

# 2019 Canadian Guideline for Physical Activity Throughout Pregnancy: Methodology



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## BACKGROUND

In the last decade, an abundance of new research from Canada and internationally has provided substantial evidence for the efficacy of exercise in preventing pregnancy complications and improving long-term maternal

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and fetal outcomes.<sup>1–12</sup> Indeed, guidelines for exercise during pregnancy are available from several countries.<sup>13</sup> This includes the expert consensus-based 2003 Joint SOGC and Canadian Society for Exercise Physiology Clinical Practice Guidelines: Exercise in Pregnancy and the Postpartum Period.<sup>14</sup> With the plethora of new scientific evidence, it was vital to re-examine the literature by using the rigorous process followed by previous Canadian health behaviour guidelines.<sup>15</sup>

The purpose of this document is to outline the process and outcomes for the re-development of the 2019 Canadian Guideline for Physical Activity Throughout Pregnancy, herein referred to as the Guidelines.<sup>16,17</sup> The target users for these Guidelines are obstetric care providers, policy-makers, and exercise professionals who provide guidance for pregnant women regarding prenatal physical activity.

**METHODS**

**Guidelines Development Process**

The 2019 Guideline was developed using the Grading of Recommendations Assessment, Development, and Evaluation method and assessed using the Appraisal of Guidelines for Research and Evaluation II instrument.<sup>18,19–25</sup>

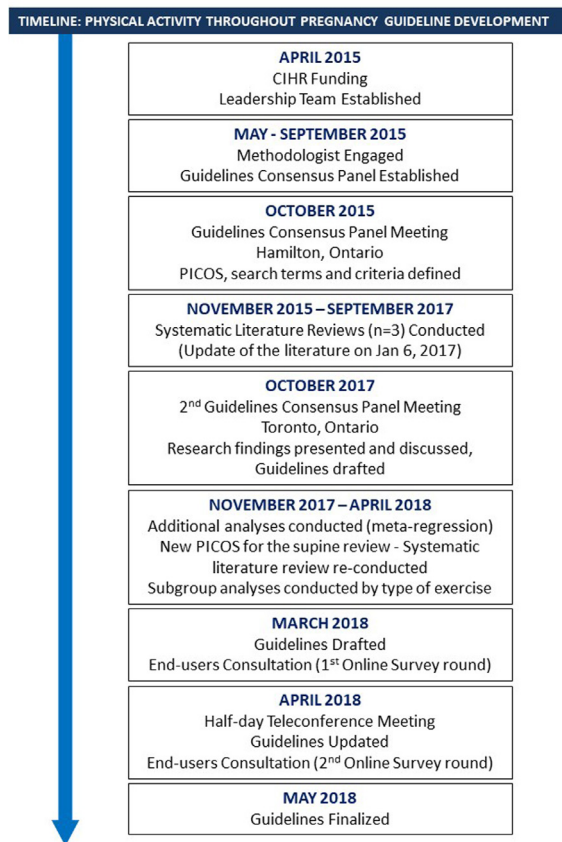
The goal in updating these guidelines was to use rigorous methodology to review the literature systematically and identify the characteristics of exercise (i.e., frequency, intensity, duration, type, and volume) that were favourably associated with maternal, fetal, and neonatal health outcomes. A summary of the timelines and sequence of events in the development of the Guidelines is presented in the Figure. Partial funding was granted from the Canadian Institutes of Health Research in April 2015 (the remainder of the project was supported by the start-up funds of MHD), and a Guidelines Consensus Panel was established (Table 1).

In October 2015, the GCP assembled to engage in the Guidelines process, identify priority outcomes for the Guidelines development, and set timelines for the systematic reviews. The GCP consisted of researchers in the field

**ABBREVIATIONS**

|       |  |
|-------|--|
| AGREE | Appraisal of Guidelines for Research and Evaluation                |
| CSEP  | Canadian Society for Exercise Physiology                           |
| GCP   | Guidelines Consensus Panel   |
| GDM   | gestational diabetes mellitus                                      |
| GRADE | Grading of Recommendations Assessment, Development, and Evaluation |
| GSC   | Guidelines Steering Committee                                      |
| PFMT  | pelvic floor muscle training                                       |

**Figure. Timeline for the development of the Canadian guidelines for physical activity throughout pregnancy. CIHR: Canadian Institutes of Health Research; population, intervention, comparison, outcome and study design: XXX.**



of prenatal exercise; methodological experts (consultants for AGREE II and GRADE methodologies, statistician, and research librarian); exercise professionals and representatives from the CSEP, the SOGC, the College of Family Physicians of Canada, the Canadian Association of Midwives, the Canadian Academy of Sport and Exercise Medicine, Exercise is Medicine Canada, and a public health representative (the Middlesex-London Health Unit) (see Table 1).

In preparation for the first meeting of the GCP, pregnant women were recruited through word of mouth by the three principal investigators (M.H.D., S.M.R., and M.F.M.) to respond to a survey to provide input on which pregnancy outcomes were most important to them and their babies when considering the potential benefits and harms of exercise during pregnancy.

The GCP convened to select the maternal, fetal, and neonatal outcomes that would be prioritized for inclusion in the systematic reviews. The meeting began with an initial presentation of the current literature, a review of the

