How are each of the following combinations of movement/non-movement behaviours associated with improved health indicators in children and youth aged 5-17 years?
  - Physical Activity + Sedentary Behaviour
  - Physical Activity + Sleep
  - Sedentary Behaviour + Sleep
  - Physical Activity + Sedentary Behaviour + Sleep
- What are the collective relationships between movement behaviours and health indicators in a representative sample of Canadian children and youth?

Target Population

The target population for the guidelines is: apparently healthy children and youth aged 5-17 years (i.e., general populations, including those with overweight/obesity, but with absence of diagnosed disease or condition), irrespective of gender, race, ethnicity or socio-economic status of the family.

Key Evidence – Sources

Key evidence to inform these guidelines comes from:

A) Four systematic reviews relating to the relationships between the following movement behaviours and relevant health indicators in children and youth (aged 5-17 years): (1) physical activity, (2) sedentary behaviour, (3) sleep, and (4) combinations of physical activity, sedentary behaviour and sleep.

B) Compositional analyses that examined the relationships between movement behaviours (physical activity, sedentary behaviour and sleep) and health indicators in a representative sample of Canadian children and youth.

These systematic reviews and compositional analyses were published along with 4 other supportive papers as a supplemental issue of Applied Physiology, Nutrition, and Metabolism (APNM), after refereed peer-review and acceptance, to inform the development of the new “Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep” (see references below).
Methods – Systematic Reviews
For each systematic review, the following general steps occurred. Please see the individual systematic reviews for specific details (Carson et al., 2016a; Chaput et al., 2016; Poitras et al., 2016; Saunders et al., 2016).

First, the authors identified relevant evidence by systematic searches of the following online databases using the OVID and EBSCO search platforms and specified search terms: MEDLINE, EMBASE, CINAHL, PsycINFO, and SPORTDiscus. Databases were searched from inception to December 2014-January 2015; specific details are in the Full Report and in the individual systematic reviews (Carson et al., 2016a; Chaput et al., 2016; Poitras et al., 2016; Saunders et al., 2016).

Using a priori inclusion and exclusion criteria, authors identified potentially relevant citations by title and abstract, and retrieved full-text articles for detailed review. Authors assessed all included articles for quality of evidence using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) framework, and qualitatively synthesized and interpreted the results. Systematic review findings were presented, discussed, and interpreted at Consensus Panel meeting in Montebello, Quebec, Canada, in August 2015, that included researchers, knowledge users, and international collaborators. The final systematic reviews were accepted through international refereed peer-review before publication.

Methods – Compositional Analyses
For the compositional analyses, data from cycles 1 to 3 of the Canadian Health Measures Survey (CHMS) were used (4,169 children and youth, aged 6-17 years). The composition of movement behaviours was entered into linear regression models using isometric log ratio transformation. Please see the published manuscript for details on this complex statistical analysis (Carson et al., 2016b). Compositional analyses findings were presented, discussed, and interpreted at a Consensus Panel meeting in Montebello, Quebec, Canada, in August 2015.

Methods – Synthesis of Evidence and Guideline Development
Results from the systematic reviews and compositional analyses were used to inform the development of new “Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep”. The draft guidelines were developed by expert consensus among a 27-member group (the “Guideline Consensus Group”; see Appendix A for membership) with research and practice expertise in physical activity, sedentary behaviour, sleep, and health promotion, together with representatives from CSEP, ParticipACTION, the Conference Board of Canada, and the Public Health Agency of Canada (PHAC), and two target-population representatives (parent and youth). The Guideline Consensus Group met face-to-face twice in Montebello, Quebec, Canada in December 2014 and August 2015. Draft guidelines were then externally reviewed by hundreds of relevant stakeholders (youth, parents, teachers, exercise practitioners, and pediatricians) in French and English, via online (survey) and in-person (Focus Groups) consultation. A final consensus meeting, with a representative subset of the Guideline Consensus Group, was convened to incorporate comments from stakeholder consultations. Final approval was obtained from the Guideline Consensus Group.

Key Evidence – Results

Physical Activity
The authors examined the relationships between objectively-measured physical activity (PA; total and all intensities) and 11 health indicators (body composition, cardiometabolic biomarkers, physical fitness, behavioural conduct/pro-social behaviour, cognition/academic achievement, quality of life/well-being, harms, bone health, motor skill development, psychological distress, and self-esteem) in children and youth (aged 5-17 years). A total of 162 studies met the inclusion criteria (204,171 participants from 31 countries). The evidence showed that total PA was favourably associated with physical, psychological/social, and cognitive health indicators. Relationships were more consistent and robust for higher (e.g., moderate-to-vigorous) versus lower (e.g., light) intensity PA. All patterns of activity (sporadic, bouts, continuous) provided benefit. No studies reported harms (i.e., injuries or adverse events, such as concussions or scraped knees) associated with objectively-measured PA of any intensity. The findings continue to support the importance of at least 60 minutes/day of moderate-to-vigorous intensity PA for disease prevention and health promotion in children and youth, but also highlight potential benefits of light-intensity PA and total PA. All intensities of PA should be considered in future work aimed at better elucidating the health benefits of PA in children and youth.
Sedentary Behaviour

The authors examined the relationships between objectively and subjectively measured sedentary behaviours and six health indicators (body composition, metabolic syndrome/cardiovascular disease risk factors, behavioural conduct/pro-social behaviour, academic achievement, fitness, and self-esteem) in children and youth (aged 5-17 years). Different types (e.g., television, computer, homework) and doses (e.g., total amount, interruptions, bout durations) of sedentary behaviour were examined. The review identified 235 studies (1,657,064 participants from 71 countries). Across the majority of health indicators, higher durations of TV viewing and/or screen time were associated with unfavourable health. A dose-response gradient was observed across health indicators, indicating that less sedentary behaviour, especially screen time, was associated with better health. Since the majority of studies were cross-sectional and used sedentary behaviour measures with no reported psychometric properties, studies with designs less vulnerable to bias that use reliable and valid sedentary behaviour measures are needed to confirm this primarily observational evidence.

Sleep

The authors examined the relationships between objectively and subjectively measured sleep duration and six health indicators (adiposity, emotional regulation, cognition/academic achievement, quality of life/well-being, harms/injuries, and cardiometabolic biomarkers) in children and youth (aged 5-17 years). The review identified 141 studies (592,215 participants from 40 countries). The evidence showed that shorter sleep duration was associated with adverse physical and mental health outcomes. Overall, longer sleep duration was associated with lower adiposity indicators, better emotional regulation, better academic achievement, and better quality of life/well-being. The evidence was mixed and/or limited for the association between sleep duration and cognition, harms/injuries and cardiometabolic biomarkers. Since the majority of studies (75%) were cross-sectional and used self-reported sleep (84%), there is a need for sleep restriction/extension interventions that examine the changes in different outcome measures against various amounts of objectively-measured sleep to achieve a better understanding of dose-response relationships and to establish optimal sleep thresholds.

Physical Activity, Sedentary Behaviour, and Sleep

The authors examined the relationships between four combinations of movement behaviours [(1) PA + sedentary behaviour (SB), (2) PA + sleep, (3) SB + sleep, (4), PA + SB + sleep] and 11 health indicators (adiposity, cardiometabolic biomarkers, physical fitness, emotional regulation/psychological distress, behavioural conduct/pro-social behaviour, cognition, quality of life/well-being, injuries, bone density, motor skill development, and self-esteem) in children and youth (aged 5-17 years). The review identified 14 studies (36,560 participants from 20 countries). The evidence showed that children and youth characterized by High PA + High Sleep + Low SB generally had more desirable measures of adiposity and cardiometabolic health, compared to those with a combination of Low PA + Low Sleep + High SB. Further, those with High PA + High Sleep, and High PA + Low SB were also likely to experience health benefits, compared to Low PA + Low Sleep, or Low PA + High SB. Optimal health benefits may come from replacing SB with moderate-to-vigorous PA, although intervention studies are needed to better clarify these relationships and to determine the potential health benefits of various combinations of movement behaviours.

Compositional Analyses

The authors examined the relationships between movement behaviours (physical activity, sedentary behaviour and sleep) and 5 health indicators (body composition, cardiometabolic disease risk, fitness, social and emotional health) in a representative sample of children and youth (cycles 1-3 of the Canadian Health Measures Survey; 4,169 children and youth, aged 6-17 years). Note that potential “harms” or risks were not integrated into this analysis; by design, this analysis included the movement behaviours that comprise the 24-hour “closed-space” period (i.e., time spent in each behaviour can be summed to 100% of the day). The evidence showed that the composition of movement behavior was significantly associated with all health indicators examined. Further, time spent in sedentary behaviour or light-intensity physical activity relative to other movement behaviours was unfavourably associated with obesity risk markers, while time spent in moderate-to-vigorous physical activity or sleep relative to other movement behaviours was favourably associated with obesity risk markers. Similar patterns were observed for other health indicators (cardiometabolic risk factors, social/psychological health, and aerobic fitness). Replacing moderate to vigorous physical activity with any other movement behaviour had the biggest effect on health. These data analyses provide novel insights into collective health implications of 24-hour movement behaviours and support the importance of an integrated healthy active living agenda to improve the health and well-being of children and youth.
PREAMBLE

These guidelines are relevant to apparently healthy children and youth [aged 5–17 years] irrespective of gender, race, ethnicity, or the socio-economic status of the family. Children and youth are encouraged to live an active lifestyle with a daily balance of sleep, sedentary behaviours, and physical activities that supports their healthy development.

Children and youth should practice healthy sleep hygiene (habits and practices that are conducive to sleeping well), limit sedentary behaviours (especially screen time), and participate in a range of physical activities in a variety of environments (e.g., home/school/community; indoors/outdoors; land/water; summer/winter) and contexts (e.g., play, recreation, sport, active transportation, hobbies, and chores).

For those not currently meeting these 24-hour movement guidelines, a progressive adjustment toward them is recommended. Following these guidelines is associated with better body composition, cardiorespiratory and musculoskeletal fitness, academic achievement and cognition, emotional regulation, pro-social behaviours, cardiovascular and metabolic health, and overall quality of life. The benefits of following these guidelines far exceed potential risks.

These guidelines may be appropriate for children and youth with a disability or medical condition; however, a health professional should be consulted for additional guidance.

The specific guidelines and more details on the background research informing them, their interpretation, guidance on how to achieve them, and recommendations for research and surveillance are available at www.csep.ca/guidelines.
GUIDELINES

For optimal health benefits, children and youth (aged 5–17 years) should achieve high levels of physical activity, low levels of sedentary behaviour, and sufficient sleep each day.

A healthy 24 hours includes:

SWEAT
MODERATE TO VIGOROUS PHYSICAL ACTIVITY
An accumulation of at least 60 minutes per day of moderate to vigorous physical activity involving a variety of aerobic activities. Vigorous physical activities, and muscle and bone strengthening activities should each be incorporated at least 3 days per week;

STEP
LIGHT PHYSICAL ACTIVITY
Several hours of a variety of structured and unstructured light physical activities;

SLEEP
SLEEP
Uninterrupted 9 to 11 hours of sleep per night for those aged 5–13 years and 8 to 10 hours per night for those aged 14–17 years, with consistent bed and wake-up times;

SIT
SEDENTARY BEHAVIOUR
No more than 2 hours per day of recreational screen time; Limited sitting for extended periods.

Preserving sufficient sleep, trading indoor time for outdoor time, and replacing sedentary behaviours and light physical activity with additional moderate to vigorous physical activity can provide greater health benefits.
DIRECTIVES CANADIENNES EN MATIÈRE DE MOUVEMENT SUR 24 HEURES POUR LES ENFANTS ET LES JEUNES :
une approche intégrée regroupant l’activité physique, le comportement sédentaire et le sommeil

PRÉAMBULE

Ces directives s’appliquent à tous les enfants et les jeunes (âgés de 5 à 17 ans) vraisemblablement en santé sans égard au genre, à la race, à l’origine ethnique ou au statut socioéconomique familial. Les enfants et les jeunes sont encouragés à adopter un mode de vie actif et à maintenir un équilibre au quotidien entre le sommeil, le comportement sédentaire et les activités physiques afin de favoriser un développement sain.

Les enfants et les jeunes devraient adopter une hygiène en matière de sommeil saine (des habitudes et pratiques qui amènent à bien dormir), limiter les comportements sédentaires (particulièrement le temps passé devant un écran) et participer à une gamme d’activités physiques dans une variété d’environnements (p. ex. à la maison/à l’école/dans la communauté; à l’intérieur/à l’extérieur; sur le sol/dans l’eau; l’été/l’hiver) et de contextes (p. ex. jeux, loisirs, sports, transport actif, passe-temps et tâches menagères).

Pour celles et ceux qui ne respectent pas ces directives en matière de mouvement sur 24 heures, un ajustement progressif est recommandé afin de parvenir à les appliquer. Suivre ces directives est associé à un meilleur profil de composition corporelle, de condition physique cardiovasculaire et musculosquelettique, de réussite scolaire, de cognition, de régulation des émotions, de comportements prosociaux, de santé cardiovasculaire et métabolique, et de qualité de vie globale. Les avantages associés à l’adoption de ces directives surpassent de loin les risques potentiels.

Ces directives pourraient convenir aux enfants et aux jeunes ayant une incapacité ou un trouble médical. Toutefois, un professionnel de la santé devrait être consulté pour obtenir des conseils additionnels.

Les directives en tant que telles et plus de renseignements sur la recherche ayant mené à leur mise au point et à leur interprétation, ainsi que des conseils pour les mettre en application et des recommandations sur la recherche et la surveillance sont disponibles au www.scpe.ca/directives.
DIRECTIVES

Pour une santé optimale, les enfants et les jeunes (âgés de 5 à 17 ans) devraient faire beaucoup d'activités physiques et peu d'activités sédentaires, et dormir suffisamment chaque jour.

Un 24 heures sain comprend :

**SUER**
ACTIVITÉ PHYSIQUE D'INTENSITÉ MOYENNE À ÉLEVÉE
L'accumulation d'au moins 60 minutes par jour d'activité physique d'intensité moyenne à élevée comprenant une variété d'activités aérobies. Des activités physiques d'intensité élevée et ces activités pour renforcer les muscles et les os devraient être intégrées au moins 3 jours par semaine;

**BOUGER**
ACTIVITÉ PHYSIQUE D'INTENSITÉ LÉGÈRE
Plusieurs heures d'une variété d'activités physiques d'intensité légère structurées et non structurées;

**DORMIR**
SOMMEIL
De 9 à 11 heures de sommeil par nuit sans interruption pour les 5 à 13 ans et de 8 à 10 heures par nuit pour les 14 à 17 ans, et des heures de coucher et de lever régulières;

**S'ASSEOIR**
COMPORTEMENT SÉDENTIAIRE
Un maximum de 2 heures par jour de temps de loisir devant un écran;
Un minimum de périodes prolongées en position assise.

Maintenir une durée de sommeil suffisante, passer plus de temps à l'extérieur et remplacer les comportements sédentaires et l'activité physique de faible intensité par plus d'activité physique d'intensité moyenne à élevée entraînent encore plus de bienfaits pour la santé.
Changes from Previous Guidelines

Previously, there were separate guidelines for each of physical activity and sedentary behaviour: the “Canadian Physical Activity Guidelines for Children (5-11 years) and Youth (12-17 years)” and “Canadian Sedentary Behaviour Guidelines for Children (5-11 years) and Youth (12-17 years)” (Tremblay et al., 2011e; Tremblay et al., 2011b). While CSEP has not formerly developed guidelines for sleep, guidelines from the National Sleep Foundation (USA) were available to Canadians (Hirshkowitz et al., 2015).

However, there is accumulating evidence that these behaviours (i.e., physical activity, sedentary behaviour, and sleep) interact and moderate the health impacts of each other. For example, the health benefits of moderate-to-vigorous physical activity can be mitigated if children have poor sleep habits and/or engage in excessive sedentary behaviour. Separate guidelines imply no interrelationship between these behaviours, which is now known to be inaccurate. Therefore the new guidelines integrate (not segregate) these movement behaviours. This novel, holistic approach incorporates all movement behaviours from sleep and sedentary behaviours (i.e., no/low movement) to vigorous-intensity physical activity (i.e., high movement) into a single guideline that spans the 24-hour period, in agreement with the best available evidence. Additional specific changes are highlighted below.

Inclusion of a recommendation regarding light-intensity physical activity. The previous “Physical Activity Guidelines” focused solely on moderate-to-vigorous intensity physical activity and made no mention of light-intensity physical activity (Tremblay et al., 2011d). However, there is a growing body of evidence showing that light-intensity physical activity (such as walking) can provide important health benefits. The systematic review identified evidence of favourable relationships between light-intensity physical activity and several health indicators, including cardiometabolic biomarkers, depressive symptoms, fitness, and bone health (Poitras et al., 2016). Therefore, the new guideline recommends including “several hours per day of a variety of structured and unstructured light physical activities” (Tremblay et al., 2016). This recommendation reflects the most recent evidence.

Inclusion of an “integrated” recommendation and emphasis that more is better. In addition to the evidence in support of the recommendations specific to each movement behaviour, the evidence suggests that greater benefits are associated with: more daily physical activity (Poitras et al., 2016), replacing sedentary time and light physical activity with time spent in moderate to vigorous physical activity (Carson et al., 2016b; Poitras et al., 2016), and trading time spent indoors for time outdoors (Gray et al., 2015). To capture this evidence, the new guideline contains the phrase: “Preserving sufficient sleep, trading indoor time for outdoor time, as well as replacing sedentary behaviours and light physical activity with additional moderate to vigorous physical activity, provides greater health benefits.” This highlights the fact that the whole day matters.

Inclusion of a diagram to illustrate the guidelines. A diagram/visual identity is now included to provide visual representation and help to communicate the guidelines. The diagram, pictured above, is an outline of the number “4”, divided into four segments to represent the four behaviours on the movement continuum (i.e., sleep, sedentary behaviour, light physical activity, and moderate-to-vigorous physical activity. The size of each segment is roughly proportional to the amount of recommended time spent in that behaviour each day. Each segment is accompanied by colour-coordinated text that provides the details of the specific recommendations.
References from *Applied Physiology, Nutrition, and Metabolism*

**Systematic reviews:**


**Compositional Analyses Paper:**


**Supportive papers:**


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Guideline Questions

**Physical Activity**
- What are the relationships between objectively-measured physical activity (PA) [overall (total PA; e.g., accelerometer counts/min, sum of minutes at all intensities, steps/day) and by intensity (light, moderate, moderate-to-vigorous, vigorous)] and relevant health indicators in children and youth aged 5-17 years?
- What are the associations between various patterns of PA [sporadic PA and bouts of PA as well as adherence to current PA guidelines (e.g., 60 minutes of moderate-to-vigorous PA each day)] and health indicators?

**Sedentary Behaviour**
- What are the relationships between objectively and subjectively measured sedentary behaviours and improved health indicators in children and youth aged 5-17 years?
- What types of sedentary behaviours (e.g., TV, computer, homework) are associated with improved health indicators?
- What doses (i.e., total amount, interruptions, bout durations) are associated with improved health indicators?

**Sleep**
- What are the relationships between objectively and subjectively measured sleep duration and a broad range of health indicators in children and youth aged 5-17 years?

**Physical Activity, Sedentary Behaviour, and Sleep**
- How are each of the following combinations of movement/non-movement behaviours associated with improved health indicators in children and youth aged 5-17 years?
  - Physical Activity + Sedentary Behaviour
  - Physical Activity + Sleep
  - Sedentary Behaviour + Sleep
  - Physical Activity + Sedentary Behaviour + Sleep
- What are the collective relationships between movement behaviours and health indicators in a representative sample of Canadian children and youth?

**Introduction and Background**

Over the past several decades, physical activity has decreased (Troiano et al., 2008; Colley et al., 2011a), sedentary behaviours have increased (Colley et al., 2011b), and sleep deprivation has become common among children and youth (Ohayon, 2012; Akerstedt and Nilsson, 2003). At the same time, overweight/obesity and their associated co-morbidities have steadily increased (Roberts et al., 2012; Tremblay et al., 2002). These “lifestyle behaviours” tend to track throughout the life course (Jones et al., 2013a), meaning that habits and practices established in childhood are likely to continue throughout adulthood; establishing healthy active lifestyles early on in life is of critical importance for promoting and maintaining holistic health and well-being.

