

New Canadian Physical Activity Guidelines

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Abstract: The Canadian Society for Exercise Physiology (CSEP), in cooperation with ParticipACTION and other stakeholders, and with support from the Public Health Agency of Canada (PHAC), has developed the new Canadian Physical Activity Guidelines for Children (aged 5–11 years), Youth (aged 12–17 years), Adults (aged 18–64 years), and Older Adults (aged ≥65 years). The new guidelines include a preamble to provide context and specific guidelines for each age group. The entire guideline development process was guided by the Appraisal of Guidelines for Research Evaluation (AGREE) II instrument, which is the international standard for clinical practice guideline development. Thus, the guidelines have gone through a rigorous and transparent developmental process; we based the recommendations herein on evidence from 3 systematic reviews, and the final guidelines benefitted from an extensive online and in-person consultation process with hundreds of stakeholders and key informants, both domestic and international. Since 2006, the products of our efforts resulted in the completion of 21 peer-reviewed journal articles (including 5 systematic reviews) that collectively guided this work. The process that Canadian researchers undertook to update the national physical activity guidelines represents the most current synthesis, interpretation, and application of the scientific evidence to date.

Key words: physical activity, recommendations, guidelines, measurement, children and youth, adults, older adults.

Résumé : La Société canadienne de physiologie de l'exercice (SCPE) en collaboration avec ParticipACTION et des parties prenantes et avec l'appui de l'Agence de santé publique du Canada (ASPC) a élaboré de nouvelles Directives canadiennes en matière d'activité physique à l'intention des enfants (âgés de 5 à 11 ans), des jeunes (âgés de 12 à 17 ans), des adultes (âgés de 18 à 64 ans) et des aînés (âgés de 65 ans et plus). Les nouvelles directives sont composées d'un préambule situant le contexte et de directives spécifiques à chaque tranche d'âge. L'élaboration complète des directives a respecté la Grille II d'évaluation de la qualité des recommandations pour la pratique clinique (AGREE), un outil reconnu internationalement pour l'élaboration des lignes directrices en pratique clinique. L'élaboration des directives résulte d'un processus rigoureux et transparent. Les recommandations présentées dans cet article sont basées sur les données probantes relevées dans trois analyses documentaires systématiques, et les directives finales ont bénéficié des fruits d'une vaste consultation en ligne et en personne auprès de centaines d'intervenants concernés et de sources de premier plan, sur la scène nationale et internationale. Depuis 2006, les résultats de nos efforts se retrouvent entre autres dans 21 articles (dont 5 analyses documentaires systématiques) sanctionnés par des pairs. La démarche entreprise par les chercheurs canadiens pour la mise à jour des directives en matière d'activité physique a abouti à la synthèse, l'interprétation et l'application des données probantes les plus récentes à ce jour.

Received 24 January 2011. Accepted 24 January 2011. Published on the NRC Research Press Web site at apnm.nrc.ca on 15 February 2011.

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La version française traduite de ce document est disponible à *Appl. Physiol. Nutr. Metab.* 36(1) : 47–58.

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Mots-clés : activité physique, recommandations, directives, mesures, enfants et jeunes, adultes, âgés.

Introduction

Over the past several decades, the physical activity and fitness of Canadians has decreased, whereas overweight–obesity and many of their associated comorbidities have increased (Colley et al. 2011a, 2011b; Shields et al. 2010; Tremblay et al. 2010b). Engaging in regular physical activity is widely accepted as an effective preventative measure for a variety of health risks across all age, gender, ethnic, and socioeconomic subgroups (Janssen 2007; Janssen and LeBlanc 2010; Martin Ginis and Hicks 2007; Paterson et al. 2007; Paterson and Warburton 2010; Physical Activity Guidelines Advisory Committee 2008; Timmons et al. 2007; Young and Katzmarzyk 2007; Warburton et al. 2007, 2010; World Health Organization (WHO) 2010). Since 1995, the Canadian Society for Exercise Physiology (CSEP) and the Public Health Agency of Canada (PHAC) have worked together on the development of the Canadian Physical Activity Guidelines to promote healthy active living in the Canadian population. The first guidelines were presented in the form of “guides” that served to translate the guidelines into a format to encourage and assist Canadians to be more active. This began with the publication of a Canadian physical activity guide for adults (aged 20–55 years) in 1998 (Health Canada and the Canadian Society for Exercise Physiology 1998), for older adults (aged >55 years) in 1999 (Health Canada and the Canadian Society for Exercise Physiology 1999), for children (aged 6–9 years) in 2002 (Health Canada and the Canadian Society for Exercise Physiology 2002b), and for youth (aged 10–14 years) in 2002 (Health Canada and the Canadian Society for Exercise Physiology 2002a). These guides have been PHAC’s most requested resource (Tremblay et al. 2007b).

This paper briefly outlines the guideline development process for the 2011 Canadian Physical Activity Guidelines for Children (aged 5–11 years), Youth (aged 12–17 years), Adults (aged 18–64 years), and Older Adults (aged ≥65 years). These guidelines were released in January 2011 by CSEP and replace the previous guidelines. PHAC has endorsed these new guidelines and ParticipACTION has played a key role in their promotion and dissemination. The new guidelines were informed by a rigorous and transparent process, and recommendations are based on systematic reviews of the scientific evidence. A detailed report outlining the full guideline methodological development process and related materials can be accessed through the CSEP Web site at <http://www.csep.ca/english/view.asp?x=804>. The purpose of this paper is to provide a summary of this process and to present the guidelines themselves.