**Table 1. GCP**

| Panel member                                      | Affiliation  | Role   |
|---|--|--|
| <i>Research experts</i>                           |  |  |
| Kristi Adamo, PhD                                 | Associate Professor, University of Ottawa, Ottawa, ON                                      | Prenatal PA Content Expert, Systematic Review Author, Co-I – CIHR Knowledge Synthesis Grant (FRN140995)                                |
| Margie H. Davenport, PhD                          | Associate Professor, University of Alberta, Edmonton, AB                                   | Chair, Prenatal PA Content Expert, Steering Committee, Systematic Review Author, Co-PI – CIHR Knowledge Synthesis Grant (FRN140995).   |
| Gregory A. Davies, MD                             | SOGC; Professor, Queen's University, Kingston, ON  | Prenatal PA Content Expert, Clinician, Steering Committee, Systematic Review Author, Co-I – CIHR Knowledge Synthesis Grant (FRN140995) |
| Michelle F. Mottola, PhD                          | Professor, Western University, London, ON  | Prenatal PA Content Expert, Steering Committee, Systematic Review Author, n-PI – CIHR Knowledge Synthesis Grant (FRN140995)            |
| Stephanie-May Ruchat, PhD                         | Assistant Professor, Université du Québec à Trois-Rivières, Trois-Rivieres, QC             | Prenatal PA Content Expert, Steering Committee, Systematic Review Author, co-PI – CIHR Knowledge Synthesis Grant (FRN140995)           |
| <i>Stakeholder groups and knowledge end-users</i> |  |  |
| Phil Chilibeck, PhD                               | Professor, University of Saskatchewan, Saskatoon, SK                                       | Invited Representative (Canadian Society for Exercise Physiology)  |
| Mary Duggan, CAE                                  | Manager, Canadian Society for Exercise Physiology, Ottawa, ON                              | Invited Representative (Canadian Society for Exercise Physiology), knowledge user, Co-I – CIHR Knowledge Synthesis Grant (FRN140995)   |
| Karen Fleming, MD                                 | Family Physician at Sunnybrook Hospital, Toronto, ON                                       | Invited Representative (Canadian Academy of Sport and Exercise Medicine)   |
| Milena Forte, MD                                  | Family Physician at Sinai Health System, Toronto, ON                                       | Invited Representative (College of Family Physicians of Canada)  |
| Jillian Korolnek, RM                              | Registered Midwife at private practice, Toronto, ON  | Invited Representative (Canadian Association of Midwives)  |
| Taniya Nagpal, BSc                                | Doctoral Student, Western University, London, ON   | Invited Representative (Exercise is Medicine Canada, Exercise Professional), Systematic Review Author                                  |
| Linda Slater, MLIS                                | Librarian, University of Alberta, Edmonton, AB   | Librarian Consultant, Systematic Review Author   |
| Deanna Stirling, RN                               | Public Health Nurse, Middlesex London Health Unit, London, ON                              | Invited Representative (Middlesex London Health Unit)  |
| Lori Zehr, PhD                                    | Interdisciplinary Education Coordinator, Camosun College, Victoria, BC                     | Invited Representative (Canadian Society for Exercise Physiology)  |
| <i>International Collaborators</i>                |  |  |
| Ruben Barakat, PhD                                | Professor, Polytechnic University of Madrid, Madrid, Spain                                 | Prenatal PA Content Expert, International Representative, Systematic Review Author   |
| <i>Methodology consultants</i>                    |  |  |
| Nick Barrowman, PhD                               | Senior Statistician, Children's Hospital of Eastern Ontario Research Institute, Ottawa, ON | Biostatistics Consultant, Steering Committee, Systematic Review Author   |
| Casey E. Gray, PhD                                | Children's Hospital of Eastern Ontario, Ottawa, ON   | AGREE II and GRADE Methodological Consultant, Steering Committee, Systematic Review Author   |
| Alejandra Jaramillo Garcia, MSc                   | Independent Researcher, Ottawa, ON   | AGREE II and GRADE Methodological Consultant, Steering Committee, Systematic Review Author   |
| Veronica J. Poitras, PhD                          | Independent Researcher, Ottawa, ON   | AGREE II and GRADE Methodological Consultant, Steering Committee, Systematic Review Author   |

All members of the GCP received a written request to declare potential conflict of interest(s). None were declared. The funding source did not influence the content of the Guidelines.

PA: Physical Activity; PI: Principal Investigator; Co-I: Co-investigator; CIHR: Canadian Institutes of Health Research.

Guidelines development process by the methodologists, and presentation of the results of the survey of pregnant women. Next, considering their expertise and the findings of the survey of pregnant women, GCP members identified a list of health outcomes to be prioritized within the Guidelines and rated them as either “critical” or “important” to end-users by consensus in terms of the benefits and harms of exercise during pregnancy. Discussion of the GCP led to selection of 20 “critical” and 17 “important” outcomes related to prenatal exercise and maternal, fetal, and neonatal health indicators (Table 2).

Following this meeting, a Guidelines Steering Committee was created to oversee the conduct of the systematic reviews. The GSC consisted of three researchers with expertise in prenatal exercise (M.H.D., S.M.R., M.F.M.), methodological experts (V.P., C.G., A.J.), and an expert statistician (N.B.). The GSC met recurrently starting in November 2015. Throughout the process, the GSC identified research gaps. The initial list was presented to the GCP at the October 2017 meeting. Over the course of the meeting, additional research gaps were identified.

### Systematic Reviews

Twelve systematic reviews were conducted between December 2015 and April 2018 to form the evidence base of the Guidelines.<sup>1–12</sup> The original timeline of 1 year set by

the GCP was extended by 2 years because of the plethora of new information and the large volume of manuscripts that met the inclusion criteria. Eleven reviews examined the relationships between exercise and groupings of “critical” and “important” health outcomes: (1) gestational diabetes mellitus and hypertensive disorders of pregnancy, (2) gestational weight gain, and postpartum weight retention (3) labour and delivery outcomes, (4) fetal growth, (5) fetal mortality, (6) maternal mental health, (7) urinary incontinence, (8) lumbopelvic pain, (9) maternal glucose responses to acute and chronic physical activity, (10) maternal temperature responses to acute physical activity and congenital anomalies, (11) fetal heart rate and blood flow responses to physical activity. A 12th manuscript was developed to examine the effect of supine exercise on four “critical” maternal outcomes and five “critical” fetal and neonatal outcomes (Table 3). In addition, an “other” category was created that included other outcomes as reported by the study’s authors.

Complete methodologies and a brief overview of each systematic review are provided in the Online Supplement. Full details are provided in two issues of the *British Journal of Sports Medicine*.<sup>1–12</sup>

### Guidelines Recommendations and Stakeholder Consultations

The second meeting of the GCP was held in October 2017. The objectives of this 2-day meeting were to review

**Table 2. “Critical” and “important” outcomes selected by the GCP**

| “Critical” outcomes  | “Important” outcomes  |
|--|---|
| <p>Maternal</p> <ol style="list-style-type: none"> <li>1. GDM</li> <li>2. Preeclampsia</li> <li>3. Gestational hypertension</li> <li>4. CS</li> <li>5. Maternal mental health (i.e., depression and anxiety during and following pregnancy)</li> <li>6. Excessive gestational weight gain</li> <li>7. Postpartum weight retention</li> <li>8. Glucose tolerance</li> <li>9. Preterm/pre-labour rupture of membranes</li> <li>10. Diastasis recti</li> </ol> <p>Fetal/Neonatal</p> <ol style="list-style-type: none"> <li>11. Miscarriage</li> <li>12. Stillbirth</li> <li>13. Neonatal death</li> <li>14. Preterm birth</li> <li>15. Fetal responses to exercise (i.e., fetal heart rate, uterine/umbilical blood flow)</li> <li>16. Low birth weight (i.e., SGA, &lt; 2500 g, &lt; 10th/15th percentile for GA)</li> <li>17. Intrauterine growth restriction</li> <li>18. High birth weight (i.e., LGA, macrosomia, &gt; 4000 g, &gt; 90th percentile for GA)</li> <li>19. Neonatal hypoglycemia</li> <li>20. Long-term offspring outcomes (i.e., obesity, cardiovascular and metabolic diseases).</li> </ol> | <p>Maternal</p> <ol style="list-style-type: none"> <li>1. Antepartum hemorrhage</li> <li>2. Inadequate gestational weight gain</li> <li>3. Total gestational weight gain</li> <li>4. Delivery complications (i.e., instrumental delivery, length of labour, vaginal tears)</li> <li>5. Lower back pain</li> <li>6. Pelvic girdle pain</li> <li>7. Urinary incontinence (during and following pregnancy)</li> <li>8. Induction of labour</li> <li>9. Long-term maternal outcomes (i.e., cardiovascular disease, osteoporosis, diabetes, hypertension, obesity)</li> <li>10. Adverse outcomes (i.e., musculoskeletal injury, trauma, dehydration, hyperthermia, cardiovascular or respiratory events, maternal hypoglycemia, fatigue)</li> </ol> <p>Fetal/Neonatal</p> <ol style="list-style-type: none"> <li>11. GA at birth</li> <li>12. Birth weight</li> <li>13. Birth defects</li> <li>14. Body composition (i.e., newborn adiposity, BMI)</li> <li>15. Birth complications (including shoulder dystocia, brachial plexus injury, Apgar scores &lt; 7, NICU admittance, metabolic acidosis)</li> <li>16. Hyperbilirubinemia</li> <li>17. Offspring developmental milestones (i.e., cognitive, psychosocial, motor skills)</li> </ol> |