With the objective of promoting healthy active living in the Canadian population, the Canadian Society for Exercise Physiology (CSEP) and the Public Health Agency of Canada (PHAC) have worked together on the development of Canadian Physical Activity Guidelines since 1995, including guidelines for children and youth that were released in 2002 (Health Canada and the Canadian Society for Exercise Physiology, 2002b; Health Canada and the Canadian Society for Exercise Physiology, 2002a). These guides have been the PHAC’s most requested resource (Tremblay et al., 2007). In 2011, up-
dated physical activity guidelines for children and youth were released (Tremblay et al., 2011c), in parallel with sedentary behaviour guidelines (Tremblay et al., 2011a). While CSEP and PHAC have not formerly developed guidelines for sleep, guidelines from the National Sleep Foundation (USA) have been available to Canadians (Hirshkowitz et al., 2015).

The uptake of the previous Canadian guidelines has been impressive, with 113 million media impressions in Canada related to their release. In addition, the guideline pages of the CSEP and ParticipACTION websites, where free downloads are available, have been visited >700,000 times since the release of the updated guidelines for children and youth, illustrating the demand for guidance on physical activity and sedentary behaviours.

However, there is accumulating evidence that these behaviours interact and moderate the health impacts of each other (Chaput et al., 2014a). For example, the health benefits of moderate-to-vigorous physical activity can be mitigated if children have poor sleep habits and/or engage in excessive sedentary behaviour (Chaput et al., 2014b). Conversely, increased physical activity could attenuate the detrimental effects of insufficient sleep and/or extended periods of sitting in some individuals (Zagaar et al., 2013; Monico-Neto et al., 2013). Thus, all behaviours along the movement continuum, from sleep and sedentary behaviour (i.e., low/no movement) to vigorous-intensity physical activity (i.e., high movement) interact with one another with respect to health. Separate guidelines imply no interrelationship between these behaviours, which is now known to be inaccurate.

To address this issue, and to provide guidance based on the best available evidence, a team of Canadian and international research and practice experts in physical activity, sedentary behaviour, sleep, health promotion, and research methodology convened in 2014 to embark on a rigorous and transparent process in the development of new guidelines that span the entire 24-hour period and incorporate physical activity, sedentary behaviour and sleep behaviours, titled the “Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep”.

The long-term objectives of these guidelines are: to enhance the promotion of healthy active lifestyles and improved sleep hygiene and to improve overall health and well-being among children and youth across Canada; to inform healthy active living policies at the local, provincial, and national levels; and to provide international leadership and advance a global healthy active living agenda.

This report outlines the steps that were taken to arrive at the “Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep”. These guidelines have been made possible through funding and support from the Canadian Society for Exercise Physiology, the Conference Board of Canada, Healthy Active Living and Obesity Research Group at the Children’s Hospital of Eastern Ontario Research Institute, the Public Health Agency of Canada, and ParticipACTION, and are made freely available in English and French to all Canadians. The guidelines were informed by a rigorous scientific process, and are based on four comprehensive systematic reviews of the evidence together with novel data analyses from a representative sample of Canadian children and youth.

**METHODS – STAGE 1: Scientific Guideline Development**

The overall process of Guideline Development followed these general steps (described in detail below):

1. The Guideline Consensus Group and subset committees (Leadership and Steering Committees) were formed (October-November 2014).
2. The Guideline Consensus Group convened a Planning Meeting to review the guideline development process, and to establish the work-plan, responsibilities and timelines (December 2014).
3. Evidence to inform the guidelines was synthesized (four systematic reviews, and novel analyses of data in a representative sample of Canadian children and youth) (January-August 2015).
4. A Consensus Meeting was convened to draft guidelines based on the information gathered in the systematic reviews and novel data analyses (August 2015).
5. Stakeholders were surveyed through online and in-person consultations for comments and concerns regarding the initial draft guidelines (September-December 2015).
6. A Guideline Revision Meeting was held to revise the draft guidelines based on stakeholder feedback; the “final” version of the guidelines was formally copy-edited and approved by the Guideline Consensus Group (January 2016).
1. Guideline Consensus Group Formation

The 27-member Guideline Consensus Group (also called the “working group” or “Consensus Panel”) followed a rigorous and transparent guideline development framework (Tremblay and Haskell, 2012). The Guideline Consensus Group included: research and practice experts in physical activity, sedentary behaviour, sleep and health promotion; three methodological experts, including a librarian scientist with expertise in systematic reviews; invited representatives from the Public Health Agency of Canada, Canadian Pediatric Society, Canadian Sleep Society, Conference Board of Canada, ParticipACTION, and Sedentary Behaviour Research Network; international content experts (from Australia, the USA, and Wales); and members of the target-population (parent and youth representatives). Members of the working group, their roles and their respective affiliations can be found in Appendix A. All participants were asked to declare if they had any conflict or competing interests that may influence the development of the guidelines; declarations are listed in Appendix A, and any competing interests did not influence the guideline process.

Figure 1 outlines the process for development of the “Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep”. As per the framework outlined by Tremblay and Haskell (2012), the process began with the establishment of a “Leadership Committee”, committed to leading and resourcing the guideline development process. A “Steering Committee” was also formed, by invitation of the Leadership Committee, to serve as the “engine” of the initiative (e.g., conducting the systematic reviews of the evidence, providing methodological guidance). The Leadership and Steering Committees met via teleconference at least bi-monthly and bi-weekly respectively throughout the process (committee membership identified in Appendix A).

Two research methodology consultants were engaged to advise the Steering Committee on best practices for conducting systematic reviews and developing clinical practice guidelines. Based on advice provided, the Steering Committee decided to use the Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument as a framework to guide the project (Brouwers et al., 2010a; Brouwers et al., 2010b; Brouwers et al., 2010c; Brouwers et al., 2016). The AGREE II instrument is an internationally accepted standard for guideline development that ensures scientific rigor and transparency throughout the process. Four consultants, including two who were external to the entire process, completed the AGREE II assessment, and the final AGREE II report can be found in Appendix F.

2. Planning Meeting

Under the guidance of the Leadership Committee, the full complement of the Guideline Consensus Group convened for a 2.5 day Planning Meeting in December, 2014.

In brief, the primary objectives of this Planning Meeting were to:
- Engage all members of the Guideline Consensus Group (including investigators, content experts, methodology experts, knowledge users, and target-population representatives) in all aspects of the process from the very beginning;
- Outline the guideline development process, including the history, methodology [overall process and use of the AGREE II and Grading of Recommendation, Assessment, Development and Evaluation (GRADE) frameworks], and timelines;
- Review background information, including the existing physical activity, sedentary behaviour, and sleep guidelines available to Canadians (i.e., from Canada and around the world);
- Discuss strategies for international harmonization of guideline efforts;
- Initiate the process for the systematic reviews; establish the final “research questions” and develop the “PICO” framework for the reviews (i.e., participants, interventions/exposures, comparators and identify and prioritize the outcomes eligible for inclusion), discuss scoping findings and draft search strategies;
- Discuss current surveillance projects (e.g., Canadian Health Measures Survey and current level of physical activity in the Canadian pediatric population) and possibility for custom analyses (e.g., compositional analyses);
- Establish a work-plan and responsibilities;
- Initiate discussions regarding knowledge translation, dissemination, promotion and evaluation strategies.

Further details can be found elsewhere (Tremblay et al., 2016).
3. Evidence Identification and Synthesis
Following this Planning Meeting, key evidence to inform the guidelines was synthesized as follows:

A) Four systematic reviews related to the relationships between the following movement behaviours and health indicators in children and youth (aged 5-17 years): (1) physical activity, (2) sedentary behaviour, (3) sleep, and (4) combinations of physical activity, sedentary behaviour and sleep. Evidence from the systematic reviews was assessed using the GRADE framework (Guyatt et al., 2011). The GRADE framework was also used to help inform the appropriate wording (i.e., strength of recommendations) for the proposed guidelines. Further details on GRADE can be found [here](#).

B) Compositional analyses that examined the relationships between movement behaviours (physical activity, sedentary behaviour and sleep) and health indicators in a representative sample of Canadian children and youth.

Further detail on the methods and results (summary of the scientific evidence) is provided in Appendix B. After refereed peer-review and acceptance, these systematic reviews and compositional analyses were published, along with 4 other supportive papers, as a special issue of *Applied Physiology, Nutrition, and Metabolism (APNM; references below)*. Please see the publications for further details.

4. Consensus Meeting: Draft Guideline Development
In August 2015, the Guideline Consensus Group convened for a 3-day Consensus Meeting where the draft guidelines were written (see participant list in Appendix A). All participants were again asked to declare if they had any conflict or competing interests that may influence the development of the guidelines; there were no changes from declarations made at the Planning Meeting, competing interests did not influence the guideline development process, and declarations are listed in Appendix A.

The guideline recommendations were informed by evidence from the systematic reviews and compositional analyses (described in further detail in Appendices B and C). Participants also received background materials including documents that helped inform individual behaviour guidelines (i.e., for physical activity, sedentary behaviour, and/or sleep) in Australia, the U.K. and U.S.A., previous Canadian guideline papers, and information explaining the GRADE and AGREE II processes.

The resulting product of the consensus meeting was a preamble to explain the guidelines, followed by the guidelines themselves. The wording of the preamble and guidelines was informed by the systematic reviews and compositional analyses. The draft guidelines (details below) were then sent to stakeholders for comment and input.

Evidence to Recommendation Synthesis
The overall quality of evidence across the four systematic reviews informing the guidelines ranged from very low to high. However, even among the low quality evidence, there was relative uniformity of findings and observation of very few unfavourable relationships; the inclusion of “low quality” evidence does not preclude drawing confident conclusions about the nature of the relationships observed. There was overwhelming evidence that the benefits of following the guidelines far exceed potential risks (Carson et al., 2016; Chaput et al., 2016; Poitras et al., 2016; Saunders et al., 2016). The evidence showed that following these guidelines is associated with better body composition, cardiorespiratory and muscular-skeletal fitness, academic achievement and cognition, emotional regulation, pro-social behaviours, cardiovascular and metabolic health, and overall quality of life. There was little to no evidence of harms; undesirable outcomes were rare and modest if they occurred and their avoidance was not highly valued. The values and preferences of the target population (i.e., youth, parents, teachers, health care providers, and fitness professionals) indicated that most would support widespread use of these guidelines (see “Stakeholder Process” below and in Appendix D). Moreover, there are low costs associated with the recommended behaviours, and high costs associated with not engaging in the recommended behaviours (Katzmarzyk and Janssen, 2004a; Katzmarzyk et al., 2009b; Bounajm et al., 2014; Institute of Medicine (US) Committee on Sleep Medicine and Research, 2006). Therefore, the Guideline Consensus Panel rated the recommendations as “strong recommendations” according to the GRADE criteria (Andrews et al., 2013).
5. **Stakeholder Consultation Process (External Review)**

Throughout the guideline development process, there was substantial stakeholder involvement, including scientists, guideline developers, and end users (Appendix A). The scientific stakeholders were engaged in formulating the research questions, completing the systematic reviews, interpreting the evidence, drafting the guidelines, participating in the stakeholder consultation, and writing this report.

The draft guidelines that were prepared at the August 2015 Consensus Meeting were reviewed externally by hundreds of relevant stakeholders (youth, parents, caregivers, teachers, exercise practitioners, pediatricians, government and non-government organizations, national and international content experts) in French and English, via online (survey) and in-person (Focus Group) consultation.

The online survey was distributed in December 2015 by collaborating organizations and Guideline Consensus Group members through their respective membership emails, listservs and/or professional networks. Stakeholders were encouraged to share the survey with their peers and colleagues to facilitate “snowball” sampling and further expand the consultation base. The survey remained open for three weeks. Questions on the survey asked about the perceived clarity, level of agreement, and perceived importance of the proposed guidelines and their associated title and preamble. Five hundred and ninety stakeholders responded to the surveys (English and French), with at least 275 providing additional comments and suggestions. A summary of the survey results can be found in Appendix D. Overall, there was a high level of agreement with and support for the draft guidelines; 94.5% and 93.8% strongly or somewhat agreed with the Preamble, and Guidelines, respectively.

In-person review was also obtained in the form of Focus Groups. Focus Groups were semi-structured and open-ended interviews, and were conducted in Ontario (Hamilton, Ottawa and Toronto), and British Columbia (Vancouver) in English and French. Overall, 28 Focus Groups were conducted, with a total of 104 participants representing all target groups (youth, parents, teachers, CSEP professionals and pediatricians). The Focus Groups were audio-taped and transcribed verbatim, and later subjected to thematic analysis following an established protocol (Braun and Clarke, 2006). Further details regarding the Focus Groups are found elsewhere (Faulkner and et al., 2016). The findings from the Focus Groups were highly consistent with those from the online survey.

6. **Guideline Revision**

In January 2016, a representative subset of the Guideline Consensus Group re-convened for a 1-day meeting to address the comments and concerns from the stakeholder consultations and revise the guidelines and preamble accordingly. Following this meeting, the draft guidelines were formally copy-edited by the Publishing Department at the Conference Board of Canada. Revisions were also applied to the French version via translators at CSEP and the Healthy Active Living and Obesity Research Group at the Children’s Hospital of Eastern Ontario Research Institute. Approval of the final guidelines (title, preamble and guidelines) was obtained from the full complement of the Guideline Consensus Group. The rationale for revisions and the final guidelines are presented in Table 1.
**Figure 1.** Timeline and key events for development of “Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep”. Figure taken from (Tremblay et al., 2016).
Table 1. Guideline revision

<table>
<thead>
<tr>
<th>Title</th>
<th>Initial Draft</th>
<th>Rationale for Edits*</th>
<th>Final Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep</td>
<td>No change. Although some stakeholders (25%, 53/212) thought that the title was too long, each word was selected deliberately by the Guideline Consensus Group to accurately describe what type of guidelines they are (movement guidelines, including physical activity, sedentary behaviour, and sleep), who the guidelines apply to (children and youth), and when they apply (the full 24-hour period). Removing any of these important details creates ambiguity. It is recognized that the title will likely be truncated in daily use to “24-Hour Guidelines”, or some iteration thereof. 7% (n=15) of stakeholder survey respondents thought that “24-Hour” should be removed or changed to “daily”. However, the term “daily” could be interpreted to exclude the night-time period. A message underlying these guidelines is that “the whole day matters”, and this is highlighted by inclusion of “24-Hour” in the title of the guidelines.</td>
<td>Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep</td>
<td></td>
</tr>
<tr>
<td>Preamble</td>
<td>Initial Draft</td>
<td>Rationale for Edits</td>
<td>Final Version</td>
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<td>These guidelines are relevant to all healthy children and youth (aged 5-17 years) irrespective of gender, race, ethnicity, or socio-economic status of the family. Children and youth are encouraged to live an active lifestyle with a daily balance of sleep, sedentary behaviours, and physical activities that support their healthy development.</td>
<td>In describing the population to whom the guidelines apply, the word “all” was deleted and “apparently healthy” was added before “healthy children”, because this better qualifies the guidelines and reflects their underlying science (i.e., the systematic reviews that informed the guidelines included studies with apparently healthy children only). The later statement “may be appropriate for children and youth with a disability or medical condition” further qualifies this.</td>
<td>These guidelines are relevant to apparently healthy children and youth (aged 5–17 years) irrespective of gender, race, ethnicity, or the socio-economic status of the family. Children and youth are encouraged to live an active lifestyle with a daily balance of sleep, sedentary behaviours, and physical activities that supports their healthy development.</td>
<td></td>
</tr>
<tr>
<td>Children and youth should practice healthy sleep hygiene, limit sedentary behaviour (especially screen time), and participate in a range of physical activities in a variety of environments (e.g., home/school/community; indoors/outdoors; land/water; summer/winter) and contexts (e.g., play, recreation, sport, active transportation, hobbies, and chores).</td>
<td>There was a lot of feedback in the stakeholder survey and focus groups about the term “sleep hygiene” – respondents did not understand this term (e.g., thought it referred to having clean sheets, washing one’s face before bed etc.). Since this is the appropriate term that is used in the sleep literature, the Guideline Consensus Group decided it was important to use this term in the preamble but to define it to generate understanding regarding its meaning. “Sleep hygiene” is defined as “habits and practices conducive to sleeping well” (Oxford Dictionary).</td>
<td>Children and youth should practice healthy sleep hygiene (habits and practices that are conducive to sleeping well), limit sedentary behaviours (especially screen time), and participate in a range of physical activities in a variety of environments (e.g., home/school/community; indoors/outdoors; land/water; summer/winter) and contexts (e.g., play, recreation, sport, active transportation, hobbies, and chores).</td>
<td></td>
</tr>
<tr>
<td>For those not currently meeting these 24-hour movement guidelines a progressive adjustment towards these guidelines is recommended. Following these guidelines is associated with better body composition, cardiorespiratory and musculoskeletal fitness, academic achievement and cognition, emotional regulation, pro-social behaviours, cardiovascular and metabolic health and overall quality of life. The benefits of following these guidelines far exceed potential risks.</td>
<td>An “s” was added to “sedentary behaviours” since this term captures more than one behaviour.</td>
<td>For those not currently meeting these 24-hour movement guidelines, a progressive adjustment toward them is recommended. Following these guidelines is associated with better body composition, cardiorespiratory and musculoskeletal fitness, academic achievement and cognition, emotional regulation, pro-social behaviours, cardiovascular and metabolic health, and overall quality of life. The benefits of following these guidelines far exceed potential risks.</td>
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<tr>
<td>These guidelines may be appropriate for children and youth with a disability or medical condition; however, a health professional should be consulted for additional guidance.</td>
<td>The phrase “are attached” was removed from the final sentence, because it may not always be the case that the guidelines are attached to the preamble (e.g., they could be printed on the same page, attached, or found separately depending on what form the public-facing messaging takes).</td>
<td>These guidelines may be appropriate for children and youth with a disability or medical condition; however, a health professional should be consulted for additional guidance.</td>
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<tr>
<td>The specific guidelines are attached and more details on the background research informing the guidelines, their interpretation, guidance on how to achieve them, and recommendations for research and surveillance are available at <a href="http://www.csep.ca/guidelines">www.csep.ca/guidelines</a>.</td>
<td>There were minor punctuation and phrasing changes via professional copy-edit, by the Publishing Department at the Conference Board of Canada.</td>
<td>The specific guidelines and more details on the background research informing them, their interpretation, guidance on how to achieve them, and recommendations for research and surveillance are available at <a href="http://www.csep.ca/guidelines">www.csep.ca/guidelines</a>.</td>
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</table>
For optimal health benefits, school-aged children and youth (aged 5–17 years) should achieve high levels of physical activity, low levels of sedentary behaviour, and sufficient sleep each day.

A healthy 24-hours includes:

- Uninterrupted sleep of 9 to 11 hours per night for those aged 5–13 years and 8 to 10 hours per night for those aged 14–17 years, with consistent bed and wake-up times;
- An accumulation of at least 60 minutes per day of moderate to vigorous physical activity involving a variety of aerobic activities. Vigorous physical activities and activities that strengthen muscle and bone should be incorporated at least 3 days a week;
- No more than 2 hours per day of recreational screen time.

For the remainder of the day:

- Limit sitting for extended periods as well as time spent indoors;
- Participate in a variety of structured and unstructured light physical activities for several hours.

Preserving sufficient sleep, as well as replacing sedentary behaviour and light physical activity with additional moderate to vigorous physical activity, provides greater health benefits.

The phrase “school-aged” was removed because: a) this is not consistent with the terminology in the title and preamble, and b) from a surveillance perspective, only age would be considered, irrespective of whether the children and youth were in school.

The guidelines were revised to fall under a single set of bullet points instead of two separate sets. This was because having two separate lists (the first prefaced by “a healthy 24 hours includes” and the second by “for the remainder of the day”) demotes the importance of the second list. In addition, the points in the second list do not actually apply to the “remainder” of the day, but the whole 24 hours (e.g., “limited sitting” also applies to the limit of 2 hours per day of recreational screen time). Therefore, the two final points were added to the initial list, along with phrasing changes for grammatical reasons.