Background

The process to create the new Canadian Physical Activity Guidelines started with a day-long think tank in Halifax in 2006. The think tank brought together experts in the fields of exercise physiology, the psychosocial aspects of physical activity, social marketing, epidemiology, and physical activity guideline development. They highlighted some key

knowledge gaps in the old Canadian Physical Activity Guidelines and proposed the creation of the official Physical Activity Measurement and Guidelines project (PAMG) and the appointment of an official steering committee to guide the project. In 2007, the PAMG Steering Committee, with leadership from CSEP, commissioned a series of 12 comprehensive narrative reviews focused on the current evidence on physical activity and health. Funding for this work was provided by PHAC. These foundation papers were to help inform new the Canadian Physical Activity Guidelines and were published jointly in *Applied Physiology, Nutrition, and Metabolism* (APNM) and the *Canadian Journal of Public Health* (CJPH) (Brawley and Latimer 2007; Cameron et al. 2007; Eslinger and Tremblay 2007; Janssen 2007; Katzmarzyk and Tremblay 2007; Martin Ginis and Hicks 2007; Paterson et al. 2007; Sharratt and Hearst 2007; Timmons et al. 2007; Tremblay et al. 2007a, 2007b, 2007c; Warburton et al. 2007; Young and Katzmarzyk 2007).

In 2008, in an effort to increase the methodological rigour of the process to one consistent with clinical practice guideline development, 5 systematic reviews were commissioned to further inform the development of the new Canadian Physical Activity Guidelines. This led to a 2.5-day conference where international representatives, content experts, stakeholders, and an independent international panel (Kesäniemi et al. 2010) debated, discussed, and came to consensus on the strength of the available evidence, important gaps in the literature, the steps needed to harmonize with international efforts, and whether the existing Canadian Physical Activity Guidelines should be modified. Concurrently, 2 research methodology consultants were engaged to advise the PAMG Steering Committee on best practices for developing the guidelines and conducting the systematic reviews needed to develop robust, evidence-informed clinical practice guidelines. Based on advice provided, the PAMG Steering Committee chose the Appraisal of Guidelines for Research Evaluation (AGREE) II instrument as a framework to guide the project (Brouwers et al. 2010a, 2010b, 2010c). AGREE II is the internationally accepted standard for guideline development that guides and assesses scientific rigor and transparency throughout the process. The 3 main systematic reviews examined the relationship between physical activity and health in school-aged children and youth (aged 5–17 years) (Janssen and LeBlanc 2010), adults (aged 18–64 years) (Warburton et al. 2010), and older adults (aged ≥65 years) (Paterson and Warburton 2010). Two additional systematic reviews examined approaches for constructing the messages accompanying the Canadian Physical Activity Guidelines (Latimer et al. 2010) and mediators of physical activity behaviour change (Rhodes and Pfaeffli 2010). A paper explaining the process behind the systematic reviews and the PAMG project up until that point (Tremblay et al. 2010a) and an independent expert consensus and review paper (Kesäniemi et al. 2010) can be found in the same series, for a total of 7 peer-reviewed papers.

Materials and methods

Guideline development

Figure 1 outlines the process used to develop the new Canadian Physical Activity Guidelines. Details on the process to guide the foundation papers (Tremblay et al. 2007b), the systematic reviews (Tremblay et al. 2010a), and the AGREE II instrument (Brouwers et al. 2010a, 2010b, 2010c) can be found elsewhere.

The target populations and guideline development questions were as follows:

Children (aged 5–11 years) and youth (aged 12–17 years)

- What is the relationship between physical activity and 7 health indicators (cholesterol, depression, injury, bone mineral density, high blood pressure, overweight and obesity, and the metabolic syndrome) in school-aged children and youth?
- How much (volume) physical activity is needed for minimal and optimal health benefits in school-aged children and youth (i.e., does this increase in a dose-response manner)?
- What types of activity are needed to produce health benefits?
- What is the appropriate physical activity intensity?
- Do the effects of physical activity on health in school-aged children and youth vary by sex and (or) age?

Adults (aged 18–64 years)

- What is the relationship between physical activity and 8 health indicators (premature all-cause mortality, cardiovascular disease, stroke, hypertension, colon cancer, breast cancer, type 2 diabetes, and osteoporosis) in adults?
- Does this relationship increase in a dose-response manner (and if so, what is the nature of the curve)?
- Does current evidence support the existing Canadian Physical Activity Guidelines?

Older adults (aged ≥65 years)

- What is the relationship between physical activity and functional independence (i.e., functional limitations, disability, or loss of independence) and cognitive function in older adults?
- What are the types, volumes, and intensities of physical activity related to higher functional status?
- Is there a dose-response of total activity or physical activity intensity related to the outcomes?

Evidence base

Please see the following 3 systematic reviews for detailed information on the evidence base informing the guidelines: (1) school-aged children and youth (aged 5–17 years) (Janssen and LeBlanc 2010); (2) adults (aged 18–64 years) (Warburton et al. 2010); and (3) older adults (aged ≥65 years) (Paterson and Warburton 2010).