**Table 3. Outcomes selected by the GCP in relation to supine exercise**

| “Critical” outcomes   |
|---|
| Potentially adverse changes in:   |
| 1. Maternal blood pressure  |
| 2. Maternal cardiac output  |
| 3. Maternal heart rate  |
| 4. Maternal oxygen saturation   |
| 5. Fetal movements  |
| 6. Uterine blood flow   |
| Adverse events:   |
| 7. Fetal heart rate (abnormal tracings and fetal bradycardia < 110 beats/min)                             |
| 8. Low birth weight (i.e., SGA, < 2500 g, < 10th/15th percentile for GA, intrauterine growth restriction) |
| 9. Perinatal mortality (including death from 20 weeks’ gestation to 28 days of life)                      |
| 10. “Other” as defined and documented by individual study authors   |

the findings of the 12 systematic reviews, discuss and interpret the results, draft a new set of recommendations and a preamble, identify research gaps, and discuss launch plans. An initial set of draft recommendations was developed by the GSC and presented to the GCP. These draft recommendations considered the balance between potential harms and benefits of prenatal exercise (considering various frequencies, intensities, durations, types, and volumes of exercise), the anticipated values or beliefs related to prenatal exercise (to be confirmed later by survey), and consideration of feasibility, acceptability, resource use, and equity.<sup>19,26</sup> At this meeting, additional analyses were requested to identify whether dose-response relationships existed between frequency, intensity, duration, or volume of exercise and any health outcomes. Over the subsequent months, these analyses were conducted, and the GCP was presented with the updated analysis and revised draft recommendations and preamble by email in January 2018. All members of the GCP consented to sending the revised draft preamble and recommendations for the end-user consultations (stakeholders [health care or exercise professionals] and pregnant or postpartum women).

End-user surveys were developed to obtain external feedback on the content and format of the draft preamble and recommendations and to gather information required to inform the GRADE Evidence to Decision framework.<sup>26</sup> Specifically, two surveys were developed to assess (1) stakeholder’s and (2) pregnant and postpartum women’s values about the feasibility, acceptability, cost, and equity of implementing or using the Guidelines recommendations. The surveys were initially approved by the University of Alberta

Research Ethics Board and were subsequently approved by the Ethics Board at the Université du Québec à Trois-Rivières. The online surveys were created using Google Forms. Two survey rounds were set up to obtain feedback from the end-user groups (see the Online Supplement for complete surveys in English and French). The first survey was open from March 21 to April 11, 2018 (stakeholder survey) and from March 24 to April 14, 2018 (pregnant and postpartum survey). Feedback was solicited by a dedicated email that was distributed through the GCP’s networks. After the end-user’s feedback was returned, it was summarized by S.M.R. and M.F.M. Multiple-choice responses were analyzed quantitatively, whereas open-ended responses were synthesized qualitatively to identify common themes that emerged from the data.

Following the first round of surveys, additional analyses regarding “type” of exercise were conducted. These analyses were completed in April 2018. The recommendations and preamble were revised to include an additional recommendation concerning the “type” of exercise and to reflect the feedback obtained in round 1 of the surveys, while remaining true to the underlying evidence. The summary of feedback obtained in the surveys and the revised recommendations were sent by email to the GSC. The GSC had two teleconference meetings to review the responses and revise the preamble and recommendations.

A second survey (open from May 22–28, 2018) was conducted to obtain feedback on the updated version of the preamble and recommendations. The survey results were summarized, and the revised recommendations were sent by email to the GSC. The GSC reached consensus regarding the preamble and recommendations by teleconference and email. M.H.D. drafted the Guidelines document, which was revised and approved by the GSC. The finalized preamble and Guidelines document were subsequently reviewed and endorsed by the full GCP, the SOGC, and CSEP. Online Supplement Tables 1 and 2 detail the proposed Guidelines at each iteration of the surveys, the changes that were made as a result of the surveys, and the rationale for the changes.

Four independent reviewers were contracted to conduct an AGREE II appraisal of the Guidelines development process. All of the materials presented in two issues of the *British Journal of Sports Medicine* were provided to the independent assessors.<sup>1–12</sup>

## **RESULTS**

### **Overall Guidelines Development Process**

Throughout the process, methodologists on the GSC who were familiar with the AGREE II<sup>18,27–29</sup> and

GRADE<sup>19,26,30</sup> frameworks provided advice about best practices in guideline development. Records of discussions and decisions were kept to help inform the Guidelines and the Evidence to Decision frameworks.<sup>26</sup> The GSC met in person or by teleconference more than 50 times over the course of the Guidelines development process.

The detailed results of the systematic reviews are presented in 12 manuscripts in two issues of the *British Journal of Sports Medicine*.<sup>1–12</sup> Overall, 27 624 titles and abstracts were screened, and 675 unique studies were included in the systematic reviews. A detailed summary of results of each systematic review is available in the Online Supplement.

The two versions of the draft preamble and Guidelines included in the end-user surveys are available in Additional File 1, and the results of the surveys are available in Tables 4–7.

### **GRADE EVIDENCE TO DECISION FRAMEWORK: SUMMARY**

The final specific recommendations in the 2019 Guideline are provided here, with corresponding statements indicating the quality of the evidence informing the recommendations and the strength of the recommendations. The Evidence to Decision Framework for each recommendation is available in Online Supplement Tables 5–13.

Specific subgroups were examined:

1. All women without contraindication should be physically active throughout pregnancy (strong recommendation, moderate quality evidence).
  - a. Women who were previously inactive (strong recommendation, moderate quality evidence).
  - b. Women diagnosed with gestational diabetes mellitus (weak recommendation,<sup>a</sup> low quality evidence).
  - c. Women categorized as overweight or obese (pre-pregnancy body mass index  $\geq 25$  kg/m<sup>2</sup>) (strong recommendation,<sup>b</sup> low quality evidence).
2. Pregnant women should accumulate at least 150 minutes of moderate-intensity<sup>c</sup> physical activity each week to achieve clinically meaningful health benefits and reductions in pregnancy complications (strong recommendation, moderate quality evidence).
3. Physical activity should be accumulated over a minimum of 3 days per week; however, being active every day is encouraged (strong recommendation, moderate quality evidence)
4. Pregnant women should incorporate a variety of aerobic and resistance training activities to achieve greater

benefits. Adding yoga and/or gentle stretching may also be beneficial (strong recommendation, high quality evidence).