The phrasing of the second bullet-point was changed in response to stakeholder feedback, to better identify that “vigorous physical activities” and “muscle and bone strengthening activities” are two separate groupings of activity, each of which should be incorporated at least 3 days per week.

The point about limiting time spent indoors was removed from the bullet-point recommendations and added to the final sentence of the guidelines.

There were minor punctuation and phrasing changes via professional copy-edit, by the Publishing Department at the Conference Board of Canada.

For optimal health benefits, children and youth (aged 5–17 years) should achieve high levels of physical activity, low levels of sedentary behaviour, and sufficient sleep each day.

A healthy 24 hours includes:

- Uninterrupted 9 to 11 hours of sleep per night for those aged 5–13 years and 8 to 10 hours per night for those aged 14–17 years, with consistent bed and wake-up times;
- An accumulation of at least 60 minutes per day of moderate to vigorous physical activity involving a variety of aerobic activities. Vigorous physical activities and muscle and bone strengthening activities should each be incorporated at least 3 days per week;
- Several hours of a variety of structured and unstructured light physical activities;
- No more than 2 hours per day of recreational screen time;
- Limited sitting for extended periods.

Preserving sufficient sleep, trading indoor time for outdoor time, and replacing sedentary behaviours and light physical activity with additional moderate to vigorous physical activity can provide greater health benefits.

*Other responses to specific Stakeholder Feedback are provided in Appendix D.
In partnership with ParticipACTION, a recognized leader in physical activity knowledge translation, and its creative partner agency Zulu Alpha Kilo, the team worked to develop a visual identity, creative concept, and marketing plan for the new guidelines via “strategic input sessions”. The objective was to enable clear, consistent and targeted communication with parents/caregivers, key influencers (e.g., health care practitioners, teachers, exercise professionals) and youth.

The visual identity provides a consistent, clear and recognizable look, tone and feel for the guidelines, which will increase awareness and recognition of the important information. The visual identity includes components such as: a public-facing name and logo, key insight, tonality/creative concept, sample executions, visual identity system (brand guidelines, including mnemonic/graphic/logo design, variations, colour palette, fonts for print and digital use), and production-ready files in English and French. The creative development process included consultation with a French agency partner to ensure that any ideas related to creative development and visual identity resonated in the Quebec market. The development of simple, evidence-based public-facing messages, creative concept and visual identity formed a platform to enable a comprehensive integrated marketing communications plan for the new guidelines.

The marketing plan identified marketing objectives, target audiences (e.g., youth, parents, teachers, pediatricians, and exercise professionals), approach, tactics, timelines and investment required to effectively reach Canadian children aged 5-17 and their key influencers (e.g., care-providers, parents, and teachers) with key messages from the evidence. Well-timed, consistent marketing content, delivered through a variety of complementary and coordinated channels, is the most comprehensive means to communicate to parents/caregivers, children and key influencers to ensure that this work will have the desired impact on Canadians. Marketing planning included development of a national public relations plan and media materials (key messages, fact sheet, press release, Q&A, and pitch notes), as well as a spokesperson briefing call. Marketing planning also included integration of the guideline messages into the design, production, printing, media materials, and spokesperson briefings for the 2016 ParticipACTION Report Card, as the “front line” vehicle of dissemination.

This upfront marketing planning resulted in clear, compelling messages and a creative idea that is capable of propelling a national, bilingual, integrated marketing communications and implementation campaign. The marketing plan includes work that is ongoing.
METHODS – STAGE 3: Dissemination and Implementation

The objective of this stage was to release the new guidelines to the public and to physical activity stakeholders via proactive national media relations outreach, hard copy, and e-distribution. To maximize impact, the new guidelines were “released” as the cover story in the 2016 ParticipACTION Report Card, as well as in both the highlight and full reports. Integrating the new guidelines into this highly-anticipated annual assessment of child and youth physical activity in Canada provided extremely high profile reach and credibility for the guidelines.

The guidelines and their supporting materials continue to be widely disseminated through a number of additional avenues. First, information on the methodological process, evidence informing the guidelines, stakeholder feedback, implications of the guidelines and the final recommendations are published (open-access) in a supplemental issue of *Applied Physiology, Nutrition, and Metabolism*. Further, this information has been, and will be, shared at scientific meetings and conferences. The guidelines and associated materials, including information for messaging and disseminating the guidelines along with public-facing messages, are posted on the CSEP and funding partner websites. These resources will be updated over time as feedback is received from stakeholders, and will continue to be distributed to partner organizations so that they are further disseminated. Hard copy resources are available from CSEP on request.

For the new guidelines to have an impact on public health, it is necessary to move beyond dissemination and raising awareness to implementation and behaviour change (Latimer-Cheung et al., 2016). Several high-level and specific implementation strategies are described by Latimer-Cheung et al. (2016). For example, qualified exercise professionals can implement the new guidelines in their practice by taking a more holistic approach to both assessment and prescription (e.g., using information about daily movement and sleep patterns to provide individualized advice). CSEP is already working to develop tools and resources to support qualified exercise professionals in implementing the guidelines. Guideline components can be implemented in the school setting through increased activity and reduced sitting time (e.g., stretch breaks and movement bursts throughout the day), which may be mandated at the policy level. Implementation of the guidelines within clinical practice requires equipping health care professionals with the necessary skills to assess patients’ movement behaviours and to counsel patients about meeting the guidelines. Community organizations can implement aspects of the guidelines by minimizing passive instruction time and ensuring leaders within these groups set a good example (e.g., by minimizing personal screen time and encouraging active participation in a range of activities). These are only some examples of implementation efforts that are needed to activate the guidelines; please see Latimer-Cheung et al. (2016) for a more comprehensive discussion of these and other suggestions for implementation.

The potential resource implications of implementing these guideline recommendations were beyond the scope of the project. However, the costs of following the guidelines at the level of the individual are likely to be very low. In addition, there is evidence that not following the guidelines can result in greater resource use. For instance, there is evidence that physical inactivity and obesity result in significant health care costs in Canada (Katzmarzyk and Janssen, 2004b), that sitting is linked with mortality independent of leisure time physical activity (Katzmarzyk et al., 2009a), and that increasing physical activity and reducing sedentary behaviour would reduce Canada’s health care costs “by $2.6 billion and inject $7.5 billion into the Canadian economy by the year 2040” (Bounajm et al., 2014). Similarly, there is evidence in adults that inadequate sleep has a substantial economic impact (e.g., via performance deficits, accident rates, and health care utilization) and significant public health implications (Institute of Medicine (US) Committee on Sleep Medicine and Research, 2006; Hillman and Lack, 2013). Establishing healthy behaviours in childhood is of particular importance because “lifestyle” behaviours tend to track throughout the life course (Jones et al., 2013b); that is, habits and practices established in childhood are likely to continue throughout adulthood. Thus applying the guideline recommendations has potentially beneficial implications from a resource perspective, in addition to the benefits with respect to health indicators.

In summary, Stage 3 includes dissemination and implementation through public relations launch and stakeholder distribution, together with resources, materials, and suggestions for putting the guidelines into practice. Implementation efforts are required to maximize uptake and ensure activation of the guidelines, and adequate funding is essential to support these strategies.
METHODS – STAGE 4: Evaluation Plan

Guideline Uptake Surveillance

Given that the new guidelines encompass the entire 24-hour period, there are new conceptual and methodological challenges in evaluating whether children and youth are meeting the recommendations. For example, is it possible to evaluate whether the recommendation to limit sitting for “extended periods” is met, and if so on what criterion should this be evaluated? Methodologically, objective measures of movement behaviours (e.g., via accelerometers or pedometers) often only comprise part of the day. Therefore, new strategies for assessing guideline uptake are required.

A Surveillance Subcommittee was established in January, 2016, to deal with such surveillance issues. This work is ongoing. Recommendations of the Surveillance Subcommittee are discussed in Tremblay et al. (2016).

There are a variety of mechanisms that have been used historically for surveillance of adherence to the guidelines. The primary Canadian studies that have been used, and their affiliated organizations, are as follows:

- Canadian Health Measures Survey (CHMS, Statistics Canada)
- Canadian Community Health Survey (CCHS, Statistics Canada)
- National Longitudinal Survey of Children and Youth (NLSCY, Statistics Canada)
- Physical Activity Levels Among Youth (CANPLAY, Canadian Fitness and Lifestyle Research Institute)
- Physical Activity Monitor (PAM, Canadian Fitness and Lifestyle Research Institute)
- Health Behavior in School-aged Children Survey (HSBC, PHAC)

For example, the CHMS directly measures (through accelerometry) the average amount of time Canadians spend in sedentary, light, moderate, and vigorous intensity movement, and in steps accumulated per day, and captures the amount of screen time and sleep through parent- or self-report. This information can be used to help determine the proportion of Canadian children and youth who are meeting the guidelines. The CHMS is conducted in two-year intervals and information is made publicly available in a timely manner. For a recent, specific example of CHMS surveillance activities see (Colley et al., 2011c).

Marketing Plan Evaluation

Success of the marketing plan will be evaluated through aided and unaided awareness, brand awareness, downloads, and level of understanding of the guidelines. ParticipACTION will use its national public relations agency, Hill+Knowlton Strategies, to provide comprehensive qualitative and quantitative reporting on media exposure across Canada for the day of release and the following weeks and months. Hard copy and e-distribution via the Report Card will be monitored and recorded by ParticipACTION and its network partners, using web surveys and web analytics.

Moreover, the proposed process evaluation will assess the overall uptake of the guidelines (e.g., presence of the guidelines on stakeholders’ websites and frequency at which they are accessed) and the extent of their implementation in practice (e.g., assessment of how schools have modified the school day to align with the guidelines). Both immediate (e.g., awareness, brand equity) and long-term (e.g., change in the behaviour of children and youth) outcomes will be evaluated to determine the impact of the dissemination and implementation strategies. Please see Tremblay et al. (2016) for further details.
FUTURE RESEARCH

Areas for future research have been identified within the four systematic reviews that informed the guidelines (Carson et al., 2016a; Chaput et al., 2016; Poitras et al., 2016; Saunders et al., 2016), as well as through the stakeholder consultations (Faulkner et al., 2016) and Consensus Panel meetings. These areas for future research are summarized in a manuscript that details the guideline development process and outcomes (Tremblay et al., 2016). In addition, key research gaps include the following:

1. **The overall quality of evidence from studies examining relationships between physical activity, sedentary behaviour and/or sleep and health indicators in children and youth is generally low.**

   There is a need for higher quality studies in the pediatric population (e.g., randomized controlled trials or longitudinal studies, with validated objective measures, larger and more diverse sample sizes, and reporting of adverse events). Utilization of standardized methods for assessing movement behaviours and health indicators will allow for better comparison across studies.

2. **There is a need for more work examining the inter-relationships between movement behaviours.**

   Although it has become clear that movement behaviours interact with one another with respect to health, there remain few studies that have directly examined the impact of combinations of movement behaviours on health indicators in children and youth. In addition, most studies have compared only the best and worst combinations of behaviours (e.g., high physical activity + high sleep + low sedentary behaviour, versus low physical activity + low sleep + high sedentary behaviour), without examining intermediate combinations. Moreover, while cross-sectional “integrated” data exist, the impact of combinations of movement behaviours on health indicators has not been examined prospectively over time. Time use research (i.e., research regarding how time is allocated during the day) will also be important for understanding these relationships. For example, when children increase the amount of time spent in physical activity, how does the amount of time allocated to other activities and behaviours (including dietary intake) change over the rest of the day? Novel analytical approaches, including the application of compositional analyses, will be important in advancing this field.

3. **There is an absence of “Canadian 24-Hour Movement Guidelines” for all other age groups (the early years, adults, and older adults) and for special populations (i.e., those with a medical condition or disability).**

   As per best practices, it has been recommended that movement behaviour guidelines be reviewed and updated on a five-year cycle (Tremblay and Haskell, 2012). Stand-alone physical activity and sedentary behaviour guidelines for the early years (ages 0-4) were released in 2012 (Tremblay et al., 2012b; Tremblay et al., 2012a). On track with the five-year cycle, rather than “updating” these guidelines the process to develop “Canadian 24-Hour Movement Guidelines” for the early years has begun. Moving forward, the Guideline Consensus Group recommends moving to a 10-year cycle. This longer timeframe will better enable stakeholders to adjust and for the guidelines to gain traction before (potentially) being altered in an updating process. In the interim, the Guideline Consensus Group commits to monitoring the literature, and if new information becomes available that could result in a change to the guideline then the process of updating it can be initiated in advance of the 10-year recommendation. Work to complete physical activity guidelines for special populations has begun (e.g., for those with multiple sclerosis, spinal cord injury, or Parkinson’s disease), but remains an important area for future work.

4. **There is a need for successful messaging strategies to translate the new guidelines to the general public.**

   Tailored messaging, gain-framed messages, and self-efficacy change messages hold promise for successful messaging strategies (Latimer et al., 2010). However, a recent study found that only 10% of survey respondents were aware of the Canadian Physical Activity guidelines, and <5% were aware of the Sedentary Behaviour Guidelines (Leblanc et al., 2015). This, together with the generally null findings of many behavioural interventions, indicates that there is important knowledge translation work to be done. Stages 2 (Develop Visual Identity, Creative Concept, and Marketing Plan) and 3 (Dissemination and Implementation) in the present initiative aim to successfully communicate and distribute the new guidelines. Stage 4 (Evaluation) will provide feedback on how well these approaches are working and enable ongoing efforts to successfully disseminate the new guidelines.
5. **There is a need for reporting harms and side effects in original research.**

Despite explicitly searching for evidence of risks, side-effects, or harms in the physical activity, sleep, and integrated systematic reviews, very little data on these outcomes was found. None of the 162 studies included in the physical activity systematic review reported on injuries or harms related to physical activity. Likewise, no studies in the integrated systematic review reported on the relationships between combinations of movement behaviours and injuries. Only four of the 141 studies included in the sleep systematic review looked at the association between sleep duration and harms/injuries. Not only are these important “health indicators” to investigate, but these should also be reported if and when they occur in other original research studies.

**UPDATING THE GUIDELINES**

Updating the guidelines is important and necessary to ensure that they remain true to the science that has informed them. In this regard, it has been recommended that movement behaviour guidelines be reviewed and updated every five years (Tremblay and Haskell, 2012). In the past, due to the immense amount of work required to update each systematic review, and the implications of new guidelines on public practice, it has not been feasible to update the guidelines for all age groups at the same time. Therefore, it was recommended that the Physical Activity and Sedentary Behaviour guidelines for each age group be updated in a 5-year cyclical fashion.

While indeed there is an abundance of new evidence within this 5-year cyclical time frame, there is evidence that it takes much longer than this for stakeholders to adjust to new recommendations (e.g., for evidence from new guidelines to be implemented) (Balas and Boren, 2000; Green, 2008). As a result, the Guideline Consensus Group recommends moving to a 10-year updating cycle in order to enable the guidelines to gain traction before (potentially) being altered in an updating process. In the interim, the Guideline Consensus Group commits to monitoring the literature, and if new information becomes available that could result in a substantial change to the guideline then the process of updating can be initiated in advance of the 10-year recommendation. In keeping with this, the aim will be to update the “24-Hour Movement Guidelines” for children and youth in 2026.

It is proposed that as the updates for the other age groups come due, they be updated to “24-Hour Movement Guidelines” instead of stand-alone guidelines in keeping with the best available evidence, and continue on the proposed 10-year update cycle (Table 2). This will allow each guideline to be updated in a timely fashion. However, as indicated above, if important evidence emerges in the interim between updates, authors will work to include it and the timeline for updates may change.

**Table 2. Proposed cycle for developing and updating the guidelines**

<table>
<thead>
<tr>
<th>Year</th>
<th>Age group to be developed/updated</th>
<th>[24-Hour Movement Guidelines]</th>
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</thead>
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<tr>
<td>2016</td>
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<td></td>
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<tr>
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<td>Adults (developed)</td>
<td></td>
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<tr>
<td>2019</td>
<td>Older Adults (developed)</td>
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<tr>
<td>2026</td>
<td>Children and Youth (updated)</td>
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<tr>
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<tr>
<td>2028</td>
<td>Adults (updated)</td>
<td></td>
</tr>
<tr>
<td>2029</td>
<td>Older Adults (updated)</td>
<td></td>
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</table>
Canadian 24-Hour Movement Guidelines for Children and Youth: 
*An Integration of Physical Activity, Sedentary Behaviour, and Sleep*

**Preamble**

These guidelines are relevant to apparently healthy children and youth (aged 5–17 years) irrespective of gender, race, ethnicity, or the socio-economic status of the family. Children and youth are encouraged to live an active lifestyle with a daily balance of sleep, sedentary behaviours, and physical activities that supports their healthy development.

Children and youth should practice healthy sleep hygiene (habits and practices that are conducive to sleeping well), limit sedentary behaviours (especially screen time), and participate in a range of physical activities in a variety of environments (e.g., home/school/community; indoors/outdoors; land/water; summer/winter) and contexts (e.g., play, recreation, sport, active transportation, hobbies, and chores).

For those not currently meeting these 24-hour movement guidelines, a progressive adjustment toward them is recommended. Following these guidelines is associated with better body composition, cardiorespiratory and musculoskeletal fitness, academic achievement and cognition, emotional regulation, pro-social behaviours, cardiovascular and metabolic health, and overall quality of life. The benefits of following these guidelines far exceed potential risks.

These guidelines may be appropriate for children and youth with a disability or medical condition; however, a health professional should be consulted for additional guidance.

The specific guidelines and more details on the background research informing them, their interpretation, guidance on how to achieve them, and recommendations for research and surveillance are available at [www.csep.ca/guidelines](http://www.csep.ca/guidelines).

**Guidelines**

For optimal health benefits, children and youth (aged 5–17 years) should achieve high levels of physical activity, low levels of sedentary behaviour, and sufficient sleep each day.

A healthy 24 hours includes:

- Uninterrupted 9 to 11 hours of sleep per night for those aged 5–13 years and 8 to 10 hours per night for those aged 14–17 years, with consistent bed and wake-up times;
- An accumulation of at least 60 minutes per day of moderate to vigorous physical activity involving a variety of aerobic activities. Vigorous physical activities and muscle and bone strengthening activities should each be incorporated at least 3 days per week;
- Several hours of a variety of structured and unstructured light physical activities;
- No more than 2 hours per day of recreational screen time;
- Limited sitting for extended periods.

Preserving sufficient sleep, trading indoor time for outdoor time, and replacing sedentary behaviours and light physical activity with additional moderate to vigorous physical activity can provide greater health benefits.
Directives canadiennes en matière de mouvement sur 24 heures pour les enfants et les jeunes :
une approche intégrée regroupant l’activité physique, le comportement sédentaire et le sommeil

Préambule

Ces directives s’appliquent à tous les enfants et les jeunes (âgés de 5 à 17 ans) vraisemblablement en santé sans égard au genre, à la race, à l’origine ethnique ou au statut socioéconomique familial. Les enfants et les jeunes sont encouragés à adopter un mode de vie actif et à maintenir un équilibre au quotidien entre le sommeil, le comportement sédentaire et les activités physiques afin de favoriser un développement sain.

Les enfants et les jeunes devraient adopter une hygiène de sommeil saine (des habitudes et pratiques qui amènent à bien dormir), limiter les comportements sédentaires (particulièrement le temps passé devant un écran) et participer à une gamme d’activités physiques dans une variété d’environnements (p. ex. à la maison/à l’école/dans la communauté; à l’intérieur/l’extérieur; sur le sol/dans l’eau; l’été/l’hiver) et de contextes (p. ex. jeux, loisirs, sports, transport actif, passe-temps et tâches ménagères).

Pour celles et ceux qui ne respectent pas ces directives de mouvement sur 24 heures, un ajustement progressif est recommandé afin de parvenir à les appliquer. Suivre ces directives est associé à un meilleur profil de composition corporelle, de condition physique cardiovasculaire et musculosquelettique, de réussite scolaire, de cognition, de régulation des émotions, de comportements prosociaux, de santé cardiovasculaire et métabolique, et de qualité de vie globale. Les avantages associés à l’adoption de ces directives surpassent de loin les risques potentiels.