Consensus meeting

In September 2010, a 2.5-day consensus meeting convened the PAMG Steering Committee, systematic review authors, content experts, health care professionals, and part-

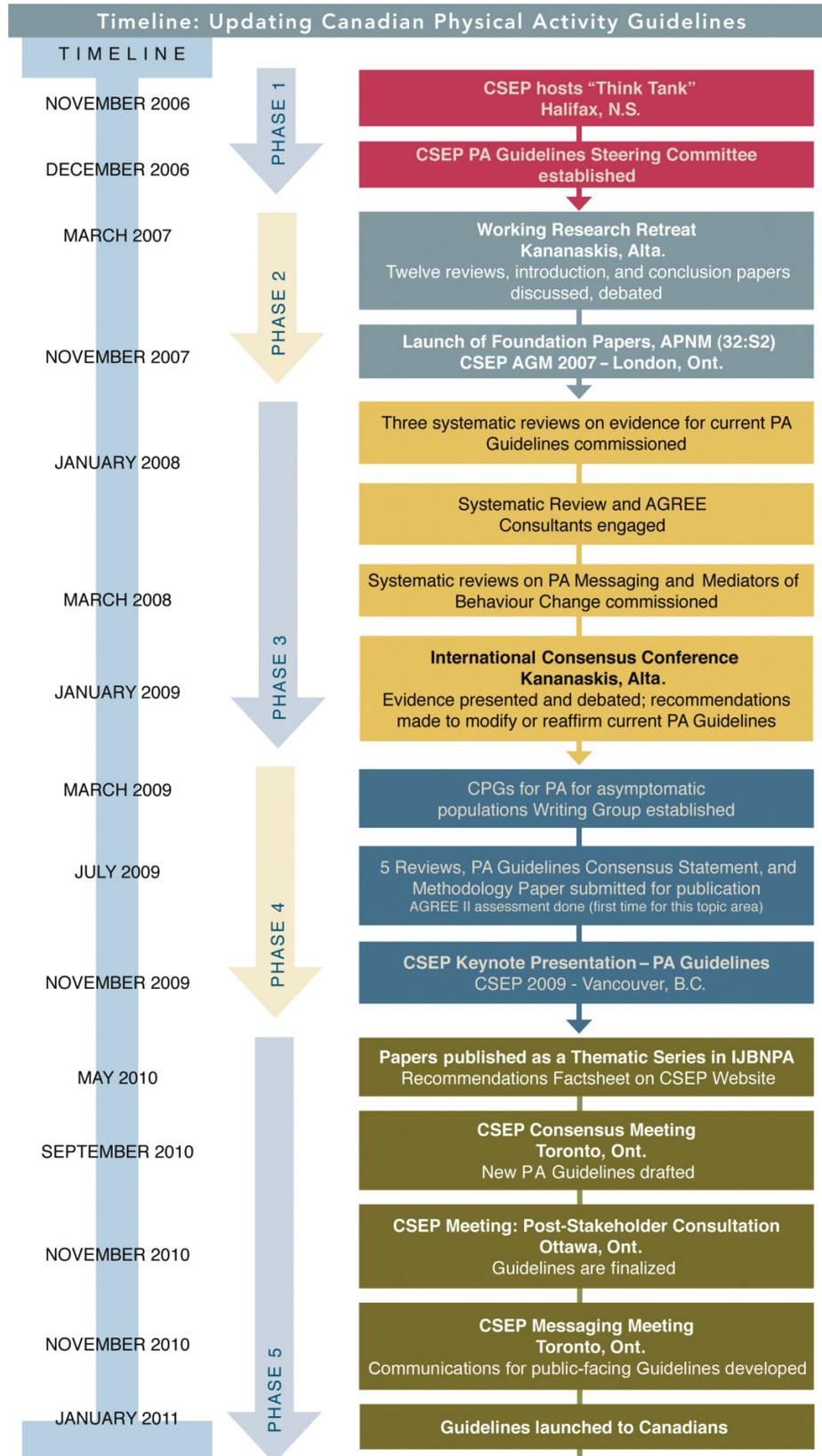
ner organizations to draft the recommendations for the new Canadian Physical Activity Guidelines. The guideline recommendations were informed by evidence from the 3 systematic reviews. Participants also received background materials including the expert consensus paper (Kesäniemi et al. 2010) and other resources from recently developed physical activity guidelines by WHO (WHO 2010), the United States (Physical Activity Guidelines Advisory Committee 2008), Australia (Okely et al. 2008), and the United Kingdom (Bull et al. 2010) to assist with wording and format harmonization. The resulting product for each age group was a preamble to explain the guidelines, followed by the guidelines themselves. The draft guidelines were then sent to stakeholders, including national and international content experts, government and nongovernmental organizations, health care professionals, teachers, and caregivers for comment and input. The final scientific Canadian Physical Activity Guidelines for all age groups are presented in this paper.

Stakeholder involvement

Throughout the guideline development process, there was substantial stakeholder involvement, including scientists, guideline developers, and potential guideline users. The scientific stakeholders were engaged through the peer-review process of all the background papers and systematic reviews. The PAMG Steering Committee liaised regularly with representatives involved in the development of physical activity guidelines in the United States, the United Kingdom, Australia, and WHO (Canadian Society for Exercise Physiology and the Public Health Agency of Canada 2009; Okely et al. 2008; Physical Activity Guidelines Advisory Committee 2008; WHO 2010). Based on the evidence and recommendations presented in the systematic reviews and the draft guidelines prepared at the September 2010 consensus meeting, feedback was also sought through a wide range of stakeholders interested in physical activity and health promotion by both CSEP and PHAC. This included national and international content experts, health professionals, government and nongovernmental organizations, teachers, and caregivers. Stakeholders were also encouraged to share the CSEP survey with their peers and colleagues to further expand the consultation base.