5. Pelvic floor muscle training (e.g., Kegel exercises) may be performed on a daily basis to reduce the risk of urinary incontinence. Instruction in proper technique is recommended to obtain optimal benefits (weak recommendation,<sup>d</sup> low quality evidence).
6. Pregnant women who experience light-headedness or nausea or feel unwell when they exercise flat on their back should modify their exercise position to avoid the supine position (weak recommendation,<sup>e</sup> very low quality evidence).

### **CONTRAINDICATIONS**

All pregnant women can participate in physical activity throughout pregnancy with the exception of those who have contraindications (listed here). Women with absolute contraindications may continue their usual activities of daily living but should not participate in more strenuous activities. Women with relative contraindications should discuss the advantages and disadvantages of moderate-to-vigorous intensity physical activity with their obstetric care provider before participation.

Absolute contraindications to exercise are the following:

- Ruptured membranes
- Premature labour
- Unexplained persistent vaginal bleeding
- Placenta previa after 28 weeks' gestation
- Preeclampsia
- Incompetent cervix
- Intrauterine growth restriction
- High-order multiple pregnancy (e.g., triplets)
- Uncontrolled type 1 diabetes
- Uncontrolled hypertension
- Uncontrolled thyroid disease
- Other serious cardiovascular, respiratory, or systemic disorder

Relative contraindications to exercise are the following:

- Recurrent pregnancy loss
- Gestational hypertension
- A history of spontaneous preterm birth
- Mild or moderate cardiovascular or respiratory disease
- Symptomatic anemia
- Malnutrition
- Eating disorder
- Twin pregnancy after the 28th week
- Other significant medical conditions

**Table 4. Summary results of stakeholder survey (round 1)**

| Question  | Strongly agree n (%) | Somewhat agree n (%) | Neither agree nor disagree n (%) | Somewhat disagree n (%)  | Strongly disagree n (%) | Total responses n |
|---|----------------------|----------------------|----------------------------------|--------------------------|-------------------------|-------------------|
| The Title is clearly stated.  | 259 (71.15)          | 54 (14.84)           | 7 (1.92)                         | 16 (4.40)                | 28 (7.69)               | 364               |
| Do you agree with the Title?  | 212 (58.40)          | 77 (21.21)           | 28 (7.71)                        | 19 (5.23)                | 27 (7.44)               | 363               |
| The Preamble is clearly stated.   | 198 (54.40)          | 97 (26.65)           | 20 (5.49)                        | 26 (7.14)                | 23 (6.32)               | 364               |
| Do you agree with the Preamble?   | 226 (62.09)          | 75 (20.60)           | 14 (3.85)                        | 20 (5.49)                | 29 (7.97)               | 364               |
| The EDP Guidelines are clearly stated.  | 129 (35.44)          | 111 (30.49)          | 67 (18.41)                       | 44 (12.09)               | 13 (3.57)               | 364               |
| Evidence to decision framework  |                      |                      |                                  |                          |                         |                   |
|   | Yes n (%)            |                      | No n (%)                         |                          | Total responses n       |                   |
| Are the EDP Guidelines important to you? (priority)   | 355 (99.16)          |                      | 3 (0.84)                         |                          | 358                     |                   |
|   | Always n (%)         | Frequently n (%)     | Occasionally n (%)               | Seldom n (%)             | Never n (%)             | Total responses n |
| Would you use the Preamble? (acceptability)   | 110 (30.73)          | 127 (35.47)          | 63 (17.60)                       | 44 (12.29)               | 14 (3.91)               | 358               |
| Would you use the EDP Guidelines? (acceptability)   | 141 (38.95)          | 163 (45.03)          | 48 (13.26)                       | 8 (2.21)                 | 2 (0.55)                | 362               |
|   | Very easy n (%)      | Somewhat easy n (%)  | Neither easy nor difficult n (%) | Somewhat difficult n (%) | Very difficult n (%)    | Total responses n |
| How easy or difficult would you find using the EDP Guidelines? (feasibility)  | 105 (29.09)          | 151 (41.83)          | 82 (22.71)                       | 17 (4.71)                | 6 (1.66)                | 361               |
|   | Strongly agree n (%) | Somewhat agree n (%) | Neither agree nor disagree n (%) | Somewhat disagree n (%)  | Strongly disagree n (%) | Total responses n |
| I feel comfortable explaining to a pregnant woman what is meant by "a moderate intensity of exercise." (feasibility)  | 169 (46.94)          | 100 (27.78)          | 51 (14.17)                       | 31 (8.61)                | 9 (2.50)                | 360               |
| The costs for you to use, or your organization to implement, the EDP Guidelines are likely to be small or negligible compared to not using the Guidelines. (resource use) | 182 (51.41)          | 75 (21.19)           | 72 (20.34)                       | 15 (4.24)                | 10 (2.82)               | 354               |
| The benefits of using the EDP Guidelines are likely to outweigh the costs. (perceived incremental cost-benefit ratio)   | 239 (66.76)          | 75 (20.95)           | 22 (6.15)                        | 14 (3.91)                | 8 (2.23)                | 358               |
| Following the EDP Guidelines is likely to benefit all population groups equally, irrespective of race, ethnicity, or the socioeconomic status of the family. (equity)     | 222 (61.67)          | 70 (19.44)           | 30 (8.33)                        | 25 (6.94)                | 13 (3.61)               | 360               |

EDP: exercise during pregnancy.