Ces directives pourraient convenir aux enfants et aux jeunes aux prises avec une incapacité ou un trouble médical. Toutefois, un professionnel de la santé devrait être consulté pour obtenir des conseils additionnels.

Les directives en tant que telles et plus de renseignements sur la recherche ayant mené à leur mise au point et à leur interprétation, ainsi que des conseils pour les mettre en application et des recommandations sur la recherche et la surveillance sont disponibles au www.scpe.ca/directives.

Directives

Pour une santé optimale, les enfants et les jeunes (âgés de 5 à 17 ans) devraient faire beaucoup d’activités physiques et peu d’activités sédentaires, et dormir suffisamment chaque jour.

Un 24 heures sain comprend :

- De 9 à 11 heures de sommeil par nuit sans interruption pour les 5 à 13 ans et de 8 à 10 heures par nuit pour les 14 à 17 ans, et des heures de coucher et de lever régulières;
- L’accumulation d’au moins 60 minutes par jour d’activité physique d’intensité moyenne à élevée comprenant une variété d’activités aérobies. Des activités physiques d’intensité élevée et des activités pour renforcer les muscles et les os devraient être intégrées au moins 3 jours par semaine;
- Plusieurs heures d’une variété d’activités physiques d’intensité légère structurées et non structurées;
- Un maximum de 2 heures par jour de temps de loisir devant un écran;
- Un minimum de périodes prolongées en position assise.

Maintenir une durée de sommeil suffisante, passer plus de temps à l’extérieur et remplacer les comportements sédentaires et l’activité physique de faible intensité par plus d’activité physique d’intensité moyenne à élevée entraîne encore plus de bienfaits pour la santé.
GLOSSARY
For a list of important definitions and explanations, see here www.csep.ca/guidelines.

LIST OF ABBREVIATIONS
The following is a list of common abbreviations used throughout this document.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tr>
<td>AGREE II</td>
<td>Appraisal of Guidelines for Research and Evaluation II</td>
</tr>
<tr>
<td>CHMS</td>
<td>Canadian Health Measures Survey</td>
</tr>
<tr>
<td>CSEP</td>
<td>Canadian Society for Exercise Physiology</td>
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<td>GRADE</td>
<td>Grading of Recommendations, Assessment, Development and Evaluation</td>
</tr>
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<td>HALO</td>
<td>Healthy Active Living and Obesity Research Group</td>
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<tr>
<td>PA</td>
<td>Physical Activity</td>
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<td>PHAC</td>
<td>Public Health Agency of Canada</td>
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<td>SB</td>
<td>Sedentary Behaviour</td>
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<td>WHO</td>
<td>World Health Organization</td>
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REFERENCES


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Appendices to the Guideline Development Report

APPENDIX A. GUIDELINE CONSENSUS GROUP
APPENDIX B. EVIDENCE
APPENDIX C. SEARCH STRATEGIES FOR SYSTEMATIC REVIEWS
APPENDIX D. STAKEHOLDER SURVEY
APPENDIX E. FINAL GUIDELINES
APPENDIX F. AGREE II REPORT
APPENDIX G. REFERENCES FOR APPENDICES
### Table A1. Members of the “Guideline Consensus (Working Group)”, and other significant contributors***

<table>
<thead>
<tr>
<th>Panel Member</th>
<th>Affiliation</th>
<th>Role</th>
<th>Conflict of Interest</th>
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<td>None</td>
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<tr>
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<tr>
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<tr>
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<tr>
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<tr>
<td>Janssen, Ian; PhD</td>
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</tr>
<tr>
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</tr>
<tr>
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<tr>
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<tr>
<td>Name</td>
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<td>Role/Committee/Expert/Author</td>
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<tr>
<td>Olds, Timothy; PhD</td>
<td>Professor, University of South Australia (Australia)</td>
<td>Content Expert (PA, SB, sleep), International Representative, Systematic Review Author</td>
<td>Received funding from Australian government bodies and Coca-Cola to present research findings in Dubai (presentation title: “The International Study of Childhood Obesity, Lifestyle and Environment”); was part of a multi-national study funded by Coca-Cola but does not receive direct funding from Coca-Cola at his institution.</td>
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<tr>
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<td>Parent Representative (Canada)</td>
<td>Stakeholder Representative (parent)</td>
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<tr>
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<td>Stakeholder Representative (youth)</td>
<td>None</td>
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<tr>
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<td>Name</td>
<td>Title and Affiliation</td>
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<tr>
<td>Saunders, Travis; PhD</td>
<td>Assistant Professor, University of Prince Edward Island (Canada)</td>
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</tr>
<tr>
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<td>Content Expert (PA), Invited Representative (CSEP), Leadership Committee, Steering Committee, Dissemination and implementation</td>
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</table>

Unless otherwise specified, participants attended both the Planning Meeting and the Consensus Meeting. *Attended the Planning Meeting only. **Attended the Consensus Meeting only. ***Did not attend Planning or Consensus Meeting; not part of “Guideline Consensus Group” - other involvement. PA = physical activity; SB = sedentary behaviour.
APPENDIX B: EVIDENCE

SYSTEMATIC REVIEWS

Four systematic reviews were commissioned to form the evidence-base for the guidelines. The following methods were common to all four systematic reviews, and specific details for each review are below.

Protocol and Registration

The systematic reviews were registered with the International Prospective Register of Systematic Reviews (PROSPERO):
- Physical Activity Systematic Review: Registration no. CRD42015015488, available from http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42015015488;
- Sedentary Behaviour Systematic Review: Registration no. CRD42015015494, available from http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42015015494;
- Sleep Systematic Review: Registration no. CRD42015015492, available from http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42015015492;

Eligibility Criteria

The participants, interventions, comparisons, outcomes and study design (PICOS) framework (Schardt et al., 2007) was followed to identify key study concepts in the research questions a priori, and to facilitate the search processes. The PICO for each systematic review is identified below.

Information Sources and Search Strategy

Online databases were searched for relevant articles meeting the a priori inclusion criteria. The electronic search strategies were created by a research librarian with expertise in systematic review searching and peer-reviewed by a second research librarian. No language or study design limits were applied. Details on individual search strategies are provided for each review below and in Appendix C.

Study Selection and Data Extraction

Please see individual systematic reviews for details on bibliographic record retrieval, screening, and data extraction for included studies.

Evidence Quality Assessment

For all four systematic reviews, the GRADE (Grading of Recommendations Assessment, Development and Evaluation) framework was used to guide the evaluation of the quality of evidence for each health indicator by each type of study design (Guyatt et al., 2011a). According to GRADE, evidence quality is categorized into four groups: high, moderate, low and very low. Evidence quality ratings start at “high” for randomized studies, and “low” for all other experimental and observational studies. The quality of evidence is downgraded if there are limitations across studies due to serious risk of bias, inconsistency, indirectness, imprecision or other factors. If there is no cause to downgrade, the quality of evidence can be upgraded if there is a large effect size, a dose-response gradient, or if all plausible confounders would decrease an apparent treatment effect (Guyatt et al., 2011b). The overall quality of evidence for each study design within each health indicator was evaluated by one reviewer and verified by the larger review team, including three systematic review methodology experts.

Evidence Synthesis

Meta-analyses were planned for the individual reviews if the data could be meaningfully pooled (i.e., if sufficiently homogenous in statistical, clinical and methodological characteristics). Narrative syntheses were conducted if meta-analyses were not possible.
Questions to be addressed in the systematic review:

- What are the relationships between objectively-measured physical activity (PA) [overall (total PA; e.g., accelerometer counts/min, sum of minutes at all intensities, steps/day) and by intensity (light, moderate, moderate-to-vigorous, vigorous)] and relevant health indicators in children and youth aged 5-17 years?

- What are the associations between various patterns of PA [sporadic PA and bouts of PA as well as adherence to current PA guidelines (e.g., 60 minutes of moderate-to-vigorous PA each day)] and health indicators?

Methods

Inclusion Criteria

Population: Apparently healthy children and youth (including those with overweight and obesity) with a mean age of 5-17 years and/or in grades kindergarten-12.

Intervention (exposure): Various volumes, durations, frequencies, intensities (i.e., light, moderate, moderate-to-vigorous, vigorous) and patterns of objectively-measured total PA. Studies were included if they reported objective PA measures (accelerometer, heart rate monitor, pedometer, arm band). For experimental studies, interventions had to target physical activity only and not multiple health behaviours (e.g., both physical activity and diet).

Comparison: Various volumes, durations, frequencies, intensities and patterns of objectively measured total PA. A comparison or control group was not required, but was used when available to compare effects.

Outcome: Key health indicators were chosen and ranked as critical or important, by expert consensus according to the GRADE framework, as follows:

Critical:
1. Body composition
2. Cardiometabolic biomarkers (i.e., metabolic syndrome and cardiovascular disease risk factors)
3. Physical fitness
4. Behavioural conduct/pro-social behaviour
5. Cognition/academic achievement
6. Quality of life/well-being
7. Harms (i.e., injuries)

Important:
8. Bone health
9. Motor skill development
10. Psychological distress
11. Self-esteem

Study design and characteristics: All study designs were considered. For longitudinal studies, any follow-up length was allowed as long as the exposure was measured before follow-up at least once between ages 5-17 years. Randomized controlled trials and non-randomized intervention studies were required to have at least 30 participants in the intervention group. Observational studies were required to have a minimum sample size of 300 participants. For feasibility reasons related to the large number of studies examining body composition, cross-sectional studies that examined body composition were required to have a minimum sample size of 1,000 participants. Studies were screened if they were in English or could be translated using “Google Translate”. Published and in-press peer-reviewed original manuscripts were eligible for inclusion; grey literature and conference abstracts were excluded.
**Literature Search Strategy** (see Appendix C)

Databases searched:
- Ovid MEDLINE (1946 to January 19, 2015)
- Ovid Embase (1980 to 2015 week 3)
- Ovid psycINFO (1806 to January week 2, 2015)
- EBSCO SPORTDiscus (1949 to January 21, 2015)

**Results**

After removing duplicates, a total of 6,220 citations were retrieved from database searches, and an additional 7 records were identified via key informants and bibliographies. After scanning titles and abstracts of these 6,227 records, full-text copies of 499 potentially relevant citations were retrieved. Of these, 162 citations met inclusion criteria and were included in the systematic review (204,171 participants from 31 countries). Several of these studies included results for two or more of the 11 relevant health indicators. No studies reported harms (i.e., injuries or adverse events, such as concussions or scraped knees) associated with objectively-measured PA of any intensity. Due to the heterogeneity in measurement tools, interventions, and outcomes, meta-analyses were not possible for any health indicator; narrative synthesis of the evidence was conducted. The quality of evidence ranged from very low to moderate. See Table B1 for a summary of findings.

**Summary of Findings**

Overall, there was low to moderate quality evidence that total PA was favourably associated with physical, psychological/social, and cognitive health indicators. Relationships were more consistent and robust for higher (e.g., moderate-to-vigorous) versus lower (e.g., light) intensity PA. All patterns of activity (sporadic, bouts, continuous) provided benefit. The findings continue to support the importance of at least 60 minutes/day of moderate-to-vigorous intensity PA for disease prevention and health promotion in children and youth, but also highlight potential benefits of light-intensity PA and total PA. All intensities of PA should be considered in future work aimed at better elucidating the health benefits of PA in children and youth.
### Table B1. Results from the physical activity systematic review (see systematic review for details)

<table>
<thead>
<tr>
<th>Health Indicator</th>
<th>Number of studies</th>
<th>Quality of Evidence</th>
<th>Summary of Findings: Number of studies reporting favourable/null/unfavourable associations with at least 1 health indicator measure by PA intensity*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Critical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Composition</td>
<td>72</td>
<td>Very low to low</td>
<td><strong>Adiposity:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total PA: favourable (26), null (30), unfavourable (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VPA: favourable (16), null (6), unfavourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (29), null (16), unfavourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MPA: favourable (4), null (10), unfavourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LPA: favourable (3), null (9), unfavourable (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Fat free mass:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total PA: favourable (3), null (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VPA: favourable (2), null (2), unfavourable (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: null (4), unfavourable (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MPA: null (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LPA: favourable (1), null (1), unfavourable (1)</td>
</tr>
<tr>
<td>Cardiometabolic Biomarkers</td>
<td>54</td>
<td>Very low to moderate</td>
<td><strong>Total PA:</strong> favourable (22), null (24)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VPA: favourable (4), null (9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (25), null (25)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MPA: favourable (4), null (9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LPA: favourable (3), null (8)</td>
</tr>
<tr>
<td>Physical Fitness</td>
<td>38</td>
<td>Very low to low</td>
<td><strong>Aerobic Fitness:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total PA: favourable (22), null (8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VPA: favourable (13), null (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (16), null (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MPA: favourable (7), null (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LPA: favourable (2), null (6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Muscular Strength &amp; Endurance:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total PA: favourable (6), null (6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VPA: favourable (2), null (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (3), null (2)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>MPA: null (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LPA: null (2), unfavourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Flexibility:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total PA: favourable (3), null (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LPA: null (1)</td>
</tr>
<tr>
<td>Indicator</td>
<td>Count</td>
<td>Level</td>
<td>Total PA</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-------</td>
<td>------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Behavioural Conduct/Pro-social Behaviour</td>
<td>1</td>
<td>Very low</td>
<td>Total PA: null (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (1), null (1)</td>
</tr>
<tr>
<td>Cognition/Academic Achievement</td>
<td>8</td>
<td>Very low</td>
<td>Academic Achievement:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total PA: favourable (1), null (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VPA: unfavourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (1), null (2), unfavourable (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MPA: unfavourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cognition:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total PA: favourable (1), null (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (1), null (1)</td>
</tr>
<tr>
<td>Quality of Life/Well-being</td>
<td>5</td>
<td>Very low to low</td>
<td>Total PA: favourable (1), null (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (1), null (1)</td>
</tr>
<tr>
<td>Harms (i.e., injuries)</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Important</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bone Health</td>
<td>20</td>
<td>Low to moderate</td>
<td>Total PA: favourable (6), null (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VPA: favourable (8), null (5), unfavourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (9), null (9), unfavourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MPA: favourable (3), null (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LPA: favourable (2), null (2), unfavourable (1)</td>
</tr>
<tr>
<td>Motor Skill Development</td>
<td>7</td>
<td>Very low to low</td>
<td>Total PA: favourable (3), null (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VPA: favourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MPA: null (1)</td>
</tr>
<tr>
<td>Psychological Distress</td>
<td>4</td>
<td>Very low to low</td>
<td>Total PA: favourable (1), null (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VPA: null (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MVPA: favourable (1), null (3), unfavourable (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LPA: null (1)</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>1</td>
<td>Very low</td>
<td>MVPA: null (1)</td>
</tr>
</tbody>
</table>

*Note that the number of studies reporting favourable/null/unfavourable associations does not sum to the total number of studies for a given indicator since some studies reported mixed associations. LPA = light-intensity physical activity; MPA = moderate-intensity physical activity; MVPA = moderate-to-vigorous intensity physical activity; N/A = not applicable; PA = physical activity; VPA = vigorous-intensity physical activity.
Questions to be answered in the systematic review:
- What are the relationships between objectively and subjectively measured sedentary behaviours and improved health indicators in children and youth aged 5-17 years?
- What types of sedentary behaviours (e.g., TV, computer, homework) are associated with improved health indicators?
- What doses (i.e., total amount, interruptions, bout durations) are associated with improved health indicators?

Methods
This review was conducted as an update to a previous systematic review (Tremblay et al., 2011) examining the relationships between objectively and subjectively measured sedentary behaviour and health indicators in children and youth. Therefore, date limits for included studies were imposed (≥February 2010 to December 2014; see Appendix C for details).

Inclusion Criteria
Population: Apparently healthy children and youth (including those with overweight and obesity) with a mean age of 5-17 years and/or in grades kindergarten-12.

Intervention (exposure): Duration, patterns, and types of sedentary behaviour. Sedentary behaviour was defined as any waking behaviour characterized by an energy expenditure ≤1.5 METs, while in a sitting or reclining posture (Sedentary Behaviour Research Network; 2012). Therefore, studies were required to have a measure of sedentary behaviour rather than a measure of the absence of physical activity (e.g., failing to meet the physical activity guidelines) or a measure of active video-gaming. Sedentary behaviour could be measured objectively (e.g., accelerometer) or subjectively (e.g., self- or proxy-report). For experimental studies, interventions had to target sedentary behaviour only and not multiple health behaviours (e.g., both sedentary behaviour and diet).

Comparison: Various durations, patterns and types of sedentary behaviour. A comparison or control group was not required, but was used when available to compare effects.

Outcome: The same six health indicators included in the original review (Tremblay et al., 2011) were included in this update. These key health indicators were originally chosen and ranked as critical or important, by expert consensus according to the GRADE framework, as follows:

- Critical:
  1. Body composition
  2. Metabolic syndrome/cardiovascular disease risk factors
  3. Behavioural conduct/pro-social behaviour
  4. Academic achievement

- Important:
  5. Fitness
  6. Self-esteem

Study design and characteristics: All study designs were considered. For longitudinal studies, any follow-up length was allowed as long as the exposure was measured before follow-up at least once between ages 5-17 years. Randomized controlled trials and non-randomized intervention studies were required to have at least 30 participants in the intervention group. Observational studies were required to have a minimum sample size of 300 participants. For feasibility reasons related to the large number of studies examining body composition, cross-sectional studies that examined body composition were required to have a minimum sample size of 1,000 participants. Studies were screened if they were in English or
could be translated using “Google Translate”. Published and in-press peer-reviewed original manuscripts were eligible for inclusion; grey literature and conference abstracts were excluded.

**Literature Search Strategy** (see Appendix C)

Databases searched:
- Ovid MEDLINE (1946 to December 18, 2014)
- Ovid Embase (1974 to 2014 week 51)
- Ovid PsycINFO (1806 to December week 3 2014)

Date limits of February 2010 and later were included in the search to minimize overlap with the original review.

**Results**

After removing duplicates, a total of 8,316 citations were retrieved from database searches, and an additional 22 records were identified via key informants and bibliographies. After scanning titles and abstracts of these 8,338 records, full-text copies of 923 potentially relevant citations were retrieved. Of these, 235 citations met inclusion criteria and were included in the systematic review (1,657,064 participants from 71 countries). Several of these studies included results for two or more of the six relevant health indicators. Due to the heterogeneity in measurement tools, interventions, and outcomes, meta-analyses were not possible for any health indicator; narrative synthesis of the evidence was conducted. The quality of evidence ranged from very low to moderate. See Table B2 for a summary of findings.

**Summary of Findings**

Different types (e.g., television, computer, homework) and doses (e.g., total amount, interruptions, bout durations) of sedentary behaviours were examined. Across the majority of health indicators examined, higher durations of TV viewing and/or screen time were associated with unfavourable health. A dose-response gradient was observed across health indicators, indicating that less sedentary behaviour, especially screen time, was associated with better health. Reading and homework were favourably associated with academic achievement. Thus, different types of sedentary behaviour may have different impacts on health. Since the majority of studies were cross-sectional in nature and used sedentary behaviour measures with no reported psychometric properties, higher quality studies using reliable and valid sedentary behaviour measures are needed to confirm this primarily observational evidence.
### Table B2. Results from the sedentary behaviour systematic review (see systematic review for details)

<table>
<thead>
<tr>
<th>Health Indicator</th>
<th># of studies</th>
<th>Quality of Evidence</th>
<th>Summary of Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Critical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body composition</td>
<td>162</td>
<td>Very low to low</td>
<td>Higher durations or frequencies of screen time and TV viewing were significantly associated with unfavourable measures of body composition across all study designs.</td>
</tr>
<tr>
<td>Metabolic Syndrome/Cardiovascular Disease Risk Factors</td>
<td>31</td>
<td>Very low</td>
<td>Higher duration or frequency of TV viewing was significantly associated with a higher clustered cardiometabolic risk score across all study designs.</td>
</tr>
<tr>
<td>Behavioural Conduct/Pro-social Behaviour</td>
<td>24</td>
<td>Very low to moderate</td>
<td>Higher durations of TV viewing and video game use were significantly associated with unfavourable measures of behavioural conduct/pro-social behaviour across observational study designs.</td>
</tr>
<tr>
<td>Academic Achievement</td>
<td>16</td>
<td>Very low</td>
<td>Higher durations of reading and doing homework outside of school were significantly associated with higher academic achievement. (Note: these types of sedentary behaviours were only examined in a small number of longitudinal studies).</td>
</tr>
<tr>
<td><strong>Important</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fitness</td>
<td>21</td>
<td>Low to Moderate</td>
<td>Higher duration of screen time was significantly associated with lower fitness across study designs.</td>
</tr>
<tr>
<td>Self-Esteem</td>
<td>10</td>
<td>Very Low</td>
<td>Higher durations of screen time and computer use were significantly associated with lower self-esteem. (Note: only cross-sectional studies were included for this indicator).</td>
</tr>
</tbody>
</table>
EVIDENCE: SLEEP – Systematic Review

Question to be answered in the systematic review:
- What are the relationships between objectively and subjectively measured sleep duration and a broad range of health indicators in children and youth aged 5-17 years?