The consultation was completed through a series of online and in-person consultations. The CSEP online survey consisted of 14 questions about the wording and agreement for the proposed Canadian Physical Activity Guidelines and their associated preamble for children, youth, adults, and older adults. Written comments were invited and respondents were told that they would receive updated and refined guidelines when the survey process was completed. Over 550 stakeholders responded through the online consultation process. The results of this online consultation were reviewed by the CSEP-PAMG Steering Committee and PHAC. Overall, the majority of respondents “completely agreed” or “agreed” with the proposed preamble and guideline for all age groups (90.2%, 88.7% and 89.7% for children and youth, adults, and older adults, respectively). Because we recruited respondents using a “snowball” process, we were unable to calculate a response rate for our online survey. A summary of the results can be found at <http://www.csep.ca/english/view.asp?x=879>.

Fig. 1. Summary of the timeline and key events in the development of the new Canadian Physical Activity (PA) Guidelines. AGREE, Appraisal of Guidelines for Research Evaluation; APNM, *Applied Physiology, Metabolism, and Nutrition*; CPG, Clinical Practice Guidelines; CSEP, Canadian Society for Exercise Physiology; IJBNPA, *International Journal of Behavioral Nutrition and Physical Activity*. © Canadian Society for Exercise Physiology.



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While the online surveys were being completed, PHAC held 8 in-person consultations across Canada. These meetings were designed so that stakeholders and scientists could discuss and debate the proposed guidelines. Following the in-person consultations, a subsequent online process was completed to ask stakeholders, government departments, educators, and health and fitness leaders about concerns and questions they had regarding the new guidelines, as well as any suggestions they may have to disseminate them. Over 800 people responded to this survey. The large majority of respondents felt comfortable with the process used to develop the new Canadian Physical Activity Guidelines, though many highlighted the need to further translate these scientific guidelines into simple messages for dissemination and utilization by the public. The full and summary reports of this consultation are available through PHAC.

Finalization of guidelines

In November 2010, the PAMG Steering Committee convened to address the concerns and comments raised through all of the stakeholder consultations and revised the guidelines accordingly.

Results

The new Canadian Physical Activity Guidelines for Children (aged 5–11 years), Youth (aged 12–17 years), Adults (aged 18–64 years), and Older Adults (aged ≥ 65 years) are presented below.

Children (aged 5–11 years) and youth (aged 12–17 years)

Preamble

These guidelines are relevant to all apparently healthy children (aged 5–11 years) and youth (aged 12–17 years), irrespective of gender, race, ethnicity, or socioeconomic status of the family. Children and youth are encouraged to participate in a variety of physical activities that support their natural development and that are enjoyable and safe.

Children and youth should be physically active daily as part of play, games, sports, transportation, recreation, physical education, or planned exercise in the context of family, school, and community (e.g., volunteer, employment) activities. This should be achieved above and beyond the incidental physical activities accumulated in the course of daily living.

Following these physical activity guidelines can improve cholesterol levels, blood pressure, body composition, bone density, cardiorespiratory and musculoskeletal fitness, and aspects of mental health. The potential benefits far exceed the potential risks associated with physical activity.

These guidelines may be appropriate for children and youth with a disability or medical condition; however, they should consult a health professional to understand the types and amounts of physical activity appropriate for them.

For those who are physically inactive, doing amounts below the recommended levels can provide some health benefits. For these children and youth, it is appropriate to start with smaller amounts of physical activity and gradually increase duration, frequency, and intensity as a stepping stone to meeting the guidelines.

For guidance on decreasing sedentary behaviour, please

refer to the Canadian Sedentary Behaviour Guidelines for Children and Youth (available online from <http://www.csep.ca/english/view.asp?x=881>) (Tremblay et al. 2011).

Guidelines

For health benefits, children (aged 5–11 years) and youth (aged 12–17 years) should accumulate at least 60 min of moderate- to vigorous-intensity physical activity daily. This should include

- Vigorous-intensity activities at least 3 days per week.
- Activities that strengthen muscle and bone at least 3 days per week.

More daily physical activity provides greater health benefits.

Adults (aged 18–64 years)

Preamble

These guidelines are relevant to all apparently healthy adults aged 18–64 years, irrespective of gender, race, ethnicity, or socioeconomic status. Adults are encouraged to participate in a variety of physical activities that are enjoyable and safe.

Adults can meet these guidelines through planned exercise sessions, transportation, recreation, sports, or occupational demands, in the context of family, work, volunteer, and community activities. This should be achieved above and beyond the incidental physical activities accumulated in the course of daily living.

Following these guidelines can reduce the risk of premature death, coronary heart disease, stroke, hypertension, colon cancer, breast cancer, type 2 diabetes, and osteoporosis, and improve fitness, body composition, and indicators of mental health. The potential benefits far exceed the potential risks associated with physical activity.

These guidelines may be appropriate for those who are pregnant, have a disability, or have a medical condition; however, they should consult a health professional to understand the types and amounts of physical activity appropriate for them.

For those who are physically inactive, doing amounts below the recommended levels can provide some health benefits. For these adults, it is appropriate to start with smaller amounts of physical activity and gradually increase duration, frequency, and intensity as a stepping stone to meeting the guidelines.