**Table 5. Summary results of pregnant/postpartum women survey (round 1)**

| Question   | Strongly agree n (%) | Somewhat agree n (%) | Neither agree nor disagree n (%) | Somewhat disagree n (%)  | Strongly disagree n (%) | Total responses n |
|--|----------------------|----------------------|----------------------------------|--------------------------|-------------------------|-------------------|
| The Title is clearly stated.   | 59 (54.13)           | 21 (19.27)           | 8 (7.34)                         | 13 (11.93)               | 8 (7.34)                | 109               |
| Do you agree with the Title?   | 51 (46.79)           | 26 (23.85)           | 12 (11.01)                       | 12 (11.01)               | 8 (7.34)                | 109               |
| The Preamble is clearly stated.  | 62 (56.88)           | 20 (18.35)           | 9 (8.26)                         | 10 (9.17)                | 8 (7.34)                | 109               |
| Do you agree with the Preamble?  | 65 (60.19)           | 18 (16.67)           | 4 (3.70)                         | 4 (3.70)                 | 17 (15.74)              | 108               |
| The EDP Guidelines are clearly stated.   | 30 (27.52)           | 34 (31.19)           | 19 (17.43)                       | 19 (17.43)               | 7 (6.42)                | 109               |
| Evidence to decision framework   |                      |                      |                                  |                          |                         |                   |
|  | Yes n (%)            |                      | No n (%)                         |                          | Total responses n       |                   |
| Are the EDP Guidelines important to you? (priority)  | 103 (96.26)          |                      | 4 (3.74)                         |                          | 107                     |                   |
|  | Always n (%)         | Frequently n (%)     | Occasionally n (%)               | Seldom n (%)             | Never n (%)             | Total responses n |
| Would you use the EDP Guidelines? (acceptability)  | 24 (22.22)           | 46 (42.59)           | 25 (23.15)                       | 11 (10.19)               | 2 (1.85)                | 108               |
|  | Very easy n (%)      | Somewhat easy n (%)  | Neither easy nor difficult n (%) | Somewhat difficult n (%) | Very difficult n (%)    | Total responses n |
| How easy or difficult would you find using the EDP Guidelines? (feasibility)   | 22 (20.37)           | 42 (38.89)           | 33 (30.56)                       | 7 (6.48)                 | 4 (3.70)                | 108               |
|  | Strongly agree n (%) | Somewhat agree n (%) | Neither agree nor disagree n (%) | Somewhat disagree n (%)  | Strongly disagree n (%) | Total responses n |
| Do you understand what is meant by "a moderate intensity of exercise"? (feasibility)   | 60 (55.56)           | 23 (21.30)           | 16 (14.81)                       | 4 (3.70)                 | 5 (4.63)                | 108               |
| The costs (e.g. financial) for you to follow the EDP Guidelines are likely to be small or negligible compared to not following the Guidelines. (resource use)  | 53 (50.48)           | 24 (22.86)           | 17 (16.19)                       | 9 (8.57)                 | 2 (1.90)                | 105               |
| When considering the impact of exercise on your own health, do you feel that the health benefits of using the EDP Guidelines are likely to outweigh the harms? (perceived incremental cost-benefit ratio)    | 70 (67.31)           | 12 (11.54)           | 7 (6.73)                         | 2 (1.92)                 | 13 (12.50)              | 104               |
| When considering the impact of exercise on your baby's health, do you feel that the health benefits of using the EDP Guidelines are likely to outweigh the costs? (perceived incremental cost-benefit ratio) | 67 (63.21)           | 19 (17.92)           | 9 (8.49)                         | 8 (7.55)                 | 3 (2.83)                | 106               |
| Following the guidelines would likely benefit all pregnant women equally, irrespective of race, ethnicity, or socioeconomic status. (equity)   | 64 (59.81)           | 21 (19.63)           | 7 (6.54)                         | 10 (9.35)                | 5 (4.67)                | 107               |

EDP: exercise during pregnancy.



**Table 6. Summary results of stakeholder survey (round 2)**

| Question   | Strongly agree n (%)  | Somewhat agree n (%) | Neither agree no disagree n (%)  | Somewhat disagree n (%)  | Strongly disagree n (%) | Total responses n |
|--|---|----------------------|----------------------------------|--------------------------|-------------------------|-------------------|
| The Title is clearly stated.   | 49 (75.38)  | 7 (10.77)            | 4 (6.15)                         | 1 (1.54)                 | 4 (6.15)                | 65                |
| Do you agree with the Title?   | 37 (56.92)  | 14 (21.54)           | 9 (13.85)                        | 2 (3.08)                 | 3 (4.62)                | 65                |
| Which title do you prefer?   | "IN": 4 (6.25) "DDURING": 22 (34.38) "THROUGHOUT": 38 (59.38) |                      |                                  |                          |                         | 64                |
| The Preamble is clearly stated.  | 29 (45.31)  | 22 (34.38)           | 7 (10.94)                        | 3 (4.69)                 | 3 (4.69)                | 64                |
| Do you agree with the Preamble?  | 32 (50.00)  | 18 (28.13)           | 5 (7.81)                         | 7 (10.94)                | 2 (3.13)                | 64                |
| Would you use (circulate) the Preamble to inform your patients or clients?   | 18 (27.69)  | 24 (36.92)           | 17 (26.15)                       | 5 (7.69)                 | 1 (1.54)                | 65                |
| The EDP Guidelines are clearly stated.   | 28 (43.08)  | 18 (27.69)           | 10 (15.38)                       | 6 (9.23)                 | 3 (4.62)                | 65                |
| Do you understand the difference between a weak and strong recommendation?   | 28 (43.08)  | 23 (35.38)           | 8 (12.31)                        | 2 (3.08)                 | 4 (6.15)                | 65                |
| <b>Evidence to decision framework</b>  |   |                      |                                  |                          |                         |                   |
|  | Yes n (%)   |                      | No n (%)                         |                          | Total responses n       |                   |
| Are the EDP Guidelines important to you? (priority)  | 62 (96.88)  |                      | 2 (3.13)                         |                          | 64                      |                   |
|  | Always n (%)  | Frequently n (%)     | Occasionally n (%)               | Seldom n (%)             | Never n (%)             | Total responses n |
| Would you use the EDP Guidelines? (acceptability)  | 27 (41.54)  | 31 (47.69)           | 5 (7.69)                         | 1 (1.54)                 | 1 (1.54)                | 65                |
|  | Very easy n (%)   | Somewhat easy n (%)  | Neither easy nor difficult n (%) | Somewhat difficult n (%) | Very difficult n (%)    | Total responses n |
| How easy or difficult would you find using the EDP Guidelines? (feasibility)   | 19 (29.23)  | 26 (40.00)           | 14 (21.54)                       | 4 (6.15)                 | 2 (3.08)                | 65                |
|  | Strongly agree n (%)  | Somewhat agree n (%) | Neither agree nor disagree n (%) | Somewhat disagree n (%)  | Strongly disagree n (%) | Total responses n |
| Do you understand what is meant by "a moderate intensity of exercise"? (feasibility)   | 45 (69.23)  | 9 (13.85)            | 7 (10.77)                        | 1 (1.54)                 | 3 (4.62)                | 65                |
| The costs FOR YOU OR YOUR ORGANIZATION to implement the EDP Guidelines with your patients or clients are likely to be small or negligible compared to not following the Guidelines. (resource use) | 33 (60)   | 13 (23.6)            | 7 (12.7)                         | 0 (0.0)                  | 2 (3.64)                | 55                |
| The health benefits to the woman and child of using the Guidelines are likely to outweigh the harms. (perceived incremental cost-benefit ratio)  | 50 (79.4)   | 9 (14.3)             | 3 (4.8)                          | 1 (1.59)                 | 0 (0.0)                 | 63                |
| Following the EDP Guidelines is likely to benefit all population groups equally, irrespective of race, ethnicity, or the socioeconomic status of the family. (equity)                              | 40 (63.5)   | 14 (22.22)           | 3 (4.76)                         | 2 (3.17)                 | 4 (6.35)                | 63                |

EDP: exercise during pregnancy.