Methods

Inclusion Criteria

Population: Apparently healthy children and youth (including those with overweight and obesity) with a mean age of 5-17 years and/or in grades kindergarten-12. Clinical populations (e.g., patients with sleep apnea) were excluded.

Intervention (exposure): Various sleep durations. Studies were included if they used objective (polysomnography, actigraphy/accelerometry) or subjective (self-report, proxy-report) measures. For experimental studies, interventions had to target sleep duration only and not multiple health behaviours (e.g., both sleep duration and physical activity).

Comparison: Various sleep durations. A comparison or control group was not required, but was used when available to compare effects.

Outcome: Six key health indicators chosen and ranked as critical or important, by expert consensus according to the GRADE framework, as follows:

Critical:
1. Adiposity markers
2. Emotional regulation (e.g., stress, anxiety, depressive symptoms, mental health)
3. Cognition/academic achievement
4. Quality of life/well-being
5. Harms/injuries

Important:
6. Cardiometabolic biomarkers (i.e., metabolic syndrome and cardiovascular disease risk factors).

Study design and characteristics: All study designs were considered. For longitudinal studies, any follow-up length was allowed as long as the exposure was measured before follow-up at least once between ages 5-17 years. Randomized controlled trials and non-randomized intervention studies were required to have at least 30 participants in the intervention group. Observational studies were required to have a minimum sample size of 300 participants. For feasibility reasons related to the large number of studies examining adiposity, cross-sectional studies that examined adiposity and used a self-report assessment of sleep were required to have a minimum sample size of 1,000 participants. Studies were screened if they were in English or could be translated using “Google Translate”. Published and in-press peer-reviewed original manuscripts were eligible for inclusion; grey literature and conference abstracts were excluded.

Literature Search Strategy (see Appendix C)

Databases searched:
- Ovid MEDLINE (1946-January 19, 2015)
- Ovid Embase (1980 to 2015 week 3)
- Ovid psycINFO (1906 to 2015 week 3)
- CINAHL (1961 to 2015 week 3)

Reference
Results
After removing duplicates, a total of 4,483 citations were retrieved from database searches, and an additional 10 records were identified via key informants and bibliographies. After scanning titles and abstracts of these 4,493 records, full-text copies of 318 potentially relevant citations were retrieved. Of these, 141 citations met inclusion criteria and were included in the systematic review (592,215 participants from 40 countries). Several of these studies included results for two or more of the six relevant health indicators. Due to the heterogeneity in measurement tools, interventions, and outcomes, meta-analyses were not possible for any health indicator; narrative synthesis of the evidence was conducted. The quality of evidence ranged from very low to high. See Table B3 for a summary of findings.

Summary of Findings
The evidence showed that shorter sleep duration was associated with adverse physical and mental health outcomes. Overall, longer sleep duration was associated with lower adiposity indicators, better emotional regulation, better academic achievement, and better quality of life/well-being. The evidence was mixed and/or limited for the association between sleep duration and cognition, harms/injuries and cardiometabolic biomarkers. Since the majority of studies were cross-sectional (78%) and used self-reported sleep (84%), there is a need for sleep restriction/extension interventions that examine the changes in different outcome measures against various amounts of objectively-measured sleep to achieve a better understanding of dose-response relationships and to establish optimal sleep thresholds.
### Table B3. Results from the sleep systematic review (see systematic review for details)

<table>
<thead>
<tr>
<th>Health Indicator</th>
<th># of studies</th>
<th>Quality of Evidence</th>
<th>Summary of Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Critical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Adiposity                | 71           | Very low to moderate| N=58 studies reported a significant association between short sleep duration and adiposity.  
N=13 studies reported null findings. |
| Emotional Regulation     | 62           | Very low to high    | N=49 studies reported that longer sleep duration was associated with better emotional regulation.  
N=11 studies reported null findings.  
N=2 studies reported opposite associations. |
| Cognition                | 6            | Very low to moderate| N=5 studies reported mixed findings.  
N=1 study reported null findings. |
| Academic Achievement     | 21           | Very low            | N=14 studies reported that longer sleep duration was associated with better academic achievement.  
N=6 studies reported null findings.  
N=1 study reported opposite associations. |
| Quality of Life/Well-Being | 3           | Very low            | N=3 studies reported better quality of life/well-being with longer sleep duration. |
| Harms/Injuries           | 4            | Very low            | N=2 studies reported mixed findings.  
N=1 study reported that short sleep duration was associated with more injuries.  
N=1 study reported null findings. |
| **Important**            |              |                     |                                                                                     |
| Cardiometabolic biomarkers | 19         | Very low to low     | N=11 studies reported mixed findings.  
N=6 studies reported null findings.  
N=1 study reported that longer sleep duration was associated with adverse cardiometabolic health.  
N=1 study reported opposite associations. |
Questions to be answered in the systematic review:
- How are each of the following combinations of movement/non-movement behaviours associated with improved health indicators in children and youth aged 5-17 years?
  - Physical Activity + Sedentary Behaviour
  - Physical Activity + Sleep
  - Sedentary Behaviour + Sleep
  - Physical Activity + Sedentary Behaviour + Sleep

Methods

Inclusion Criteria
Population: Apparently healthy children and youth (including those with overweight and obesity) with a mean age of 5-17 years and/or in grades kindergarten-12.

Intervention (exposure): Any of the following combinations of behaviours:
- Physical Activity + Sedentary Behaviour
- Physical Activity + Sleep
- Sedentary Behaviour + Sleep
- Physical Activity + Sedentary Behaviour + Sleep

Only objective measures of physical activity (e.g., accelerometry or heart rate measures) were included in this review, whereas objective or subjective measures were included for sedentary behaviour and sleep. The decision to restrict to objective measures of physical activity was to allow for comparison of all intensities of physical activity (including light intensity), whereas subjective measures of physical activity typically focus exclusively on moderate-to-vigorous intensity activity.

Comparison: Various levels and combinations of physical activity, sedentary behaviour and sleep. The combinations could not include any other behaviours (e.g., diet), although such behaviours could be included as covariates in regression analyses. A comparator group had to report some combination of physical activity, sedentary behaviour and/or sleep that was different from the intervention/exposure group.

Outcome: Eleven key health indicators chosen and ranked as critical or important, by expert consensus according to the GRADE framework, as follows:

Critical:
1. Adiposity
2. Cardiometabolic biomarkers
3. Physical fitness
4. Emotional regulation/psychological distress
5. Behavioural conduct/pro-social behaviour
6. Cognition
7. Quality of life/well-being
8. Injuries

Important:
9. Bone density
10. Motor skill development

Reference
Study design and characteristics: All study designs were considered. For longitudinal studies, any follow-up length was allowed as long as the exposure was measured before follow-up at least once between ages 5-17 years. Randomized controlled trials and non-randomized intervention studies were required to have at least 30 participants in the intervention group. Observational studies were required to have a minimum sample size of 300 participants. Studies were screened if they were in English or could be translated using “Google Translate”. Published and in-press peer-reviewed original manuscripts were eligible for inclusion; grey literature and conference abstracts were excluded.

Literature Search Strategy (see Appendix C)
All articles that screened into the other three systematic reviews were manually screened to determine eligibility for inclusion in this review. Further, a new search that targeted combinations of two or more movement behaviours was performed using the CINAHL database (inception to June 2, 2015).

Results
After removing duplicates, a total of 486 citations were retrieved from database searches, and an additional 3 records were identified via key informants and bibliographies. After scanning titles and abstracts of these 489 records, full-text copies of 71 potentially relevant citations were retrieved. Of these, 14 citations met inclusion criteria and were included in the systematic review (36,560 participants from 20 countries). Most of these studies included results for two or more of the 11 relevant health indicators. Due to the heterogeneity in measurement tools, exposures, and outcomes, meta-analyses were not possible for any health indicator; narrative synthesis of the evidence was conducted. The quality of evidence was rated as low. See Table B4 for a summary of findings.

Summary of Findings
The evidence showed that children and youth characterized by High PA + High Sleep + Low SB generally had more desirable measures of adiposity and cardiometabolic health, when compared to those with a combination of Low PA + Low Sleep + High SB. Further, those with High PA + High Sleep, and High PA + Low SB were also likely to experience health benefits, when compared to Low PA + Low Sleep, or Low PA + High SB. Optimal health benefits may come from replacing SB with moderate-to-vigorous PA, although intervention studies are needed to better clarify these relationships and to determine the potential health benefits of various combinations of movement behaviours.
### Table B4. Results from the integrated (physical activity, sedentary behaviour, and sleep) systematic review (see systematic review for details)

<table>
<thead>
<tr>
<th>Health Indicator</th>
<th># of studies</th>
<th>Quality of Evidence</th>
<th>Summary of Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body composition</td>
<td>10</td>
<td>Low</td>
<td>Children and youth with a combination of High PA/High Sleep/Low SB had <strong>more desirable</strong> measures of body composition when compared to children with Low PA/Low Sleep/High SB. <strong>More desirable</strong> measures of body composition were also observed for those with a combination of High PA/High Sleep or High PA/Low SB, compared to Low PA/Low Sleep or Low PA/High SB.</td>
</tr>
<tr>
<td>Metabolic Syndrome/Cardiovascular Disease Risk Factors</td>
<td>3</td>
<td>Low</td>
<td>Children and youth with a combination of High PA/High Sleep/Low SB had <strong>more desirable</strong> measures of cardiometabolic health when compared to children with Low PA/Low Sleep/High SB. <strong>More desirable</strong> measures of cardiometabolic health were also observed for those with a combination of High PA/High Sleep or High PA/Low SB, compared to Low PA/Low Sleep or Low PA/High SB.</td>
</tr>
<tr>
<td>Cardiorespiratory Fitness</td>
<td>2</td>
<td>Low</td>
<td>Children and youth with a combination of High MVPA/Low SB group had higher VO2max, when compared to those with Low MVPA/High SB.</td>
</tr>
<tr>
<td>Musculoskeletal Fitness</td>
<td>1</td>
<td>Low</td>
<td>One isotemporal substitution study estimated that replacing 60 min/day of SB with MVPA was associated with improved musculoskeletal. There were <strong>no estimated benefits when replacing SB with LPA.</strong></td>
</tr>
</tbody>
</table>

Note: PA=physical activity; MVPA=moderate-and-vigorous physical activity; SB=sedentary behaviour.
**Reference**

**Research Question:**
- What are the relationships between movement behaviours and health indicators in a representative sample of Canadian children and youth?

**Methods**
For the compositional analyses, data from cycles 1 to 3 of the Canadian Health Measures Survey (CHMS) were used (4,169 children and youth, aged 6-17 years). Data collection consisted of a health interview administered in the participant’s home and a physical health examination conducted at a mobile examination centre. Sedentary time and physical activity [light-intensity (LPA) and moderate-to-vigorous intensity (MVPA)] were measured via accelerometry; sleep was assessed during the in-home interview. Health indicators were chosen to capture obesity risk (BMI z-score), cardiometabolic disease risk (blood pressure, total sample; and triglycerides, HDL-cholesterol, C-reactive protein, insulin; fasting sub-sample only), fitness (Modified Canadian Aerobic Fitness Test), and social and emotional health (strengths and difficulties questionnaire). Please see the published manuscript for details on this complex statistical analysis (Carson et al., 2016b). Compositional analyses findings were presented, discussed, and interpreted at the second Consensus Panel meeting in Montebello, Canada in August 2015.

**Results**
Of the 5,217 eligible participants for this study, 4,169 had complete data for the variables of interest in the full sample (and 1,242 participants had complete data for the variables of interest in the fasting subsample). The average age was 11 years and approximately half (49%) were female. In the full sample, participants spent ~40% of the 24-hour period in sleep, 38% in sedentary time, 18% in light-intensity physical activity, and 4% in moderate to vigorous intensity physical activity. The composition of movement behaviours (sleep, sedentary time, and physical activity) was significantly associated with all health indicators.

**Summary of Findings**
The composition of movement behaviours was significantly associated with all health indicators. Time spent in sedentary behaviour or LPA relative to other movement behaviours was unfavourably associated with obesity risk markers, while time spent in MVPA or sleep relative to other movement behaviours was favourably associated with obesity risk markers. Similar patterns were observed for other health indicators (cardiometabolic risk factors, social/psychological health, and aerobic fitness). Replacing moderate to vigorous physical activity with any other movement behaviour had the biggest effect on health. Compositional data analyses provide novel insights into collective health implications of 24-hour movement behaviours and support the importance of an integrated healthy active living agenda to improve the health and well-being of children and youth.
APPENDIX C: SEARCH STRATEGIES FOR THE SYSTEMATIC REVIEWS

Physical Activity Systematic Review


MEDLINE (1946 to January 19, 2015)
1. Physical Activity.mp.
2. exp Exercise/
3. exp Exercise Movement Techniques/
4. exp Exercise Therapy/
5. Physical Exertion/
6. Motor Activity/
7. exp “Physical Education and Training”/
8. exp Sports/
9. “Play and Playthings”/
10. (sport$ or bicycl$ or swim$ or walk$ or run$ or jog$).tw.
11. (physical$ adj2 activ$).tw.
12. (aerobic adj2 (train$ or active$)).tw.
13. or/1-12
14. limit 13 to (“preschool child (2 to 5 years)” or “child (6 to 12 years)” or “adolescent (13 to 18 years)”)
15. 13 and (child* or adolescent*).mp.
16. 14 or 15
17. exp Monitoring, Physiologic/
18. exp Accelerometry/
19. (activPAL* or ActiGraph* or acceleromet* or heart rate monit* or heart rate monit* or pedomet* or armband* or arm band* or inclinomet*).tw.
20. (activity monitor* or activity tracker* or fitness tracker* or portable monitor* or wearable monitor* or Fitbit* or Vivofit* or Fuelband*).tw.
21. ((objectiv* adj3 measur*) or (direct* adj3 measure*)).tw.
22. or/17-21
23. 16 and 22
24. limit 23 to journal article
25. remove duplicates from 24

EMBASE (1980 to 2015 week 3)
1. exp Physical Activity/
2. exp Exercise/
3. exp Kinesiotherapy/
4. exp Motor Activity/
5. Physical Education/
6. exp Disabled Sport/ or exp Sport/
7. Play/
8. (sport$ or bicycl$ or swim$ or walk$ or run$ or jog$).tw.
10. (aerobic adj2 (train$ or active$)).tw.
11. or/1-10
12. exp Physiologic Monitoring/
13. Accelerometer/ or Accelerometry/
14. (activPAL* or ActiGraph* or acceleromet* or heart rate monit* or heart rate monit* or pedomet* or armband* or arm band* or inclinomet*).tw.
15. (activity monitor* or activity tracker* or fitness tracker* or portable monitor* or wearable monitor* or Fitbit* or Vivofit* or Fuelband*).tw.
16. ((objective* adj3 measur*) or (direct* adj3 measure*)).tw.
17. or/12-16
18. 11 and 17
19. limit 18 to (preschool child <1 to 6 years> or school child <7 to 12 years> or adolescent <13 to 17 years>)
20. 18 and (child* or youth* or adolescent* or pediatric* or paediatric*).tw.
21. 19 or 20
22. limit 21 to embase
23. limit 22 to article

SportDiscus (1949 to January 21, 2015)

( health* OR wellness OR well being OR wellbeing OR “quality of life” OR social behav* OR prosocial behav* OR behavio* conduct or conduct disorder* OR aggression OR delinquent* OR academic achievement OR educational achievement OR grade point average OR GPA OR drop out OR dropout OR attention or concentrat* OR psychomotor performance OR motor development OR motor skill* OR motor activit* OR movement OR physical competenc* OR physical* litera* OR postural balance OR depression OR depressive OR depressed OR mood disorder* OR anxiety OR distress OR worry OR burnout OR burn out OR psycho-social adjustment or psychosocial adjustment OR self esteem OR self concept OR (bone N2 density) OR (bone N2 mass) OR hypertens* OR high blood pressure OR cholesterol OR hypercholester* OR hyperlipid* OR dyslipid* OR lipids* OR lipoprote* OR obese OR obesity OR overweight OR body mass index OR BMI OR waist OR adipos* OR fat OR metabolic syndrome OR insulin resistance OR diabet* OR glucose OR HBA1C OR fitness or physical condition* ) AND ( physiological monitor* OR DE “Patient Monitoring” OR DE “Patient Self-monitoring” OR (objective* N3 measur*) OR (direct* N3 measur*) OR activPAL* OR ActiGraph* OR acceleromet* OR heartrate monit* OR heart rate monit* OR pedomet* OR armband* OR arm band* OR inclinomet or activity monitor* OR activity tracker* OR fitness tracker* OR portable monitor* OR wearable monitor* OR Fitbit* OR Vivofit* OR Fuelband* OR Actical OR Genea ) AND ( boy OR boys OR girl* OR child* OR schoolchild* OR adolescent* OR juvenil* OR youth* OR teen* OR pubescen* OR pediatric* OR paediatric* )

PsycINFO (1806 to January week 2, 2015)

1. exp Physical Activity/
2. exp Motor Performance/
3. Physical Fitness/
4. Energy Expenditure/
5. Activity Level/
6. Physical Education/
7. exp Sports/
8. Athletic Participation/
9. (sport$ or bicycl$ or swim$ or walk$ or run$ or jog$).tw.
10. (physical$ adj2 activ$).tw.
11. (aerobic adj2 (train$ or active$)).tw.
12. or/1-11
13. Monitoring/
14. (activPAL* or ActiGraph* or acceleromet* or heartrate monit* or heart rate monit* or pedomet* or armband* or arm band* or inclinomet).tw.
15. (activity monitor* or activity tracker* or fitness tracker* or portable monitor* or wearable monitor* or Fitbit* or Vivofit* or Fuelband* or Actical or Genea).tw.
16. ((objective* adj3 measur*) or (direct* adj3 measure*)).tw.
17. or/13-16
18. 12 and 17
19. 18 and (child* or youth* or adolescent* or pediatric* or paediatric* or school age or pre-school).tw.
20. limit 18 to (160 preschool age or 180 school age or 200 adolescence )
21. 19 or 20
22. limit 21 to journal article
**Sedentary Behaviour Systematic Review**


**MEDLINE (1946 to December 18, 2014)**
1. Sedentary Lifestyle/
2. sedentar$.tw.
3. (chair or car or automobile or auto or bus or indoor or in-door or screen or computer) adj time).tw.
4. low energy expenditure.tw.
5. (computer game* or video game* or television or tv).tw.
6. (electronic game* or gaming).tw.
7. Television/ or Computers/ or Video games/
8. (screen based entertainment or screen-based entertainment or screen time).tw.
9. (texting or text messag* or app or apps or mobile applications).tw.
10. (smartphone* or smart phone* or cell phone* or mobile phone* or small screen*).tw.
11. (iphone* or ipad* or ipod* or tablet* or laptop*).tw.
12. (social media or Facebook or Youtube or Twitter or Snapchat or Instagram or Pinterest or Skype or Vine).tw.
13. bed rest.mp.
14. sitting.tw.
15. (physical* adj2 inactivit*).tw.
16. or/1-15
17. limit 16 to (“child (6 to 12 years)” or “adolescent (13 to 18 years)”)
18. 16 and (child* or adolescent*).mp.
19. ((2010* or 2011* or 2012* or 2013* or 2014*) not 20101*).dc.
20. (17 or 18) and 19
21. exp Monitoring, Physiologic/
22. exp Accelerometry/
23. (activPAL* or ActiGraph* or acceleromet* or heartrate monit* or heart rate monit* or pedomet* or armband* or arm band* or inclinomet*).tw.
24. (activity monitor* or activity tracker* or fitness tracker* or portable monitor* or wearable monitor* or Fitbit* or VivoFit* or Fuelband*).tw.
25. Self report/ or Questionnaires/ or Reproducibility of Results/
26. (report* or self-report* or questionnaire* or diary or diaries or scale* or interview* or journal*).tw.
27. or/21-26
28. 20 and 27
29. remove duplicates from 28