Guidelines

- To achieve health benefits, adults aged 18–64 years should accumulate at least 150 min of moderate- to vigorous-intensity aerobic physical activity per week, in bouts of 10 min or more.
- It is also beneficial to add muscle- and bone-strengthening activities that use major muscle groups, at least 2 days per week.
- More physical activity provides greater health benefits.

Older adults (aged ≥ 65 years)

Preamble

These guidelines are relevant to all apparently healthy

adults aged 65 years and older, irrespective of gender, race, ethnicity, or socioeconomic status. Older adults are encouraged to participate in a variety of physical activities that are enjoyable and safe.

Older adults can meet these guidelines through planned exercise sessions, transportation, recreation, sports, or occupational demands in the context of family, work, volunteer, and community activities. This should be achieved above and beyond the incidental physical activities accumulated in the course of daily living.

Following these guidelines can reduce the risk of chronic disease and premature death, maintain functional independence and mobility, as well as improve fitness, body composition, bone health, cognitive function, and indicators of mental health. The potential benefits far exceed the potential risks associated with physical activity.

These guidelines may be appropriate for older adults with frailty, a disability, or medical condition; however, they should consult a health professional to understand the types and amounts of physical activity appropriate for them based on their exercise capacity and specific health risks or limitations.

For those who are physically inactive, doing amounts below the recommended levels can provide some health benefits. For these adults, it is appropriate to start with smaller amounts of physical activity and gradually increase duration, frequency, and intensity as a stepping stone to meeting the guidelines.

Guidelines

- To achieve health benefits and improve functional abilities, adults aged 65 years and older should accumulate at least 150 min of moderate- to vigorous-intensity aerobic physical activity per week, in bouts of 10 min or more.
- It is also beneficial to add muscle- and bone-strengthening activities that use major muscle groups, at least 2 days per week.
- Those with poor mobility should perform physical activities to enhance balance and prevent falls.
- More physical activity provides greater health benefits.

Discussion

This paper presents the new Canadian Physical Activity Guidelines for Children (aged 5–11 years), Youth (aged 12–17 years), Adults (aged 18–64 years), and Older Adults (aged ≥65 years). These guidelines were developed through a robust and rigorous process, are based on the best possible scientific evidence, and involved extensive input from stakeholders.

Changes from previous guidelines

Children and youth

Inclusion of all school-aged children and youth

The new guidelines apply to a wider age group for the pediatric population. Whereas the previous guidelines focused on children (aged 6–9 years) (Health Canada and the Canadian Society for Exercise Physiology 2002*b*) and youth (aged 10–14 years) (Health Canada and the Canadian Society for Exercise Physiology 2002*a*), the new guidelines apply to all school-aged children (aged 5–11 years) and youth

(aged 12–17 years). The change in age groups also reflects the availability of the best evidence, which is often focused in the school setting. The new guidelines, therefore, fill the void in the previous guidelines for 5-year-olds and 15- to 17-year-olds.

Recommendation for 60 min of moderate- to vigorous-intensity physical activity per day

The best available evidence shows a clear dose-response relationship between the volume of moderate- to vigorous-intensity physical activity and increased health benefits (Janssen and LeBlanc 2010). Most of the increased health benefits occur within the initial 60 min of moderate- to vigorous-intensity physical activity per day. Whereas the previous guidelines recommended that children and youth should increase time currently spent on physical activity, starting with 30 min more per day and progressing over 5 months to 90 min more per day, data from the systematic review did not support this recommendation (Janssen and LeBlanc 2010). Therefore, the new guidelines have changed to reflect the new evidence. The evidence is also clear that physical activity in excess of the 60-minutes-per-day guideline is associated with further health benefits, and this is reflected in the new guidelines. These new guidelines are also harmonized with the new United States and WHO guidelines (Physical Activity Guidelines Advisory Committee 2008; WHO 2010). The new guidelines clarify that the 60 min is *inclusive* of the recommended vigorous-intensity physical activity and bone- and muscle-strengthening activities. Finally, because of an absence of supporting evidence, reference to bouts of any particular length has been removed from the new guidelines.

Emerging recommendations for sedentary behaviours

The final substantive change from previous guidelines is the omission of recommendations for time spent engaging in sedentary behaviours, in particular screen-time activities such as watching television, computer use, and playing video games. Work to provide evidence-informed Canadian guidelines specifically for sedentary behaviour for school-aged children and youth (aged 5–17 years) was completed concurrently with, and following a similar process to, that which the Canadian Physical Activity Guidelines have undergone. A sister document focusing on sedentary behaviour has been developed separately (available online from <http://www.csep.ca/english/view.asp?x=881>) (Tremblay et al. 2011).

Adults

Revised age range (18 to 64 years)

The new adult guidelines cover a larger age range. Whereas the previous guidelines focused on adults aged 20–55 years, the new guidelines include those aged 18–64 years. This change was made to reflect the best available evidence (Warburton et al. 2010) and to ensure guidelines for the complete age range of adults. Furthermore, this recommendation harmonizes with guideline recommendations with other countries and organizations.

Recommendation for 150 min of moderate- to vigorous-intensity aerobic physical activity per week

Evidence demonstrates clearly the dose-response relationship between increased physical activity and health benefits (Physical Activity Guidelines Advisory Committee 2008; Warburton et al. 2010; WHO 2010), but it is unclear about the best frequency of physical activity (i.e., whether this activity needs to be done daily, or every other day for maximum effect). Although previous guidelines recommended “60 minutes of physical activity everyday to stay healthy and improve your health” (Health Canada and the Canadian Society for Exercise Physiology 1998), the wording of the guidelines has been updated to reflect more precisely the aggregated evidence. These new guidelines have the inherent advantage of allowing each individual to customize their weekly routine to their schedule while adhering to the guidelines. The guidelines also state that additional physical activity is associated with increased health benefits. The new guidelines also clarify that the muscle- and bone-strengthening activities should be in *addition* to the recommended 150 min per week.