**Table 7. Summary results of pregnant/postpartum women survey (round 2)**

| Question   | Strongly agree n (%)   | Somewhat agree n (%) | Neither agree nor disagree n (%) | Somewhat disagree n (%)  | Strongly disagree n (%) | Total responses n |
|--|--|----------------------|----------------------------------|--------------------------|-------------------------|-------------------|
| The Title is clearly stated.   | 49 (80.33)   | 4 (6.56)             | 1 (1.64)                         | 1 (1.64)                 | 6 (9.84)                | 61                |
| Do you agree with the Title?   | 41 (67.21)   | 7 (11.48)            | 7 (11.48)                        | 2 (3.28)                 | 4 (6.56)                | 61                |
| Which title do you prefer?   | "IN": 5 (8.20) "DURING": 18 (29.51) "THROUGHOUT": 38 (62.30) |                      |                                  |                          |                         | 61                |
| The Preamble is clearly stated.  | 30 (49.18)   | 21 (34.43)           | 4 (6.56)                         | 1 (1.64)                 | 5 (8.20)                | 61                |
| Do you agree with the Preamble?  | 30 (40.18)   | 18 (25.51)           | 6 (9.84)                         | 2 (3.28)                 | 5 (8.20)                | 61                |
| The EDP Guidelines are clearly stated.   | 20 (32.79)   | 17 (27.87)           | 7 (11.48)                        | 13 (21.31)               | 4 (6.56)                | 61                |
| Do you understand the difference between a weak and strong recommendation?   | 24 (39.34)   | 21 (34.43)           | 5 (8.20)                         | 5 (8.20)                 | 6 (9.84)                | 61                |
| Evidence to decision framework   |  |                      |                                  |                          |                         |                   |
|  | Yes n (%)  |                      | No n (%)                         |                          | Total responses n       |                   |
| Are the EDP Guidelines important to you? (priority)  | 59 (96.72)   |                      | 2 (3.28)                         |                          | 61                      |                   |
|  | Always n (%)   | Frequently n (%)     | Occasionally n (%)               | Seldom n (%)             | Never n (%)             | Total responses n |
| Would you use the EDP Guidelines? (acceptability)  | 21 (34.43)   | 31 (50.82)           | 9 (14.75)                        | 0 (0.0)                  | 0 (0.0)                 | 61                |
|  | Very easy n (%)  | Somewhat easy n (%)  | Neither easy nor difficult n (%) | Somewhat difficult n (%) | Very difficult n (%)    | Total responses n |
| How easy or difficult would you find using the EDP Guidelines? (feasibility)   | 15 (24.59)   | 27 (44.26)           | 11 (18.03)                       | 7 (11.48)                | 1 (1.64)                | 61                |
|  | Strongly agree n (%)   | Somewhat agree n (%) | Neither agree nor disagree n (%) | Somewhat disagree n (%)  | Strongly disagree n (%) | Total responses n |
| Do you understand what is meant by "a moderate intensity of exercise"? (feasibility)   | 41 (69.49)   | 9 (15.25)            | 2 (3.39)                         | 1 (1.69)                 | 6 (10.17)               | 59                |
| The costs (e.g., financial) for you to follow the EDP Guidelines are likely to be small or negligible compared to not following the Guidelines. (resource use)   | 28 (50.90)   | 19 (34.54)           | 4 (7.27)                         | 3 (5.45)                 | 1 (1.82)                | 55                |
| When considering the impact of exercise on YOUR OWN HEALTH, do you feel that the health benefits of using the EDP Guidelines are likely to outweigh the harms? (perceived incremental cost-benefit ratio)    | 44 (75.90)   | 13 (22.40)           | 0 (0.0)                          | 0 (0.0)                  | 1 (1.72)                | 58                |
| When considering the impact of exercise on YOUR BABY'S HEALTH, do you feel that the health benefits of using the EDP Guidelines are likely to outweigh the harms? (perceived incremental cost-benefit ratio) | 42 (72.4)  | 15 (25.90)           | 1 (1.72)                         | 0 (0.0)                  | 0 (0.0)                 | 58                |
| Following the guidelines would likely benefit all pregnant women equally, irrespective of race, ethnicity, or socioeconomic status. (equity)   | 39 (65.00)   | 18 (30.00)           | 2 (3.33)                         | 1 (1.66)                 | 0 (0.0)                 | 60                |

EDP: exercise during pregnancy.

## **STRENGTH OF THE RECOMMENDATIONS**

The GRADE system was used to grade the strength of the recommendations. Recommendations are rated as strong or weak on the basis of the (1) balance between benefits and harms, (2) overall quality of the evidence, (3) importance of outcomes (i.e., values and preferences of pregnant women), (4) use of resources (i.e., cost), (5) impact on health equity, (6) feasibility, and (7) acceptability.

*Strong recommendation:* Most or all pregnant women will be best served by the recommended course of action.

*Weak recommendation:* Not all pregnant women will be best served by the recommended course of action; there is a need to consider other factors such as the individual's circumstances, preferences, values, resources available, or setting. Consultation with an obstetric care provider may assist in decision making.

## **QUALITY OF THE EVIDENCE**

The quality of the evidence refers to the level of confidence in the evidence and ranges from very low to high.

*High quality:* The GCP is very confident that the estimated effect of physical activity on the health outcome is close to the true effect.

*Moderate quality:* The GCP is moderately confident in the estimated effect of physical activity on the health outcome; the estimate of the effect is likely to be close to the true effect, but there is a possibility that it is substantially different.

*Low quality:* The GCP's confidence in the estimated effect of physical activity on the health outcome is limited; the estimate of the effect may be substantially different from the true effect.

*Very low quality:* The GCP has very little confidence in the estimated effect of physical activity on the health outcome; the estimate of the effect is likely to be substantially different from the true effect.

<sup>a</sup>This was a weak recommendation because the quality of evidence was low, and the net benefit between women who were physically active and those who were not was small.

<sup>b</sup>This was a strong recommendation because, despite low quality evidence supporting physical activity during pregnancy for women categorized as overweight or obese, there was evidence from randomized controlled trials

demonstrating an improvement in gestational weight gain and blood glucose.

<sup>c</sup>Moderate-intensity physical activity is intense enough to noticeably increase heart rate; a person can talk but not sing during activities of this intensity. Examples of moderate intensity physical activity include brisk walking, water aerobics, stationary cycling (moderate effort), resistance training, carrying moderate loads, and household chores (e.g., gardening, washing windows).

<sup>d</sup>This was a weak recommendation because urinary incontinence was not rated as a "critical" outcome and the evidence was low quality.

<sup>e</sup>This was a weak recommendation because: (1) the quality of evidence was very low; and (2) although harms were investigated, there was limited available information to inform the balance of benefits and harms. This recommendation was primarily based on expert opinion.

Although the supporting systematic reviews included interventions that comprised exercise alone or in combination with a co-intervention (e.g., diet), the evidence from the exercise-only studies was sufficient such that only this direct evidence was used to inform the Guidelines. Specific recommendations about physical activity (Recommendations 1–6): On the basis of the systematic reviews where meta-regression analyses were performed, it was the judgement of the GCP that the guideline for prenatal exercise be based on the least amount of exercise necessary to achieve a clinically meaningful impact (i.e., at least 25% reduction in the following unfavourable outcomes: GDM, GH, PE, prenatal depression, excessive gestational weight gain. To achieve clinically meaningful reductions in these pregnancy complications, the evidence showed pregnant women needed to accumulate at least 150 minutes of moderate-intensity physical activity (corresponding to 700 metabolic equivalents-minutes per week of exercise [Recommendation 2]).<sup>2,7</sup> These benefits were attained with a frequency of at least 3 days per week (Recommendation 3).<sup>2,7</sup> Although the evidence suggested that moderate-intensity exercise was associated with greater benefit, light-intensity activity also was associated with benefits. Further meta-regression analysis performed on maternal glucose responses to acute exercise that demonstrated even a 15-minute bout of exercise reduced blood glucose concentrations by an average of 0.5 mmol/L.<sup>8</sup>

Our systematic reviews did not identify evidence of harms to the mother or fetus. However, because the maximal prescribed intensity of the exercise interventions was the

equivalent of jogging (7 metabolic equivalents), the impact of long-term high-intensity exercise was not examined. Therefore, evidence was not identified regarding the safety or additional benefit of exercising at higher intensities. Nevertheless, on the basis of the evidence, the judgement of the GCP indicated that accumulating the suggested volume, frequency, intensity, and duration of exercise would be unlikely to cause harms to mother or fetus.