**EMBASE (1974 to 2014 week 51)**
1. sedentar$.tw.
2. (chair or sitting or car or auto or automobile or bus or indoor or in-door or screen or computer) adj time).tw.
3. low energy expenditure.tw.
4. (computer game* or video game*).tw.
5. (television adj watch*) or tv watch*.tw.
6. television viewing/ or computer/ or recreation/
7. (screen based entertainment or screen-based entertainment or screen time).tw.
8. Social Media/ or Mobile Application/ or Mobile Phone/
9. (texting or text messag* or app or apps or mobile applications).tw.
10. (smartphone* or smart phone* or cell phone* or mobile phone* or small screen*).tw.
11. (iphone* or ipad* or ipod* or tablet* or laptop*).tw.
12. (social media or Facebook or Youtube or Twitter or Snapchat or Instagram or Pinterest or Skype or Vine).tw.
13. bed rest.mp. or sitting.tw. or (physical* adj3 inactivit*).tw.
14. or/1-13
15. limit 14 to (school child <7 to 12 years> or adolescent <13 to 17 years>)
16. (child* or youth* or adolescent* or pediatric* or paediatric*).tw.
17. (14 and 16) or 15
18. exp Physiologic Monitoring/
19. Accelerometer/ or Accelerometry/
20. (activPAL* or ActiGraph* or accelerometer* or heartrate monit* or heart rate monit* or pedomet* or armband* or arm band* or inclinomet*).tw.
21. (activity monitor* or activity tracker* or fitness tracker* or portable monitor* or wearable monitor* or Fitbit* or Vivofit* or Fuelband*).tw.
22. Self report/ or Questionnaire/ or Rating Scale/
23. (report* or self-report* or questionnaire* or diary or diaries or scale* or interview* or journal*).tw.
24. or/18-23
25. 17 and 24
26. limit 25 to embase
27. limit 26 to dd=20100201-20141231

PsycINFO (1806 to December week 3)
1. sedentar*.tw.
2. ((chair or sitting or car or automobile or auto or bus or indoor or in-door or screen or computer) adj time).tw.
3. (computer game* or video game*).tw.
4. ((television adj watch*) or tv watch*).tw.
5. (Electronic game* or gaming).tw.
6. (screen based entertainment or screen-based entertainment or screen time).tw.
7. exp Social Media/
8. exp Mobile Devices/
9. (texting or text messag* or app or apps or mobile applications).tw.
10. (smartphone* or smart phone* or cell phone* or mobile phone* or small screen*).tw.
11. (iphone* or ipad* or ipod* or tablet* or laptop*).tw.
12. bed rest.mp. or sitting.tw.
13. or/1-12
14. limit 13 to ((180 school age or 200 adolescence ) and “0100 journal”)
15. (child* or youth* or adolescent* or pediatric* or paediatric*).tw.
16. 14 or (15 and 13)
17. Polysomnography/
18. Monitoring/
19. (activPAL* or ActiGraph* or accelerometer* or heartrate monit* or heart rate monit* or pedomet* or armband* or arm band* or inclinomet*).tw.
20. (activity monitor* or activity tracker* or fitness tracker* or portable monitor* or wearable monitor* or Fitbit* or Vivofit* or Fuelband*).tw.
21. Self report/ or Questionnaires/ or Reproducibility of Results/
22. (report* or self-report* or questionnaire* or diary or diaries or scale* or interview* or journal*).tw.
23. or/18-22
24. 16 and 23
25. 24 and (2010$ or 2011$ or 2012$ or 2013$ or 2014$).an.
Sleep Systematic Review


MEDLINE (1946 to January 19, 2015)
1. Sleep/
2. (sleep adj3 duration).tw.
3. exp *Sleep Apnea Syndromes/ and (apnea or apnoea).ti.
4. (1 or 2) not 3
5. Polysomnography/
6. Accelerometer/ or Accelerometry/
7. Actigraphy/
8. (polysomnogr* or actigr* or accelerom*).tw.
9. ((objectiv* adj3 measur*) or (direct* adj3 measure*)).tw.
10. (Sleep* adj3 (report or questionnaire* or index or eval* or diary or diaries or log* or journal*)).tw.
11. (self report* or proxy report*).tw.
12. or/5-11
13. 4 and 12
14. limit 13 to (“preschool child (2 to 5 years)” or “child (6 to 12 years)” or “adolescent (13 to 18 years)”) 15. 13 and (child* or adolescent*).mp.
16. 12 and (14 or 15)
17. limit 16 to journal article
18. remove duplicates from 17

EMBASE (1980 to 2015 week 3)
1. Sleep/
2. Sleep Time/
3. (sleep adj3 duration).tw.
4. exp Sleep Disordered Breathing/ and (apnea or apnoea).ti.
5. (or/1-3) not 4
6. Polysomnography/
7. Accelerometer/ or Accelerometry/
8. Actigraphy/
9. (polysomnogr* or actigr* or accelerom*).tw.
10. (Sleep* adj3 (report or questionnaire* or index or eval* or diary or diaries or log* or journal*)).tw.
11. (self report* or proxy report*).tw.
12. ((objectiv* adj3 measur*) or (direct* adj3 measure*)).tw.
13. or/6-12
14. 5 and 13
15. 14 and (child* or youth* or adolescent* or pediatric* or paediatric*).tw.
16. limit 14 to (child or preschool child <1 to 6 years> or school child <7 to 12 years> or adolescent <13 to 17 years>)
17. 15 or 16
18. limit 17 to embase
19. limit 18 to article

PsycINFO (1906 to 2015 week 3)
1. Sleep/ or Sleep Deprivation/
2. (sleep adj3 duration).tw.
3. *Sleep Apnea/ and (apnea or apnoea).ti.
4. (1 or 2) not 3
5. Polysomnography/
6. Monitoring/
7. (activPAL* or ActiGraph* or acceleromet* or heartrate monit* or heart rate monit* or pedomet* or armband* or arm band* or inclinomet*).tw.
8. (activity monitor* or activity tracker* or fitness tracker* or portable monitor* or wearable monitor* or Fitbit* or Vivofit* or Fuelband*).tw.
9. ((objectiv* adj3 measur*) or (direct* adj3 measure*)).tw.
10. Self report/ or Questionnaires/ or Reproducibility of Results/
11. Self Monitoring/
12. Journal Writing/
13. (report* or self-report* or questionnaire* or diary or diaries or scale* or interview* or journal*).tw.
14. or/5-13
15. 4 and 14
16. limit 15 to (180 school age or 200 adolescence )
17. 15 and (child* or youth* or adolescent* or pediatric* or paediatric*).tw.
18. 16 or 17
19. limit 18 to journal article

CINAHL (1961 to 2015 week 3)
S13 ( S11 or S12 ) Limiters - Exclude MEDLINE records; Publication Type: Journal Article
S12 ( S4 and S10 ) AND ( (child* or adolescent or pediatric* or paediatric* or youth* or school age or pre-school) )
S11 S4 and S10 Limiters - Age Groups: Child, Preschool: 2-5 years, Child: 6-12 years, Adolescent: 13-18 years
S10 S5 or S6 or S7 or S8 or S9
S9 TX (sleep* N3 report) or (sleep N3 questionnaire*) or (sleep* N3 index) or (sleep* N3 diar*) or (sleep* N3 log*) or (sleep* N3 journal)
S8 TX polysomnogr* or actigr* or accelerom* or (objective* n3 measure*) or (direct* n3 measure*)
S7 (MH “Accelerometry”)
S6 (MH “Accelerometers”)
S5 (MH “Polysomnography”)
S4 (S1 or S2) not S3
S3 (MH “Sleep Apnea Syndromes+”) AND TI ( (apnea or apnoea) )
S2 TX sleep N2 duration
S1 (MH “Sleep”) OR (MH “Sleep Deprivation”)
Integrated Systematic Review


All articles that screened into the other three systematic reviews were manually screened to determine eligibility for inclusion in this review. Further, a new search that targeted combinations of two or more movement behaviours was performed using the CINAHL database, as follows.

CINAHL (inception to June 2, 2015)
S1 (MH “Exercise+”)
S2 (MH “Therapeutic Exercise+”)
S3 (MH “Motor Activity+”)
S4 (MH “Physical Activity”)
S5 (MH “Physical Education and Training+”)
S6 (MH “Sports+”)
S7 (MH “Play and Playthings+”)
S8 TX sport$ or bicycl$ or swim$ or walk$ or run$ or jog$
S9 TX physic* N2 activ*
S10 TX aerobic N2 activ* OR aerobic N2 train*
S11 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10
S12 sedentar*
S13 chair time or desk time or car time or automobile time or auto time or bus time or indoor time or in-door time or screen time or computer time
S14 low energy expenditure
S15 computer game* or video game* or television or tv
S16 electronic game* or gaming
S17 screen based entertainment or screen-based entertainment
S18 texting or text messag* or app or apps or mobile applications
S19 smartphone* or smart phone* or cell phone* or mobile phone* or small screen*
S20 social media or Facebook or Youtube or Twitter or Snapchat or Instagram or Pinterest or Skype or Vine
S21 bed rest
S22 sitting
S23 physical* N2 inactivit*
S24 S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23
S25 (MH “Sleep”) OR (MH “Sleep Deprivation”)
S26 TX sleep N2 duration
S27 (MH “Sleep Apnea Syndromes+”) AND TI ( (apnea or apnoea) )
S28 (S25 or S26) not S27
S29 S11 and S24 and S28
APPENDIX D: STAKEHOLDER SURVEY

METHODS

To gain feedback on the clarity of the initial draft of the guidelines, as well as level of agreement, perceived importance, and support for the guidelines from a large number of practitioners, an online Stakeholder Survey was distributed in November/December 2015. The Children’s Hospital of Eastern Ontario Research Ethics Board reviewed and approved the administration of the survey and use of a passive consent process. The survey was distributed (in English and French) by collaborating organizations and Guideline Consensus Group members through their respective membership emails, listservs and/or professional networks. Stakeholders were encouraged to share the survey with their peers and colleagues to facilitate “snowball” sampling (recognizing the inherent risk of bias) and further expand the consultation base. The survey remained open for 3 weeks.

In the online survey, stakeholders were shown the initial draft of the title, preamble, guidelines, and diagram, and answered 22 closed- and open-ended questions regarding each component. The specific content of the stakeholder survey, in English and French, is presented below.

**English Survey**

Study title: Stakeholder Survey for the Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep

Investigators: Dr. Mark Tremblay, Healthy Active Living and Obesity Research Group, Children’s Hospital of Eastern Ontario (CHEO), email: mtremblay@cheo.on.ca

As a practitioner or researcher whose work is in some way connected with physical activity, sedentary time and/or sleep, you are being invited to participate in a survey soliciting your opinion on a draft of Canada’s Integrated 24-Hour Movement Behaviour Guidelines for Children and Youth: an integration of physical activity, sedentary behavior and sleep (herein referred to as the Integrated Guidelines).

Traditionally, research examining the health implications of physical activity, sedentary behaviour, and sleep among children and youth has been conducted in movement behaviour silos, even though these behaviours do not occur in isolation of each other and have intuitive and empirical interactions. A body of research indicates that an integrated or holistic approach is more effective in changing behaviour resulting in a larger impact on health indicators, compared to an approach that only focuses on individual risk factors. Feedback from Canadian pediatricians, our knowledge user colleagues, and our expert international collaborators indicates that evidence-informed 24-hour guidelines that integrate physical activity, sedentary behaviour and sleep are needed and preferred over separate guides in order to enhance the promotion of healthy active lifestyles among children and youth across Canada. With leadership from the Canadian Society for Exercise Physiology, a group of Canadian and International research and practice experts in physical activity, sedentary behaviour, sleep, and health promotion were convened to participate in the development of the Integrated Guidelines. After reviewing and consolidating the existing bodies of evidence in physical activity, sedentary behaviour and sleep, the experts have produced an initial version of the Integrated Guidelines.

One of the final stages in the development of the Integrated Guidelines is to gain feedback about the clarity of the guidelines, as well as level of agreement, perceived importance, and support for the guidelines from a large number of practitioners (e.g., pediatrics, education, public health, health promotion, physical activity, etc.). Acceptance and dissemination of the Integrated Guidelines is important for the alignment of strategic efforts in policy, practice, and research aimed at promoting health for Canadian children. Participation in this survey is voluntary. By accessing and completing this survey you are giving your implied/passive consent to participate in the survey. A potential discomfort may include you feeling uncomfortable with some of the questions being asked if they are sensitive or evocative. If you feel uncomfortable, you may choose not to answer a question. The survey does not collect information about your name or email address and responses will be presented in group format only. This survey will be distributed through our collaborating partner’s networks, memberships and email listservs; in the past, similar surveys have resulted in 2,000 respondents.

If you have any questions about this study, please contact Dr. Mark Tremblay at 613-737-7600 ext. 4114 or mtremblay@
cheo.on.ca. The Children’s Hospital of Eastern Ontario (CHEO) Research Ethics Board (REB) has reviewed this protocol. The REB considers ethical aspects of all research studies involving human participants at the CHEO and its Research Institute. If you have any questions about your rights as a study participant, you may contact the CHEO REB Chairperson at 613-737-7600 ext. 3624.

Note: Canada’s Integrated 24-Hour Movement Behaviour Guidelines for Children and Youth is in draft form and is not intended for general circulation.

Thanks for your time! We encourage you to circulate the survey link to your colleagues and among your networks. This stakeholder survey will be open until 12 p.m. EST on December 18th, 2015.

Guideline Title

Canadian 24-hour Movement Guidelines for Children and Youth: An integration of physical activity, sedentary behaviour, and sleep

1. Is the Title clearly stated?

<table>
<thead>
<tr>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somewhat Agree</td>
</tr>
<tr>
<td>Neither Agree Nor Disagree</td>
</tr>
<tr>
<td>Somewhat Disagree</td>
</tr>
<tr>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

2. Do you agree with the Title?

<table>
<thead>
<tr>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somewhat Agree</td>
</tr>
<tr>
<td>Neither Agree Nor Disagree</td>
</tr>
<tr>
<td>Somewhat Disagree</td>
</tr>
<tr>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

3. In the box below, please enter any comments that you would like to add regarding the Title.
Preamble

These guidelines are relevant to all healthy children and youth (aged 5-17 years) irrespective of gender, race, ethnicity, or socio-economic status of the family. Children and youth are encouraged to live an active lifestyle with a daily balance of sleep, sedentary behaviours, and physical activities that support their healthy development. Children and youth should practice healthy sleep hygiene, limit sedentary behaviour (especially screen time), and participate in a range of physical activities in a variety of environments (e.g., home/school/community; indoors/outdoors; land/water; summer/winter) and contexts (e.g., play, recreation, sport, active transportation, hobbies, and chores). For those not currently meeting these 24-hour movement guidelines a progressive adjustment towards these guidelines is recommended. Following these guidelines is associated with better body composition, cardiorespiratory and musculoskeletal fitness, academic achievement and cognition, emotional regulation, pro-social behaviours, cardiovascular and metabolic health and overall quality of life. The benefits of following these guidelines far exceed potential risks. These guidelines may be appropriate for children and youth with a disability or medical condition; however, a health professional should be consulted for additional guidance. The specific guidelines are attached and more details on the background research informing the guidelines, their interpretation, guidance on how to achieve them, and recommendations for research and surveillance are available at www.csep.ca/guidelines.

4. Is the Preamble clearly stated?

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Somewhat Agree</th>
<th>Neither Agree Nor Disagree</th>
<th>Somewhat Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

5. Do you agree with the Preamble?

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Somewhat Agree</th>
<th>Neither Agree Nor Disagree</th>
<th>Somewhat Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

6. In the box below, please enter any comments that you would like to add regarding the Preamble.

Guidelines

For optimal health benefits, school-aged children and youth (aged 5-17 years) should achieve high levels of physical activity, low levels of sedentary behaviour, and sufficient sleep each day. A healthy 24-hours includes: Uninterrupted sleep of 9 to 11 hours per night for those aged 5-13 years and 8 to 10 hours per night for those aged 14-17 years, with consistent bed and wake-up times; An accumulation of at least 60 minutes per day of moderate to vigorous physical activity involving a variety of aerobic activities. Vigorous physical activities and activities that strengthen muscle and bone should be incorporated at least 3 days a week; No more than 2 hours per day of recreational screen time. For the remainder of the day:
Limit sitting for extended periods as well as time spent indoors; Participate in a variety of structured and unstructured light physical activities for several hours. Preserving sufficient sleep, as well as replacing sedentary behaviour and light physical activity with additional moderate to vigorous physical activity, provides greater health benefits.

7. Are the Guidelines clearly stated?

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Somewhat Agree</th>
<th>Neither Agree Nor Disagree</th>
<th>Somewhat Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

8. Do you agree with the Guidelines?

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Somewhat Agree</th>
<th>Neither Agree Nor Disagree</th>
<th>Somewhat Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

9. Which phrase is the most appropriate for communicating the physical activity recommendation?

<table>
<thead>
<tr>
<th>An accumulation of at least <strong>60 minutes</strong> per day of moderate to vigorous physical activity involving a variety of aerobic activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>An accumulation of at least <strong>one hour</strong> per day of moderate to vigorous physical activity involving a variety of aerobic activities</td>
</tr>
</tbody>
</table>
10. The diagram accurately portrays the Integrated Guidelines.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Somewhat Agree</th>
<th>Neither Agree Nor Disagree</th>
<th>Somewhat Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

11. The Integrated Guidelines are easily understood from viewing the diagram.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Somewhat Agree</th>
<th>Neither Agree Nor Disagree</th>
<th>Somewhat Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>
12. The diagram clearly portrays the Integrated Guidelines.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Somewhat Agree</th>
<th>Neither Agree Nor Disagree</th>
<th>Somewhat Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

13. In the box below, please enter any comments that you would like to add regarding the diagram.

14. Are the Integrated Guidelines important to you and/or your job?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

15. Would you use the Integrated Guidelines?

<table>
<thead>
<tr>
<th>No, I would not use the guidelines at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, I would use the Integrated Guidelines instead of the stand-alone guidelines (i.e., physical activity, sedentary behaviour, sleep).</td>
</tr>
<tr>
<td>Yes, I would use the Integrated Guidelines in addition to the stand-alone guidelines.</td>
</tr>
</tbody>
</table>

In the box below, please briefly provide any explanation you would like to add for your response.

16. How easy or difficult would you find using the Integrated Guidelines in your work? (e.g., Could your messaging, policies, or programs be made consistent with the Integrated Guidelines?)

<table>
<thead>
<tr>
<th>Very Easy</th>
<th>Somewhat Easy</th>
<th>Neither Easy Nor Difficult</th>
<th>Somewhat Difficult</th>
<th>Very Difficult</th>
</tr>
</thead>
</table>

17. In comparison to separate physical activity, sedentary behaviour and sleep guidelines, do you find these Integrated Guidelines...

<table>
<thead>
<tr>
<th>Much More Useful</th>
<th>More Useful</th>
<th>Neutral</th>
<th>Less Useful</th>
<th>Much Less Useful</th>
</tr>
</thead>
</table>

18. In the box below, please enter any comments that you would like to add regarding the Integrated Guidelines.

19. With what sector do you primarily associate?

- Sport sector
- Education sector
- Recreation sector
- Childcare sector
- Healthcare sector
- Public health sector
- Physical activity/fitness sector
- Research sector
- Government sector
- Other, please specify... ______________________

20. Where do you primarily live / practice?

- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland and Labrador
- Northwest Territories
- Nova Scotia
- Nunavut
- Ontario
- Prince Edward Island
- Quebec
- Saskatchewan
- Yukon Territory
- Outside Canada
- If you selected outside Canada, please indicate country... ______________________
21. When the final version of the Canadian 24-hour Movement Guidelines for Children and Youth are complete, would you like to be contacted for final review so that if supportive, your organization can decide if it would like to be listed in a “supported by” section associated with the Integrated Guidelines?