Since the earlier guidelines (Health Canada and the Canadian Society for Exercise Physiology 1998), there has been substantial evidence showing that shorter duration but higher intensity activity is associated with health benefits. This is captured in the wording of the new guidelines and will be further profiled in the messaging delivered to the general public.

Flexibility recommendations

Specific guidelines for flexibility activities were removed as there is currently limited evidence to substantiate such a clear recommendation. Such activities and exercises are not discouraged, but should not replace the physical activity recommended in the new guidelines. Further investigation in this area is warranted.

Emerging recommendations for sedentary behaviours

The final substantive change from previous guidelines is the omission of recommendations for time spent engaging in sedentary behaviours, in particular screen-time activities such as watching television, computer use, and playing video games. Work to provide evidence-informed Canadian guidelines specifically for sedentary behaviour for adults (aged 18–64 years) is a priority for the CSEP.

Older adults

Revision of age range (aged ≥ 65 years)

The new guidelines for older adults include people ≥ 65 years of age to reflect the best available evidence, whereas previous guidelines focused on ≥ 55 years of age. This age grouping provides a complete age continuum for the new guidelines, and is consistent with that used by the WHO (WHO 2010).

Recommendation for 150 min of moderate- to vigorous-intensity aerobic physical activity per week

As with the adult guidelines, evidence clearly demonstrates the dose-response relationship between increased physical activity and health benefits (Paterson and Warburton 2010; Physical Activity Guidelines Advisory Committee

2008; WHO 2010), but it is unclear the best frequency of physical activity (e.g., if this activity needs to be done daily, or every other day for maximum effect). Although previous guidelines recommended “60 minutes of physical activity everyday to stay healthy and improve your health” (Health Canada and the Canadian Society for Exercise Physiology 1999), the wording of the guidelines was updated to reflect more precisely the aggregated evidence. This new guideline has the inherent advantage of allowing each individual to customize their weekly routine to their schedule while adhering to the guidelines. The guidelines also state that additional physical activity is associated with increased health benefits. As with the adult guidelines, the new guidelines clarify that the muscle and bone strengthening activities should be in *addition* to the recommended 150 min per week.

Since the earlier guidelines (Health Canada and the Canadian Society for Exercise Physiology 1999), there has been substantial evidence showing that shorter duration but higher-intensity activity is associated with health benefits, and outcomes related to functional independence. This is captured in the wording of the new guidelines and is further profiled in the messaging delivered to the general public.

Flexibility recommendations

Specific guidelines for flexibility activities have been removed as there is limited evidence to substantiate such a recommendation. Such activities and exercises are not discouraged, but should not replace the physical activity recommended in the new guidelines. Further investigation in this area is warranted.

Consultation feedback

Through the extensive consultation process, many respondents expressed concern over the perception that the new Canadian Physical Activity Guidelines are lower than the previous ones. Respondents indicated that some may misinterpret the new guidelines as “Canadians require less activity than previously thought”, which may cause some to question the credibility of the new guidelines. We offer the following responses to these concerns: the new guidelines are evidence-based, are realistic and achievable, are widely endorsed by expert groups, and are consistent with other jurisdictions. More specifically, the new Canadian Physical Activity Guidelines are evidence-based:

- based on systematic reviews of the best available evidence following a rigorous and transparent scientific process,
- are consistent with the over-arching message of the previous Canadian Physical Activity Guidelines, which is that, in general, “more is better”, and the new guidelines should be viewed as a minimal target, and
- the previous guidelines are not exactly what many think they are (e.g., the common perception is that the previous guidelines for children were 90 min of moderate- to vigorous-intensity physical activity per day, but in fact they were a *progression* from 0 to 90 min a day, resulting in 60 min of moderate physical activity and 30 min of vigorous physical activity per day *and* a commensurate decrease of 90 min of sedentary behaviour per day);

are realistic and achievable:

- using the previous guidelines for children and youth as presented in the above list, we have no surveillance data in Canada to assess progressive changes in physical activity behaviours among Canadians — even if we did, it is unlikely that a single Canadian child would meet this guideline when assessed with objective measures (Colley et al. 2011*b*), which would make such a guideline questionable in value, and
- having guidelines that are unattainable to the vast majority of the population risks disenfranchising those who would benefit the most from an increase in physical activity — the new guidelines are being met by only 7% of Canadian children and youth (Colley et al. 2011*b*);

are endorsed by expert groups and are consistent with other jurisdictions:

- the majority of stakeholder respondents “completely agreed” or “agreed” with the proposed preamble and guideline for all age groups (90.2%, 88.7%, and 89.7% for children and youth, adults, and older adults, respectively),
- are consistent and harmonized with other recent physical activity guidelines based on the same evidence, and
- are accepted by the Canadian Cardiovascular Harmonization of National Guidelines Endeavour (C-CHANGE).

Furthermore, until the decline in the fitness of Canadians (Shields et al. 2010; Tremblay et al. 2010*b*) subsides, it is likely that an even smaller amount of physical activity will produce health benefits in future research studies, so the evidence compiled through future systematic reviews will naturally lead to a progressive reduction in physical activity guidelines based on the most recent evidence.