It was decided that strong recommendations to accumulate at least 150 minutes of moderate-intensity physical activity each week (Recommendation 2) over a minimum of 3 days per week (Recommendation 3) were warranted because the benefits of exercising outweighs potential harms, the overall quality of the evidence was high, and the values and preferences of the pregnant women suggested most would be served by the recommended course of action. Further, the findings from the stakeholder survey suggested that the costs versus the benefits associated with implementing the Guidelines were perceived as minimal, and recommendations were perceived as feasible and acceptable.

Although the body of evidence regarding types of exercise was very heterogeneous, the evidence showed that engaging in various types of physical activities was more beneficial than aerobic activities alone. In the stakeholder and pregnant and postpartum women surveys, many pregnant women expressed a desire for more advice regarding type of exercise. In considering the balance of the benefits and harms with respect to various types of physical activities, there was no evidence of harm, thus warranting a recommendation in favour of various types of physical activities. The GSC therefore put forth a recommendation for “type” of exercise, by stating that pregnant women should incorporate a variety of aerobic and resistance training activities to achieve greater benefits, and that yoga and/or gentle stretching may also be beneficial (Recommendation 4). The evidence was “high” quality on the basis of the exercise-only RCTs (interventions that did not have a co-intervention) reporting on “critical” outcomes, and a mixed-exercise approach was deemed to be acceptable, feasible, and cost effective by stakeholders and pregnant women, with large theoretical savings to the health care system and with little variability in values and preferences among stakeholders and pregnant women; this supported a strong recommendation.

Although recommendations are typically based on outcomes rated as having “critical” importance, the GCP chose to develop a recommendation on pelvic floor muscle training in relation to urinary incontinence, (which was rated as an “important” outcome (Recommendation 5). The reduction

in the odds of developing urinary incontinence either during or following pregnancy was substantially reduced with PFMT alone or in combination with aerobic exercise, with no harms identified<sup>5</sup>; however, the certainty that PFMT would result in long-term benefits was limited.

The stakeholder and pregnant and postpartum women surveys identified that (1) the majority of women would want to engage in PFMT but many would not and (2) the recommendation was thought to be feasible and cost effective. Together, these factors indicated that a weak recommendation was warranted. In the judgement of the GCP a pregnant woman should discuss the potential benefits and harms with her health care provider to reach a decision consistent with her values and preferences. Because instruction in proper technique was provided in the intervention studies reviewed, it was unclear whether the same benefits would be obtained in the absence of such instruction; the GCP recommended instruction in proper technique to obtain optimal benefits.

The GCP decided to examine exercise in the supine position separately (Recommendation 6). On the basis of the systematic review that examined exercise in the supine position in relation to potential adverse maternal and fetal outcomes, no conclusions could be drawn regarding the balance of benefits and harms.<sup>10</sup> No association was found between supervised exercise interventions that included supine exercise and low birth weight compared with no exercise. However, abnormal fetal heart rate tracings were found in 11 of 26 (42%) and five of 27 (19%) fetuses when women moved from left-lateral rest to an acute bout of supine exercise, with a decrease in uterine blood flow.<sup>10</sup> In the judgement of the GCP, potential harms resulting from exercise in the supine position, and the balance of benefits and harms, are unknown. On the basis of “very low” quality evidence, the GCP recommended that pregnant women who experience light headedness or nausea or who feel unwell when they exercise flat on their back should avoid this position.

### Dissemination, Implementation, and Evaluation Plans

The preamble and Guidelines were made public by the concurrent open-access joint publication in the *JOGC* and the *British Journal of Sports Medicine*.<sup>16,17</sup> A media event to communicate the Guidelines to the general public coincided with the publication of the Guidelines. These Guidelines were translated into French and made available on the CSEP and SOGC websites. The future extension of the Guidelines will be to update the primary knowledge translation tool, the PARmed-X for Pregnancy (CSEP 2013) by

a subset of the GCP in conjunction with CSEP in 2019. The PARmed-X is a four-page document that currently includes a medical history taking page for the pregnant woman, a medical screening checklist to facilitate the health care provider to determine whether the individual has contraindications to exercise, and aerobic and resistance training. The planned updated PARmed-X for Pregnancy tool will be launched in both English and French and disseminated both nationally and internationally. The Guidelines and the PARmed-X for Pregnancy will be incorporated into the CSEP training manuals for exercise professionals and physiologists (to be released in Fall 2018). In addition, these documents have been simplified into a tear-off sheet for health care providers to use for prenatal exercise prescription, and an infographic was developed (csep.ca/guidelines). Pending the availability of funds, additional knowledge translation tools (e.g., webinars, lecture tours) will be developed.

### Research Gaps and Surveillance Recommendations

Throughout the guideline development process, research gaps were identified and recorded. These research gaps are provided in Online Supplement Table 3. These gaps in the literature should be addressed to inform areas where specific recommendations could not be provided. There was limited to no high quality evidence from randomized controlled trials regarding the benefits and harms of different types of non-aerobic physical activity (e.g., resistance training, yoga) either alone or in combination with aerobic physical activity. Furthermore, evidence was lacking regarding certain specific populations (e.g.,  $\geq 35$  years of age, women with overweight or obesity or GDM). Further identification of the benefits and harms of prenatal physical activity in complicated pregnancies (e.g., type 1 diabetes, type 2 diabetes, preeclampsia, gestational hypertension, chronic hypertension, asthma) is also needed.

These guidelines are specific to physical activity; however, it is very likely that other movement behaviours (e.g., light physical activity, sleep, and sedentary behavior) may affect health outcomes. Although the impact of sedentary behavior and light physical activity is a novel area of research in prenatal populations, relationships between these behaviours and health outcomes are well established in a variety of non-pregnant populations.<sup>15</sup> Future research examining the impact of all movement behaviours during pregnancy is needed.

Researchers conducting physical activity trials should, at a minimum, report the specific prescription (i.e., frequency, intensity, duration of session, type of physical activity, duration of the intervention) for each intervention. Compliance

with each intervention should be reported consistently and indicate the mean number of physical activity sessions completed as a percentage of the total prescribed sessions. In addition, objective measures of physical activity should be used (i.e., accelerometers) to capture frequency, intensity, and duration of physical activity wherever feasible. Furthermore, Guidelines surveillance (monitoring the proportion of women meeting the Guidelines) is important. Objective criteria to determine what constitutes “meeting the guidelines” need to be developed to be used for future surveillance measures.

### AGREE II ASSESSMENT

The four independent assessors scored the procedures used to develop the Guidelines following the rubric of the AGREE II.<sup>27</sup> Online Supplement Table 4 provides the scores for each item from each independent reviewer. Overall, the Guidelines development process was scored 6.2 (overall average rating 88.3%), and all assessors indicated that they would recommend the Guidelines for use.