[ ] Yes
[ ] No
[ ] Don’t Know

22. If you answered “Yes” to the previous question, please provide your email address so we can send your organization the final version and if supportive, gather your organization’s name and province/country to be listed in a “supported by” section associated with the Integrated Guidelines.

---

French Survey


Chercheurs : Mark Tremblay, Ph. D., Groupe de recherche sur les saines habitudes de vie et l’obésité, Centre hospitalier pour enfants de l’est de l’Ontario (CHEO), courriel : mtremblay@cheo.on.ca

En tant qu’intervenant, chercheur, ou acteur qui œuvre d’une façon ou d’une autre dans un domaine relié à l’activité physique, à la sédentarité et/ou au sommeil, vous êtes invités à remplir un sondage pour nous faire connaître votre opinion au sujet de la version préliminaire des Directives canadiennes en matière de mouvements sur 24 heures à l’intention des enfants et des jeunes : une intégration de l’activité physique, du comportement sédentaire et du sommeil (Directives intégrées dans le présent texte).

Traditionnellement, la recherche qui examine les effets sur la santé de l’activité physique, du comportement sédentaire et du sommeil chez les enfants et les jeunes se conduit en considérant ces comportements en silos, malgré que ces comportements ne se produisent pas isolément les uns des autres, mais présentent plutôt des interactions intuitives et empiriques. Un ensemble d’études indiquent qu’une approche intégrée ou holistique est plus efficace qu’une approche qui ne se centre que sur des comportements individuels pour changer un comportement et obtenir des effets importants sur des marqueurs de santé. Des pédiatres canadiens, nos collègues utilisateurs de connaissances et nos collaborateurs experts internationaux ont indiqué que des directives qui intégreraient sur 24 heures l’activité physique, le comportement sédentaire et le sommeil étaient nécessaires, et même préférables aux directives séparées, afin d’améliorer la promotion du mode de vie sain et actif auprès des enfants et des jeunes au Canada. Grâce au leadership de la Société canadienne de physiologie de l’exercice, un groupe d’experts canadiens et internationaux de la recherche et la pratique de l’activité physique, du comportement sédentaire, du sommeil et de la promotion de la santé ont été invités à participer au développement de ces Directives intégrées. Après avoir révisé et regroupé les évidences en matière d’activité physique, de comportement sédentaire et de sommeil, les experts ont produit une version préliminaire des Directives intégrées.

L’une des étapes finales du développement de ces Directives est de recevoir, de la part d’un grand nombre de professionnels, de chercheurs et d’intervenants qui œuvrent dans des domaines connexes (p. ex. pédiatrie, éducation, santé publique, promotion de la santé, activité physique, etc.), des commentaires au sujet de la clarté, du niveau d’accord, de l’importance perçue et du soutien éventuel vis-à-vis des Directives. L’accueil favorable et la diffusion des Directives intégrées sont importants pour coordonner les efforts stratégiques dans la création de politiques, dans la pratique et dans la recherche ayant pour but la promotion de la santé des enfants et des jeunes canadiens. En tant que professionnel, chercheur ou intervenant dans ce domaine, nous apprécierions votre implication dans cette démarche. La participation à ce sondage est volontaire.
En accédant à ce sondage et en le remplissant, vous donnez votre consentement implicite/passif à y participer. Il est possible que vous vous sentiez inconfortables à l’idée de répondre à certaines des questions. Si c’est le cas, vous pouvez choisir de ne pas répondre à cette question. Nous ne vous demanderons pas votre nom ni votre adresse courriel et les réponses ne seront présentées que sous une forme regroupée. Avec l’appui d’organisations collaboratrices, ce sondage sera distribué aux réseaux et aux membres; dans le passé, des enquêtes similaires ont reçu environ 2,000 répondants.

Veuillez communiquer avec Mark Tremblay au 613 737-7600, poste 4114, ou au mtremblay@cheo.on.ca pour toute question au sujet de cette étude. Le comité d’éthique de la recherche (CER) du CHEO a révisé ce protocole. Le CER étudie les aspects éthiques de toute recherche qui implique les sujets humains au CHEO et à son institut de recherche. Si vous avez des questions au sujet de vos droits en tant que participant à l’étude, veuillez communiquer avec le président du CER du CHEO au 613 737-7600, poste 3624. Note : Ces Directives canadiennes en matière de mouvements sur 24 heures à l’intention des enfants et des jeunes sont présentées en version préliminaire et ne doivent pas être distribuées.

Merci pour votre temps! Nous vous encourageons à faire circuler le lien de ce sondage à vos collègues et à travers vos réseaux. Le sondage sera ouvert jusqu’au 18 décembre 2015.

**Titre des Directives**

Directives canadiennes en matière de mouvements sur 24 heures à l’intention des enfants et des jeunes : une intégration de l’activité physique, du comportement sédentaire et du sommeil

1. **Le titre des Directives est-il clairement énoncé?**

<table>
<thead>
<tr>
<th>Fortement d’accord</th>
<th>D’accord</th>
<th>Ni en accord, ni en désaccord</th>
<th>En désaccord</th>
<th>Fortement en désaccord</th>
</tr>
</thead>
</table>

2. **Êtes-vous d’accord avec le titre?**

<table>
<thead>
<tr>
<th>Fortement d’accord</th>
<th>D’accord</th>
<th>Ni en accord, ni en désaccord</th>
<th>En désaccord</th>
<th>Fortement en désaccord</th>
</tr>
</thead>
</table>

3. Veuillez inscrire dans la boîte ci-dessous tout commentaire additionnel au sujet du titre.
Mise en contexte

Ces Directives s’adressent à tous les enfants et les jeunes en santé (âgés de 5 à 17 ans), sans égard à leur genre, à leur race, à leur ethnie ou au statut socio-économique de leur famille. Les enfants et les jeunes sont encouragés à mener une vie active, qui comprend un équilibre quotidien entre le sommeil, les activités sédentaires et les activités physiques qui soutiennent leur développement sain. Les enfants et les jeunes devraient adopter une saine hygiène de sommeil, limiter leurs comportements sédentaires (surtout le temps d’écran) et participer à une grande variété d’activités physiques dans divers environnements (p. ex. maison/école/communauté, à l’intérieur/à l’extérieur, sur la terre/dans l’eau, l’été/l’hiver) et contextes (p. ex. jeux, loisirs, transport actif, passe-temps, travaux ménagers). Pour ceux qui n’atteignent pas actuellement ces Directives en matière de mouvement sur 24 heures, un ajustement progressif est recommandé. Suivre ces Directives est associé à de meilleurs paramètres de composition corporelle, de condition physique cardiovasculaire et musculo-squelettique, de réussite académique, de cognition, de régulation affective, de comportements prosociaux, de santé cardiovasculaire et métabolique et de qualité de vie globale. Les bénéfices associés au respect des Directives surpassent de beaucoup les risques potentiels. Il peut être approprié pour des enfants ou des jeunes qui présentent un handicap ou une condition médicale de suivre ces Directives, mais un professionnel de la santé devrait être consulté pour obtenir plus de conseils à cet égard. Visez le www.csep.ca/fr/directives/obtenez-les-directives pour lire les Directives spécifiques. Vous y trouverez également plus de renseignements sur la recherche qui a mené à leur rédaction, sur leur interprétation, des conseils sur la façon de les satisfaire, ainsi que des pistes de recherche et de surveillance.

4. La mise en contexte est-elle clairement énoncée?

<table>
<thead>
<tr>
<th>Fortement d’accord</th>
</tr>
</thead>
<tbody>
<tr>
<td>D’accord</td>
</tr>
<tr>
<td>Ni en accord, ni en désaccord</td>
</tr>
<tr>
<td>En désaccord</td>
</tr>
<tr>
<td>Fortement en désaccord</td>
</tr>
</tbody>
</table>

5. Êtes-vous d’accord avec la mise en contexte?

<table>
<thead>
<tr>
<th>Fortement d’accord</th>
</tr>
</thead>
<tbody>
<tr>
<td>D’accord</td>
</tr>
<tr>
<td>Ni en accord, ni en désaccord</td>
</tr>
<tr>
<td>En désaccord</td>
</tr>
<tr>
<td>Fortement en désaccord</td>
</tr>
</tbody>
</table>

6. Veuillez inscrire tout commentaire additionnel au sujet de la mise en contexte dans la boîte ci-dessous.
Directives

Pour obtenir des bénéfices santé optimaux, les enfants et les jeunes (5 à 17 ans) devraient atteindre des niveaux élevés d’activité physique, des niveaux faibles de comportement sédentaire et suffisamment de sommeil, chaque jour. Un 24 heures sain inclut : un sommeil ininterrompu de 9 à 11 heures par nuit pour les 5 à 13 ans, et de 8 à 10 heures pour les 14 à 17 ans, avec des heures constantes de coucher et de réveil; un total d’au moins 60 minutes par jour d’activités physiques d’intensité moyenne à vigoureuse qui incluent une variété d’activités cardiovasculaires. Des activités d’intensité vigoureuse et des activités qui permettent de renforcer les muscles et les os devraient être incorporées au moins 3 jours par semaine; pas plus de 2 heures par jour de temps d’écran pour les loisirs. Pour le reste de la journée : Limitez les longues périodes de temps passées en position assise, ainsi que le temps passé à l’intérieur; Participez à une variété d’activités structurées et non structurées de faible intensité pendant plusieurs heures; Maintenir un sommeil suffisant, de même que remplacer les comportements sédentaires et les activités physiques de faible intensité par des activités physiques d’intensité moyenne et vigoureuse additionnelles fournit de plus grands bénéfices pour la santé.

7. Les Directives sont-elles clairement énoncées?

<table>
<thead>
<tr>
<th>Fortement d’accord</th>
</tr>
</thead>
<tbody>
<tr>
<td>D’accord</td>
</tr>
<tr>
<td>Ni en accord, ni en désaccord</td>
</tr>
<tr>
<td>En désaccord</td>
</tr>
<tr>
<td>Fortement en désaccord</td>
</tr>
</tbody>
</table>

8. Êtes-vous d’accord avec les Directives?

<table>
<thead>
<tr>
<th>Fortement d’accord</th>
</tr>
</thead>
<tbody>
<tr>
<td>D’accord</td>
</tr>
<tr>
<td>Ni en accord, ni en désaccord</td>
</tr>
<tr>
<td>En désaccord</td>
</tr>
<tr>
<td>Fortement en désaccord</td>
</tr>
</tbody>
</table>

9. Quelle phrase est la plus appropriée pour communiquer la recommandation au sujet de l’activité physique?

<table>
<thead>
<tr>
<th>Un total d’au moins 60 minutes par jour d’activités physiques d’intensité moyenne à vigoureuse qui incluent une variété d’activités cardiovasculaires.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Un total d’au moins 1 heure par jour d’activités physiques d’intensité moyenne à vigoureuse qui incluent une variété d’activités cardiovasculaires.</td>
</tr>
</tbody>
</table>
10. Le diagramme représente avec précision les Directives intégrées.

<table>
<thead>
<tr>
<th>Fortement d’accord</th>
</tr>
</thead>
<tbody>
<tr>
<td>D’accord</td>
</tr>
<tr>
<td>Ni en accord, ni en désaccord</td>
</tr>
<tr>
<td>En désaccord</td>
</tr>
<tr>
<td>Fortement en désaccord</td>
</tr>
</tbody>
</table>

11. Regarder le diagramme permet de facilement comprendre les Directives intégrées.

<table>
<thead>
<tr>
<th>Fortement d’accord</th>
</tr>
</thead>
<tbody>
<tr>
<td>D’accord</td>
</tr>
<tr>
<td>Ni en accord, ni en désaccord</td>
</tr>
<tr>
<td>En désaccord</td>
</tr>
<tr>
<td>Fortement en désaccord</td>
</tr>
</tbody>
</table>
12. Le diagramme représente clairement les Directives intégrées.

| Fortement d’accord | D’accord | Ni en accord, ni en désaccord | En désaccord | Fortement en désaccord |


14. Ces Directives intégrées sont-elles importantes pour vous / pour votre travail?

| Oui | Non |

15. Utiliserez-vous ces Directives intégrées?

| Non, je n’utiliserais pas ces Directives du tout. | Oui, j’utiliserais les Directives intégrées plutôt que les directives séparées (c.-à-d. activité physique, comportement sédentaire, sommeil). | Oui, j’utiliserais les Directives intégrées, en plus des directives séparées. |

Veuillez utiliser la boîte ci-dessous pour expliquer brièvement votre réponse si désiré.

16. Serait-il facile ou difficile d’utiliser les Directives intégrées à votre travail? (Vos messages, vos politiques, vos programmes pourraient-ils devenir compatibles avec les Directives intégrées?)

| Très facile | Plutôt Facile | Ni facile, ni difficile | Plutôt difficile | Difficile |
17. En comparaison avec des directives séparées sur l’activité physique, le comportement sédentaire et le sommeil, trouvez-vous que ces Directives sont…

<table>
<thead>
<tr>
<th>Beaucoup plus utiles</th>
<th>Plus utiles</th>
<th>Neutre</th>
<th>Moins utiles</th>
<th>Beaucoup moins utiles</th>
</tr>
</thead>
</table>


19. À quel secteur de pratique êtes-vous principalement associé?

<table>
<thead>
<tr>
<th>Sport</th>
<th>Éducation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loisirs</td>
<td>Soins à l’enfance</td>
</tr>
<tr>
<td>Soins de santé</td>
<td>Santé publique</td>
</tr>
<tr>
<td>Activité physique/Conditionnement physique</td>
<td>Recherche</td>
</tr>
<tr>
<td>Gouvernement</td>
<td>Autre, veuillez préciser : ________________</td>
</tr>
</tbody>
</table>

20. Quel est votre principal lieu de résidence/de travail?

<table>
<thead>
<tr>
<th>Alberta</th>
<th>Colombie-Britannique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manitoba</td>
<td>Nouveau-Brunswick</td>
</tr>
<tr>
<td>Terre-Neuve et Labrador</td>
<td>Territoires du Nord-Ouest</td>
</tr>
<tr>
<td>Nouvelle-Écosse</td>
<td>Nunavut</td>
</tr>
<tr>
<td>Ontario</td>
<td>Île-du-Prince-Édouard</td>
</tr>
<tr>
<td>Québec</td>
<td>Saskatchewan</td>
</tr>
<tr>
<td>Yukon</td>
<td>Hors Canada</td>
</tr>
<tr>
<td>Si vous avez choisi « hors Canada », veuillez préciser le pays : ________________</td>
<td></td>
</tr>
</tbody>
</table>
21. Lorsque la version finale des Directives canadiennes en matière de mouvements sur 24 heures à l’intention des enfants et des jeunes sera terminée, aimeriez-vous que l’on communique avec vous pour révision finale et, dans le cas où vous souhaiteriez appuyer les Directives, votre organisation déciderait si elle souhaite apparaître dans une section « appuis » associée aux Directives?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oui</td>
<td></td>
</tr>
<tr>
<td>Non</td>
<td></td>
</tr>
<tr>
<td>Ne sais pas</td>
<td></td>
</tr>
</tbody>
</table>

22. Si vous avez répondu « oui » à la question précédente, veuillez inscrire votre adresse courriel afin que nous puissions vous envoyer la version finale. Si vous appuyez toujours les Directives, nous recueillerons le nom de votre organisation et votre province/pays. Ces renseignements seront placés dans la section « appuis » associée aux Directives.

---

RESULTS

In total, 590 individuals (531 in English, 59 in French) initiated the survey, and at least 275 provided additional comments and suggestions.

Overall, there was a high level of agreement with and support for the draft guidelines. 93% of respondents indicated that they would use the new guidelines either instead of, or in addition to, the stand-alone guidelines. Respondents were from a variety of sectors (including the sport, education, recreation, childcare, healthcare, public health, physical activity/fitness, research, government and other sectors), and were from across (n=402) and outside of Canada (n=67). One hundred and ninety four individuals indicated that they would like to be contacted for review of the final guidelines so that, if supportive, they or their organization could decide if they would like to be listed in a “supported by” section associated with the Guidelines. A list of individuals and organizations who support the final guidelines is available on the CSEP website (www.csep.ca/guidelines).

Specific results of the stakeholder survey are provided below.
Table D1. Summary Results of Closed-Ended Stakeholder Survey Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree % (n)</th>
<th>Somewhat Agree % (n)</th>
<th>Neither Agree Nor Disagree % (n)</th>
<th>Somewhat Disagree % (n)</th>
<th>Strongly Disagree % (n)</th>
<th>Total Responses (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the Title Clearly Stated?</td>
<td>49.3% (291)</td>
<td>42.0% (248)</td>
<td>3.1% (18)</td>
<td>5.6% (33)</td>
<td>0.0% (0)</td>
<td>590</td>
</tr>
<tr>
<td>Do you agree with the Title?</td>
<td>41.4% (241)</td>
<td>43.1% (251)</td>
<td>8.8% (51)</td>
<td>6.2% (36)</td>
<td>0.5% (3)</td>
<td>582</td>
</tr>
<tr>
<td>Is the Preamble Clearly Stated?</td>
<td>55.8% (286)</td>
<td>38.4% (197)</td>
<td>3.5% (18)</td>
<td>2.1% (11)</td>
<td>0.2% (1)</td>
<td>513</td>
</tr>
<tr>
<td>Do you agree with the Preamble?</td>
<td>62.0% (317)</td>
<td>32.5% (166)</td>
<td>3.1% (16)</td>
<td>2.0% (10)</td>
<td>0.4% (2)</td>
<td>511</td>
</tr>
<tr>
<td>Are the Guidelines clearly stated?</td>
<td>59.6% (298)</td>
<td>35.8% (179)</td>
<td>1.6% (8)</td>
<td>2.6% (13)</td>
<td>0.4% (2)</td>
<td>500</td>
</tr>
<tr>
<td>Do you agree with the Guidelines?</td>
<td>66.0% (330)</td>
<td>27.8% (139)</td>
<td>3.8% (19)</td>
<td>2.2% (11)</td>
<td>0.2% (1)</td>
<td>500</td>
</tr>
<tr>
<td>The diagram accurately portrays Integrated Guidelines.</td>
<td>45.3% (217)</td>
<td>38.8% (186)</td>
<td>6.7% (32)</td>
<td>7.3% (35)</td>
<td>1.9% (9)</td>
<td>479</td>
</tr>
<tr>
<td>The Integrated Guidelines are easily understood from viewing the diagram.</td>
<td>33.3% (159)</td>
<td>41.0% (196)</td>
<td>7.1% (34)</td>
<td>15.9% (76)</td>
<td>2.7% (13)</td>
<td>478</td>
</tr>
<tr>
<td>The diagram clearly portrays the Integrated Guidelines.</td>
<td>34.8% (166)</td>
<td>40.7% (194)</td>
<td>9.4% (45)</td>
<td>12.2% (58)</td>
<td>2.9% (14)</td>
<td>477</td>
</tr>
<tr>
<td>In comparison to separate physical activity, sedentary behaviour, and sleep guidelines, do you find these Integrated Guidelines...</td>
<td>Much More Useful % (n)</td>
<td>More Useful % (n)</td>
<td>Neutral % (n)</td>
<td>Less Useful % (n)</td>
<td>Much Less Useful % (n)</td>
<td>Total Responses (n)</td>
</tr>
<tr>
<td></td>
<td>29.0% (137)</td>
<td>50.2% (237)</td>
<td>19.5% (92)</td>
<td>0.6% (3)</td>
<td>0.6% (3)</td>
<td>472</td>
</tr>
</tbody>
</table>

Additionally, stakeholders were asked which phrase they preferred for communicating the physical activity recommendation: an accumulation of at least “60 minutes” per day or at least “one hour” per day of moderate to vigorous physical activity. The majority preferred the “60 minutes” terminology (72.6%, n=363 vs 27.4%, n=137); therefore, this phrase was retained in the final guidelines.
Summary of Responses to Open-Ended Questions

The following are comments and suggestions from the open-ended questions on the Stakeholder Survey, presented in order of frequency. Note that only recurring comments and suggestions are highlighted here (i.e., isolated comments that reflect <3% of respondents are not included).