Dissemination and implementation

The work to inform the development of these guidelines has been published in the peer-reviewed literature (Brawley and Latimer 2007; Cameron et al. 2007; Esliger and Tremblay 2007; Janssen 2007; Janssen and LeBlanc 2010; Katzmarzyk and Tremblay 2007; Kesäniemi et al. 2010; Latimer et al. 2010; Martin Ginis and Hicks 2007; Paterson et al. 2007; Paterson and Warburton 2010; Rhodes and Pfaeffli 2010; Sharratt and Hearst 2007; Timmons et al. 2007; Tremblay et al. 2007*a*, 2007*b*, 2007*c*, 2010*a*; Warburton et al. 2007, 2010; Young and Katzmarzyk 2007). Further, the methodological process, systematic reviews, and final recommendations have been and will be shared at scientific meetings and conferences and are posted on the CSEP Web site (available from www.csep.ca).

These new guidelines are endorsed, promoted, and disseminated by the CSEP, ParticipACTION, PHAC, Federal–Provincial–Territorial partners, stakeholder groups, and committed individuals. This process is guided by a set of content and dissemination recommendations put forth by a committee of experts, including the guideline authors, health communication and marketing experts, and health behaviour change researchers. The steps to develop these recommendations paralleled the rigorous process used for the development of the Canadian Physical Activity Guidelines themselves. The process to inform and develop the messaging recommendations for the new guidelines can be found

elsewhere (Latimer et al. 2010; Rhodes and Pfaeffli 2010; www.csep.ca).

Updating the guidelines

Updating the new guidelines in the future will be important and necessary to ensure that the guidelines remain true to the most current science. Due to the immense amount of work required to update each systematic review and the implications of new guidelines on public practice, it is difficult to update the guidelines for all age groups simultaneously. Therefore, the PAMG Steering Committee has proposed a cyclical update of the guidelines. This will allow each guideline to be updated in a timely fashion. However, if important evidence emerges in the interim between updates, leaders will work to include it in a timely fashion and the timeline for updates may change.

Surveillance

There are a variety of mechanisms that will be used for surveillance of adherence to the new guidelines. The primary surveys that will be used and their affiliated organization are as follows:

- Canadian Health Measures Survey (CHMS; Statistics Canada: <http://www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=5071&lang=en&db=imdb&adm=8&dis=2>)
- Canadian Community Health Survey (CCHS; Statistics Canada: <http://www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3226&lang=en&db=imdb&adm=8&dis=2>)
- National Longitudinal Survey of Children and Youth (NLSCY; Statistics Canada: <http://www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=4450&lang=en&db=imdb&adm=8&dis=2>)
- Physical Activity Levels Among Youth (CAN PLAY; Canadian Fitness and Lifestyle Research Institute: <http://www.cflri.ca/eng/programs/canplay>)
- Physical Activity Monitor (PAM; Canadian Fitness and Lifestyle Research Institute: <http://www.cflri.ca/eng/statistics/surveys/pam2005.php>)
- Health Behavior in School-aged Children Survey (HBSC; PHAC and Queen’s University: <http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/child-enfant/index-eng.php>)

For recent, specific examples of surveillance activities see Colley et al. (2011*a*, 2011*b*), Active Healthy Kids Canada Report Cards (Active Healthy Kids Canada 2005, 2006, 2007, 2008, 2009, 2010), and the Canadian Fitness and Lifestyle Research Institutes CANPLAY results (Craig et al. 2010).

Future research

Areas for future research have been identified within the systematic reviews that informed the guidelines development, as well as through the stakeholder consultations. Many of these areas are specific to their respective age groups; however, 4 important gap areas exist for all age groups. The first is to develop physical activity guidelines for special populations (i.e., diseased or disabled); the second is the absence of guidelines for time spent engaging in sedentary behaviour (e.g., sitting or watching television).

The third gap area related to physical activity is related to the messaging strategies used to disseminate the new guidelines to the general public. Tailored messaging, gain-frame messages, and self-efficacy change messages hold promise for the future (Latimer et al. 2010), but the general null findings of many behavioural interventions are of a timely concern and should be a focus for improvements in physical activity (Rhodes and Pfaeffli 2010). Finally, across all age groups, systematic data are required on adverse effects related to the recommended levels of physical activity reported herein.

Sedentary behaviours have important health consequences independent of moderate- to vigorous-intensity physical activity levels (Tremblay et al. 2010c). However, there are currently no evidence-based sedentary behaviour guidelines, not only in Canada, but in the world. This is evident with the absence of any recommendations for time spent engaging in sedentary behaviours in the new Canadian Physical Activity Guidelines. This was done purposefully and not to diminish the importance of limiting sedentary behaviours. This absence only highlights the need for work to be completed in this area. For school-aged children and youth, sedentary guidelines have been developed through a process completed in parallel with the Canadian Physical Activity Guidelines described here (available from <http://www.csep.ca/english/view.asp?x=881>) (Tremblay et al. 2011).

More research is needed on structured, population-based samples looking at direct and standardized measures of physical activity and age-specific health outcomes. Consideration needs to be taken when accounting for covariates such as age, gender, socioeconomic status, and ethnicity.

Children and youth

The first, and arguably the most important limitation associated with the guidelines for children and youth is the complete absence of guidelines for children under the age of 5 years. To date, no systematic evidence-based guidelines exist for this age group, not only in Canada, but in the world.