### DISCUSSION

#### Guidelines Development Process and Outcomes

The objective of this paper was to summarize the process and outcomes for the development of the 2019 Guidelines.<sup>16,17</sup> As briefly reported in the Results section and in more detail in the Online Supplement, the GCP agreed unanimously that there was sufficient evidence to strongly support the final Guidelines recommendations presented in this paper.

The procedures used to develop the 2019 Guidelines were comprehensive, rigorous, and transparent.<sup>15,18,19</sup> They included systematic reviews, consultations, and feedback from experts, stakeholders, and end-users. The Guidelines document started with a preamble to provide the context for the recommendations followed by the recommendations themselves. The preamble and recommendations as presented in the JOGC and the *British Journal of Sports Medicine* are designed for obstetric health care providers and exercise professionals to assist and engage pregnant women to be more physically active.<sup>16,17</sup> More user-friendly support and tools directed to pregnant women and the general public have been developed.

The procedures used to develop the 2019 Guidelines were an improvement over the procedures used for the development of the 2003 Joint SOGC/CSEP Clinical Practice Guideline for Exercise in Pregnancy and the Postpartum Period,<sup>14</sup> which were not based on systematic reviews, did



not follow the GRADE methodology, and were not guided by the AGREE II instrument because it was not available at the time. The most notable additions to the present Guidelines are (1) recommendations for specific subgroups of pregnant women (i.e., women with a pre-pregnancy BMI  $\geq 25$  kg/m<sup>2</sup>, who were previously inactive, or women who developed GDM), (2) a recommendation for a minimal amount of exercise per week (volume) to achieve clinically meaningful reductions in the risk of pregnancy complications, (3) specific recommendations regarding type of exercise, and (4) a recommendation for daily PFMT during pregnancy to reduce the risk of urinary incontinence.

In addition to specific recommendations for prenatal exercise, the Guidelines also provide some general guidance that will assist with implementation of the recommendation but were not developed using the GRADE methods<sup>19</sup> related to the type of exercise that women should avoid during pregnancy and the reasons to stop exercise. In the expert opinion of the GCP, pregnant women who were previously inactive can initiate exercise at any time during pregnancy, the earlier the better, and should be encouraged gradually to increase their frequency, intensity, and duration of exercise until the recommendations are achieved. Furthermore, evidence was not identified regarding the safety or additional benefit of exercising at levels significantly above the recommendations. The GCP agreed that women who consider exercising above the recommendations should speak to their obstetric health care professional to clarify risk and make modifications, if necessary.

It is possible that implementing and following the 2019 Guidelines may be challenging for some stakeholders and pregnant women. The feedback received through the online surveys indicated the Guidelines were a priority for the respondents. Furthermore, implementing and following the Guidelines were perceived to be acceptable, affordable, and feasible. However, a limitation of the end-users consultation process was that pregnant and postpartum women with a high socioeconomic and educational status were likely overrepresented in the sample. It is therefore possible that the perceptions of acceptability, affordability, and feasibility of following the Guidelines were overestimated. Nevertheless, end-user consultation indicated the need to develop materials to support and communicate the Guidelines to a lay audience, and this is planned, as indicated in the dissemination, implementation, and evaluation section of the Results section.

It is the opinion of the GCP that all the recommendations are supported by the best available scientific evidence. Even for recommendations having the weakest evidence, the

potential for benefits still exists, and the possibility of harm is very small. However, more refined and informed Guidelines are needed in the future; thus additional research addressing the identified research gaps is warranted.

### **Release, Dissemination, Implementation, and Activation Planning**

The 2019 Guidelines document will inform the PARmed-X for Pregnancy tool, which will also be updated with the new guidelines and will be widely available to the public at [www.csep.ca/guidelines](http://www.csep.ca/guidelines). The PARmed-X for Pregnancy can easily be downloaded from the website and adapted for use in a clinical or exercise setting (compatibility), with a clear and succinct message for prenatal exercise prescription (simplicity).

The GCP engaged several end-users, including the CSEP, SOGC, Canadian Association of Midwives, Canadian Academy of Sport and Exercise Medicine, College Family Physicians, Public Health Unit (Middlesex-London Health Unit), and Exercise Is Medicine Canada. In addition, the 2019 Guidelines and the PARmed-X for Pregnancy tool will inform the CSEP training manuals for exercise professionals and exercise physiologists (release Fall 2018).

The goal of these Guidelines is to provide guidance for pregnant women, as well as health care and exercise professionals, on prenatal physical activity. These Guidelines may be used to develop policies for healthy active living at the local, provincial, national, and international levels. These new Guidelines will provide the evidence base to advance a healthy, active living agenda for pregnant women around the globe.

### **Updating the Guidelines**

A duration of 10 years has been identified as an appropriate period to allow feedback from stakeholders and pregnant women while also providing sufficient time for addressing gaps in the literature for implementation of evidence-based research.<sup>31</sup> It is therefore recommended that an update occur in 10 years to keep the Guidelines current and that an update be revisited sooner if new evidence that could substantially alter the existing Guidelines is identified.

### **STRENGTHS AND LIMITATIONS**

There are a number of strengths of these Guidelines. The development process followed rigorous, transparent methodological and evaluation criteria including GRADE and AGREE II. The process was guided by methodological and content experts, and the GCP also included an international consultant and collaborators. Key end-users were consulted throughout the process, the literature was

comprehensively and systematically reviewed, and a wide range of key health outcomes was considered to provide a comprehensive evidence base. There was substantial “moderate” to “high” quality evidence from RCTs reporting on “critical” outcomes that was synthesized in 12 systematic reviews to inform the Guidelines. The views of the funding bodies did not influence the content of the Guidelines, and no members of the GCP declared competing interests.

There are also a number of limitations of the guidelines. Very little research examined the impact of prenatal exercise initiated during the first trimester of pregnancy, and this limited the ability to make trimester-specific recommendations. There was also a paucity of literature examining the impact of vigorous-intensity exercise; thus it was not possible to identify a safe upper limit of exercise intensity. In addition, we were not able to provide guidance for subgroups because there were no available data specifically in women < 20 or ≥ 35 years of age and minimal data in women with overweight or obesity or GDM. It is possible that the surveys used in the consultation process resulted in biased feedback because the pregnant and postpartum women may have been from a higher socioeconomic status. Finally, the cost-effectiveness of the Guidelines was not evaluated.

## **CONCLUSION**

The 2018 Guidelines were developed using rigorous methodology and the best available evidence, and they took into consideration acceptability, feasibility, and cost of the intervention. They represent a foundational shift in our view of prenatal physical activity from a recommended behaviour to improve quality of life to a specific prescription to reduce pregnancy complications and optimize health across the lifespan of two generations. It is critical that these guidelines be followed to achieve the significant and potentially lifelong health benefits for both mother and child.

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## **SUPPLEMENTARY DATA**

Supplementary data related to this article can be found at [doi:10.1016/j.jogc.2018.09.004](https://doi.org/10.1016/j.jogc.2018.09.004).

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