1. Comments regarding the Title. (n=212 respondents)
   - 25% (53/212) thought the title was too long;
   - 21% (25/212) thought the title was too complex, or too wordy, or too technical, or required high literacy, or academic, or tailored to health professionals and not the lay public;
   - 33% (71/212) thought that one of the words in the title should be removed or modified:
     - 10% (22/212): remove/modify the word “movement”, since sedentary behaviour and sleep do not require movement;
     - 7% (15/212): remove “24-hour” or change to “daily”;
     - 3% (6/212): change “Canadian” to “Canada’s” or remove;
     - Many suggested specific alternate titles.

2. Comments regarding the Preamble. (n=156 respondents)
   - 32% (50/155) thought that the Preamble was too wordy, or too technical, or too academic, or tailored to health practitioners;
   - 28% (43/155) thought that certain concepts or terminologies needed to be changed, explained or modified:
     - 12% (19/155): remove or rephrase “sleep hygiene”;
     - 8% (12/155): give examples of benefits and/or risks of following these guidelines;
     - 3% (5/155): remove the word “healthy” in front of “children” (first sentence);
     - 3% (4/155): provide more detail for children with disabilities.

3. Comments regarding the Diagram. (n=275 respondents)
   - Many respondents shared concerns that the diagram was not clear and would not be interpreted correctly (36%, 99/275). Specific concerns included:
     - 13% (35/275): The large proportion of the diagram for sedentary behaviour is visually unbalanced and overpowering. It suggests that sedentary behaviour is a normal part of life, more important than physical activity, and/or a required behaviour throughout the day;
     - 6% (16/275): MVPA acronym is confusing or sector jargon or too technical;
     - 4% (10/275): the diagram is too busy, or too complex, or wordy, or high literacy;
     - 3% (9/275): the green arrows are confusing, or unclear, or going in the wrong direction;
     - 3% (9/275): the phrase “extended periods” is ambiguous, or unclear, or open to interpretation;
     - 3% (7/275): the diagram will not be understood by families and the general public.
   - Many responses contained specific suggestions for improving the diagram (45%, 125/275), including:
     - 7% (20/275): display ideal proportions/time allocations for specific behaviours (e.g., no more than 2 hours of screen time);
     - 5% (14/275): avoid using red for sleep since red is interpreted negatively;
     - 4% (11/275): have the green arrows pointing in a clockwise direction;
     - 3% (9/275): associate numbers with the tick marks on the clock;
     - 3% (8/275): write out “MVPA” in full and define better
4. **Responses to the question: “Would you use the integrated guidelines?”** (n=130 respondents)
   - Overall, responses were positive; 47% (61/130) echoed the rationale for creating integrated guidelines, and indicated that they preferred the comprehensive, integrated approach;
   - 8% (10/130) indicated that they would use both sets of guidelines (or these along with those from other countries), or thought that the separate guidelines provided more useful information, or didn’t understand the distinction;
   - Other specific suggestions included:
     - 8% (10/130): improve clarity, or lower the level of writing, or use more pictures;
     - 5% (7/130): develop similar guidelines for adults or other age groups;
     - 3% (4/130): incorporate food or nutrition.

5. **Responses to the statement: “Please enter any comments that you would like to add regarding the Integrated Guidelines.”** (n=107 respondents)
   - Most additional comments comprised agreement/praise (40%; 43/107);
   - 9% (10/107) requested specific examples of interventions or resources;
   - 3% (3/107) expressed concerns that the guidelines were not sufficiently developed.

**Responses to Feedback**

1. **Concerns that the Title is too long.**
   It is understood that the title will be truncated in daily use, likely to “Canadian 24-Hour Movement Guidelines”, or just “24-Hour Movement Guidelines”. The full title is descriptive of what is encompassed in the guidelines: who (children and youth), what (movement guidelines, including physical activity, sedentary behaviour, and sleep), and when (the full 24-hour period). Removing these important details creates ambiguity.

2. **Concerns around the use of the word “movement”, since sedentary behaviour and sleep do not require movement.**
   Discussions regarding the appropriate terminology have been ongoing; members of the Guideline Consensus Group agree that the term “movement behaviours” most accurately describes these behaviours. The rationale for using this terminology is that movement occurs along a continuum from no/low movement (i.e., sleep and sedentary behaviours) to high movement (i.e., vigorous physical activity). There is no other term that is equally accurate in describing this grouping of behaviours. For example “lifestyle” or “daily” behaviours could include a whole host of other behaviours, including dietary habits, smoking etc.

3. **Suggestion to remove “Canadian” or change to “Canada’s” in the Title.**
   Three percent (n=6) of stakeholder survey respondents thought that “Canadian” should be changed to “Canada’s” or removed from the title altogether. “Canadian” is consistent with the previous iteration of the guidelines, and gives authority to the guidelines (i.e., these are the country’s “official” guidelines); therefore, this was not changed or removed.

4. **Suggestion to remove “24-hour” or change to “daily”.**
   The term “daily” could be interpreted to exclude the night-time period. A message underlying these guidelines is that “the whole day matters”, and this is highlighted by inclusion of “24-Hour” in the title of the guidelines.

5. **Concerns that the Preamble and Guidelines are too technical.**
   The Guideline Consensus Panel discussed this concern at length. Ultimately, it was determined that the high-level detail cannot be removed, because then it will be unclear who the guidelines apply to, in what context, what the benefits are of following the guidelines, etc. Throughout the revision process, it was determined that if there were equally precise or succinct but more accessible ways of communicating concepts then these changes would be made, but not at the expense of accuracy. Concepts that require further explanation will be clarified in the messaging and public-facing materials that are associated with the “official” guideline document.
6. Suggestions to remove the word “healthy” in front of “children” in the Preamble, and to provide more information for children with disabilities.
   The evidence that informed the development of the guidelines (i.e., the four systematic reviews and compositional analyses) was from studies that included apparently healthy children and youth (i.e., general populations, including those with overweight/obesity, but not specific groups with diagnosed diseases or conditions). Therefore, this is the population to whom the guidelines apply. It is recognized that these guidelines may also be appropriate for children and youth with a disability or medical condition, and it is recommended that a health professional be consulted for additional guidance in these instances. It is an acknowledged limitation that specific recommendations for all possible medical conditions and disabilities are outside of the scope of population-level public health guidelines.

7. Misunderstanding of what is meant by the term “sleep hygiene” in the Preamble.
   The term “sleep hygiene” is the appropriate term that is used in the sleep literature; therefore, it is important to use this term, but to also define it to begin to generate understanding regarding its meaning. Therefore, a description of what is meant by this term was added in parentheses (i.e., “habits and practices that are conducive to sleeping well”).

8. Concerns that the diagram was not clear and/or would not be interpreted correctly.
   An additional stage was added to the overall process to address this issue: Creative Development and Visual Identity. Please see “METHODS - Stage 2: Develop Visual Identity, Creative Concept, and Marketing Plan” in the “Full Report” for further details.

9. Requests for examples, details, and resources.
   These will be provided in the messaging and public-facing materials that are associated with the “official” guideline document.

10. Other suggestions.
    Many other suggestions were related to personal preference and would not influence the clarity of the Title, Preamble or Guidelines.

After revisions to the guidelines were made, they were formally “copy-edited” by the Publishing Department at the Conference Board of Canada. The Consensus Panel unanimously approved the final, revised Title, Preamble and Guidelines.
Canadian 24-Hour Movement Guidelines for Children and Youth:
An Integration of Physical Activity, Sedentary Behaviour, and Sleep

Preamble

These guidelines are relevant to apparently healthy children and youth (aged 5–17 years) irrespective of gender, race, ethnicity, or the socio-economic status of the family. Children and youth are encouraged to live an active lifestyle with a daily balance of sleep, sedentary behaviours, and physical activities that supports their healthy development.

Children and youth should practice healthy sleep hygiene (habits and practices that are conducive to sleeping well), limit sedentary behaviours (especially screen time), and participate in a range of physical activities in a variety of environments (e.g., home/school/community; indoors/outdoors; land/water; summer/winter) and contexts (e.g., play, recreation, sport, active transportation, hobbies, and chores).

For those not currently meeting these 24-hour movement guidelines, a progressive adjustment toward them is recommended. Following these guidelines is associated with better body composition, cardiorespiratory and musculoskeletal fitness, academic achievement and cognition, emotional regulation, pro-social behaviours, cardiovascular and metabolic health, and overall quality of life. The benefits of following these guidelines far exceed potential risks.

These guidelines may be appropriate for children and youth with a disability or medical condition; however, a health professional should be consulted for additional guidance.

The specific guidelines and more details on the background research informing them, their interpretation, guidance on how to achieve them, and recommendations for research and surveillance are available at www.csep.ca/guidelines.

Guidelines

For optimal health benefits, children and youth (aged 5–17 years) should achieve high levels of physical activity, low levels of sedentary behaviour, and sufficient sleep each day.

A healthy 24 hours includes:

- Uninterrupted 9 to 11 hours of sleep per night for those aged 5–13 years and 8 to 10 hours per night for those aged 14–17 years, with consistent bed and wake-up times;
- An accumulation of at least 60 minutes per day of moderate to vigorous physical activity involving a variety of aerobic activities. Vigorous physical activities and muscle and bone strengthening activities should each be incorporated at least 3 days per week;
- Several hours of a variety of structured and unstructured light physical activities;
- No more than 2 hours per day of recreational screen time;
- Limited sitting for extended periods.

Preserving sufficient sleep, trading indoor time for outdoor time, and replacing sedentary behaviours and light physical activity with additional moderate to vigorous physical activity can provide greater health benefits.
Directives canadiennes en matière de mouvement sur 24 heures pour les enfants et les jeunes : une approche intégrée regroupant l’activité physique, le comportement sédentaire et le sommeil

Préambule

Ces directives s’appliquent à tous les enfants et les jeunes (âgés de 5 à 17 ans) vraisemblablement en santé sans égard au genre, à la race, à l’origine ethnique ou au statut socioéconomique familial. Les enfants et les jeunes sont encouragés à adopter un mode de vie actif et à maintenir un équilibre au quotidien entre le sommeil, le comportement sédentaire et les activités physiques afin de favoriser un développement sain.

Les enfants et les jeunes devraient adopter une hygiène de sommeil saine (des habitudes et pratiques qui amènent à bien dormir), limiter les comportements sédentaires (particulièrement le temps passé devant un écran) et participer à une gamme d’activités physiques dans une variété d’environnements (p. ex. à la maison/à l’école/dans la communauté; à l’intérieur/à l’extérieur; sur le sol/dans l’eau; l’été/l’hiver) et de contextes (p. ex. jeux, loisirs, sports, transport actif, passe-temps et tâches ménagères).

Pour celles et ceux qui ne respectent pas ces directives de mouvement sur 24 heures, un ajustement progressif est recommandé afin de parvenir à les appliquer. Suivre ces directives est associé à un meilleur profil de composition corporelle, de condition physique cardiovasculaire et musculosquelettique, de réussite scolaire, de cognition, de régulation des émotions, de comportements prosociaux, de santé cardiovasculaire et métabolique, et de qualité de vie globale. Les avantages associés à l’adoption de ces directives surpassent de loin les risques potentiels.

Ces directives pourraient convenir aux enfants et aux jeunes aux prises avec une incapacité ou un trouble médical. Toutefois, un professionnel de la santé devrait être consulté pour obtenir des conseils additionnels.

Les directives en tant que telles et plus de renseignements sur la recherche ayant mené à leur mise au point et à leur interprétation, ainsi que des conseils pour les mettre en application et des recommandations sur la recherche et la surveillance sont disponibles au [www.scpe.ca/directives](http://www.scpe.ca/directives).

Directives

Pour une santé optimale, les enfants et les jeunes (âgés de 5 à 17 ans) devraient faire beaucoup d’activités physiques et peu d’activités sédentaires, et dormir suffisamment chaque jour.

Un 24 heures sain comprend :

- De 9 à 11 heures de sommeil par nuit sans interruption pour les 5 à 13 ans et de 8 à 10 heures par nuit pour les 14 à 17 ans, et des heures de coucher et de lever régulières;
- L’accumulation d’au moins 60 minutes par jour d’activité physique d’intensité moyenne à élevée comprenant une variété d’activités aérobies. Des activités physiques d’intensité élevée et des activités pour renforcer les muscles et les os devraient être intégrées au moins 3 jours par semaine;
- Plusieurs heures d’une variété d’activités physiques d’intensité légère structurées et non structurées;
- Un maximum de 2 heures par jour de temps de loisir devant un écran;
- Un minimum de périodes prolongées en position assise.

Maintenir une durée de sommeil suffisante, passer plus de temps à l’extérieur et remplacer les comportements sédentaires et l’activité physique de faible intensité par plus d’activité physique d’intensité moyenne à élevée entraîne encore plus de bienfaits pour la santé.
APPENDIX F: AGREE II REPORT

The Appraisal of Guidelines for Research Evaluation (AGREE) II instrument was used as a framework to guide this project, and to provide an appraisal and evaluation of the final product (Brouwers et al., 2010a; Brouwers et al., 2010b; Brouwers et al., 2010c; Brouwers et al., 2016). The AGREE II is an internationally accepted standard for guideline development that ensures scientific rigor and transparency throughout the process.

Four independent reviewers, including two who were external to the entire process, completed the AGREE II assessment. The Doman Scores (%) were calculated as per the AGREE II instrument (AGREE Next Steps Consortium, 2009). The results of this evaluation are presented in Table F1 below. All four reviewers stated that they would recommend the guideline for use, and the overall quality of the guideline was rated at 92% (Overall Guideline Assessment; on a scale from 1 to 7 the absolute scores were 6, 6, 7 and 7; maximum score of 100% indicates the “highest possible quality”).

For improvement, the reviewers recommended the following:

- Presenting more explicit detail regarding the consideration of benefits and harms in developing the final recommendations (Item 11);
- Providing more detail regarding facilitators and barriers to the application of the guideline (Item 18);
- Providing greater advice and/or tools on how the recommendations can be put into practice (Item 19);
- More rigorously considering the potential resource implications of applying the recommendations (Item 20).
Table F1. Appraisal of Guidelines for Research and Evaluation (AGREE) II Reporting Grid

<table>
<thead>
<tr>
<th>AGREE II Item</th>
<th>Reporting Location</th>
<th>Domain Score (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domain 1. Scope and Purpose</strong></td>
<td></td>
<td>99</td>
</tr>
<tr>
<td>1. The overall objective(s) of the guideline is (are) specifically described.</td>
<td>• This Guideline Development Report</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tremblay et al. 2016a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tremblay et al. 2016b</td>
<td></td>
</tr>
<tr>
<td>2. The health question(s) covered by the guideline is (are) specifically</td>
<td>• This Guideline Development Report</td>
<td></td>
</tr>
<tr>
<td>described.</td>
<td>• Tremblay et al. 2016b</td>
<td></td>
</tr>
<tr>
<td>3. The population (patients, public, etc.) to whom the guideline is meant to</td>
<td>• This Guideline Development Report</td>
<td></td>
</tr>
<tr>
<td>apply is specifically described.</td>
<td>• Tremblay et al. 2016b</td>
<td></td>
</tr>
<tr>
<td><strong>Domain 2. Stakeholder Involvement</strong></td>
<td></td>
<td>93</td>
</tr>
<tr>
<td>4. The guideline development group includes individuals from all the relevant</td>
<td>• This Guideline Development Report</td>
<td></td>
</tr>
<tr>
<td>professional groups.</td>
<td>• Tremblay et al. 2016b</td>
<td></td>
</tr>
<tr>
<td>5. The views and preferences of the target population (patients, public, etc.)</td>
<td>• This Guideline Development Report</td>
<td></td>
</tr>
<tr>
<td>have been sought.</td>
<td>• Faulkner et al. 2016</td>
<td></td>
</tr>
<tr>
<td>6. The target users of the guideline are clearly defined.</td>
<td>• This Guideline Development Report</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tremblay et al. 2016b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Latimer-Cheung et al. 2016</td>
<td></td>
</tr>
<tr>
<td>AGREE II Item</td>
<td>Reporting Location</td>
<td>Domain Score (%)</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>Domain 3. Rigour of Development</strong></td>
<td></td>
<td>93</td>
</tr>
</tbody>
</table>
| 7. Systematic methods were used to search for evidence. | • This Guideline Development Report  
• Systematic reviews (Carson et al. 2016a; Chaput et al. 2016; Poitras et al. 2016; Saunders et al. 2016) |                  |
| 8. The criteria for selecting the evidence are clearly described. | • This Guideline Development Report  
• Systematic reviews (Carson et al. 2016a; Chaput et al. 2016; Poitras et al. 2016; Saunders et al. 2016) |                  |
| 9. The strengths and limitations of the body of evidence are clearly described. | • This Guideline Development Report  
• Tremblay et al. 2016b  
• Systematic reviews (Carson et al. 2016a; Chaput et al. 2016; Poitras et al. 2016; Saunders et al. 2016) |                  |
| 10. The methods for formulating the recommendations are clearly described. | • This Guideline Development Report  
• Tremblay et al. 2016b |                  |
| 11. The health benefits, side effects and risks have been considered in formulating the recommendations. | • This Guideline Development Report  
• Tremblay et al. 2016b Systematic reviews (Carson et al. 2016a; Chaput et al. 2016; Poitras et al. 2016; Saunders et al. 2016) |                  |
| 12. There is an explicit link between the recommendations and the supporting evidence. | • This Guideline Development Report |                  |
| 13. The guideline has been externally reviewed by experts prior to its publication. | • This Guideline Development Report  
• Tremblay et al. 2016b  
• Faulkner et al. 2016 |                  |
| 14. A procedure for updating the guideline is provided. | • This Guideline Development Report  
• Tremblay et al. 2016b |                  |
| **Domain 4. Clarity of Presentation** |                                                                                  | 100              |
| 15. The recommendations are specific and unambiguous. | • This Guideline Development Report  
• Tremblay et al. 2016b |                  |
| 16. The different options for management of the condition or health issue are clearly presented.* | • Not applicable |                  |
| 17. Key recommendations are easily identifiable. | • This Guideline Development Report  
• Tremblay et al. 2016b |                  |
<table>
<thead>
<tr>
<th>AGREE II Item</th>
<th>Reporting Location</th>
<th>Domain Score (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domain 5. Applicability</strong></td>
<td></td>
<td>79</td>
</tr>
</tbody>
</table>
| 18. The guideline describes facilitators and barriers to its application. | • This Guideline Development Report  
• Latimer-Cheung et al. 2016 | |
| 19. The guideline provides advice and/or tools on how the recommendations can be put into practice. | • This Guideline Development Report  
• Latimer-Cheung et al. 2016 | |
| 20. The potential resource implications of applying the recommendations have been considered. | • This Guideline Development Report  
• Tremblay et al. 2016b | |
| 21. The guideline presents monitoring and/or auditing criteria. | • This Guideline Development Report  
• Tremblay et al. 2016b | |
| **Domain 6. Editorial Independence** | | 100 |
| 22. The views of the funding body have not influenced the content of the guideline. | • This Guideline Development Report  
• Tremblay et al. 2016b | |
| 23. Competing interests of guideline development group members have been recorded and addressed. | • Tremblay et al. 2016b  
• Systematic reviews (Carson et al. 2016a; Chaput et al. 2016; Poitras et al. 2016; Saunders et al. 2016) | |

*NOTE: Item 16 was rated as “not applicable” and was not included in the scaled Domain 4 score.

Four independent reviewers applied the AGREE II assessment; the Domain Scores (%) were calculated by summing all the scores of the individual items in a domain and by scaling the total as a percentage of the maximum possible score for that domain (as per the AGREE II Instrument, available at [www.agreetrust.org](http://www.agreetrust.org)). The “Reporting Location” is not a comprehensive summary of all places where the information in each item can be found.


Tremblay, M.S., Carson, V., and Chaput, J.P. 2016a. Introduction to the Canadian 24-Hour Movement Guidelines for