The authors of the systematic review (Janssen and LeBlanc 2010) highlighted many limitations in the current evidence. First, the review itself was limited by methodological shortfalls of the current evidence. A great deal of the available evidence in young people was based on self-report data through questionnaires. Self-report data not only introduces a variety of biases but also introduces high heterogeneity across studies, making it difficult to conduct large scale meta-analyses. In addition, the authors were limited by the nature of child-focused research: children and youth have difficulty recalling physical activity habits; parents have a great deal of control over their children's daily activities; and most often researchers study *predictors* of health outcomes (e.g., blood pressure, obesity) and cannot rely on morbidity or mortality outcomes. The use of more robust, direct measures in future research is recommended.

There are several recommendations for future work in the pediatric population. Most notably, there is a need for a higher quality of randomized controlled trials in this age group (i.e., larger and more diverse sample sizes, direct measures of physical activity, intention-to-treat analyses, reporting of adverse events). These larger studies should then

be able to address the impact various sociodemographic variables. Furthermore, future research should focus on standardizing methods for data collection and analysis and work towards implementing direct (i.e., accelerometers) and indirect (i.e., questionnaires for context) measures of physical activity. Standardized methods for assessing physical activity will also allow researchers to look specifically at different intensities of activity and the associated benefits and (or) risks.

Adults

A great deal of work has examined the relationship between physical activity and morbidity–mortality in adults (Warburton et al. 2007, 2010). The authors of the systematic review (Warburton et al. 2010) noted that the biggest limitation in the current research is the variety of ways in which data are analyzed. For example, early research analyses generally controlled for few confounders (i.e., only for age), whereas current research often controls for many factors (i.e., age, sex, race, socioeconomic status, etc.). There are also discrepancies in measurement methods. High heterogeneity makes it difficult to conduct meta-analyses within this review. Future work should standardize methods for measuring and assessing levels of physical activity and its relationship to various health outcomes.

There is also a clear need for guidelines that meet the unique needs of persons living with chronic conditions, including the prevention and long-term maintenance of unfavourable body composition. Finally, future research should focus on the relationship between enhancing flexibility and skeletal fitness and comorbidities across the lifespan. This work should be completed in large, diverse, international trials, which can examine subgroup differences to determine if different guidelines are warranted (i.e., for different age, sex, or ethnic subgroups).

Older adults

Future research requires better assessment and definition of the physical activity nature, type, intensity, and volume, and what physical activity variables relate to specific outcomes with a dose-response analysis. For example, is light-intensity activity, as well as moderate- and vigorous-intensity activity, associated with better cognitive outcomes? Is vigorous activity required for certain physiological outcomes that predispose to prevention of certain disease processes? Which of intensity or volume of physical activity is critical to the dose-response for various outcomes?

Additionally, whereas prospective cohort studies examined the relationship of physical activity with long-term outcomes, or the effects of life-long activity, for older adults, the more immediate effects consequent to physical activity interventions (i.e., exercise programs) over a few weeks to months and their short-term outcomes are important. The concept “it is not too late to start” appears to apply, as short-term exercise training can greatly improve function and maintain functional independence; however, there is a need for longer-term follow-up of these initiatives to observe how increased physical activity is maintained, and the longer-term outcomes related to disability and (or) loss of independence. Exercise training programs have been rather standardized in terms of their nature, components, type,

intensity, and volume, and many have been multicomponent interventions; there is need for future work to isolate the most beneficial components (e.g., strength or aerobic; need for flexibility or balance components).

Conclusions

This paper provides a brief overview of the process that has been followed to develop new Canadian Physical Activity Guidelines for Children (aged 5–11 years), Youth (aged 12–17 years), Adults (aged 18–64 years), and Older Adults (aged ≥65 years). These guidelines have been developed through partnerships with many organizations to present the best evidence on the relationship between physical activity and various health outcomes. The PAMG Steering Committee has ensured that the process to develop the guidelines has been rigorous, transparent, and thoroughly documented.

Acknowledgements

The authors wish to acknowledge the Canadian Society for Exercise Physiology (CSEP) for leading the development of the new physical activity guidelines; ParticipACTION for being a lead partner in their development and dissemination; and the Public Health Agency of Canada (PHAC) for providing support to the guideline development process. CSEP and PHAC funded these guidelines. The views of the funding agencies had no influence on the content or recommendations included in this document. We would also like to acknowledge the in-kind funding support provided by the lead authors and their respective laboratories in the generation of the systematic reviews. Special thanks to Drs. Antero Kesäniemi, Steven Blair, Chris Riddoch, Bruce Reeder, and Thorkild Sørensen for serving as the independent review panel. We acknowledge Dr. Andrea Tricco's contributions as the methodological consultant for the systematic reviews. The quality of the guidelines is a result of the contributions and commitment of all authors of the foundational, systematic review and process papers and reports, participants at the 2009 Consensus meeting in Kananaskis, participants in final guideline development meetings, participants in messaging meetings, stakeholders, partners and participants in the online CSEP consultations, participants in the PHAC stakeholder consultation meetings, and the PHAC online consultations. CSEP wishes to extend special thanks to Professor Marcel Nadeau, retired from the Université de Sherbrooke, for translating the reviews from English to French. Michelle Kho is funded by a Fellowship Award and Bisby Prize from the Canadian Institutes of Health Research.

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