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## Guidelines for Physical Activity During Pregnancy: Comparisons From Around the World

Kelly R. Evenson

*The University of North Carolina at Chapel Hill*

Ruben Barakat

*Universidad Politécnica de Madrid*

Wendy J. Brown

*The University of Queensland*

Patricia Dargent-Molina

*Inserm*

Megumi Haruna

*Graduate School of Medicine*

*See next page for additional authors*

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**Authors**

Kelly R. Evenson, Ruben Barakat, Wendy J. Brown, Patricia Dargent-Molina, Megumi Haruna, Ellen M. Mikkelsen, Michelle F. Mottola, Katrine M. Owe, Emily K. Kim, Bandar Al-Judaibi, Ute I. Schwarz, Alnoor Ramji, Edward Tam, Colin J. Ross, and Bruce C. Carleton

# ANALYTIC REVIEW

Kelly R. Evenson, PhD, MS, FACSM, Ruben Barakat, PhD, Wendy J. Brown, PhD, MSc, FACSM, Patricia Dargent-Molina, PhD, Megumi Haruna, PhD, Ellen M. Mikkelsen, PhD, MPH, RN, Michelle F. Mottola, PhD, FACSM, Katrine M. Owe, PhD, Emily K. Rousham, PhD and SeonAe Yeo, PhD

## Guidelines for Physical Activity During Pregnancy: Comparisons From Around the World

**Abstract:** Introduction. Women attain numerous benefits from physical activity during pregnancy. However, because of physical changes that occur during pregnancy, special precautions are also needed. This review summarizes current guidelines for physical activity among pregnant women worldwide. Methods. We searched PubMed (MedLINE) for country-specific governmental and clinical guidelines on physical activity during pregnancy through the year 2012. We cross-referenced with articles referring to guidelines, with only the most recent included. An abstraction form was used to extract key details and summarize. Results. In total, 11 guidelines were identified from 9 countries (Australia, Canada, Denmark, France, Japan, Norway, Spain, United Kingdom, United States). Most guidelines supported moderate-intensity physical activity during pregnancy (10/11) and indicated specific frequency

(9/11) and duration/time (9/11) recommendations. Most guidelines provided advice on initiating an exercise program during pregnancy (10/11). Six guidelines included absolute and relative contraindications to exercise. All guidelines generally ruled-out sports with risks of falls,

can help inform new guidelines as they are created or updated and facilitate the development of a worldwide guideline.

**Keywords:** guidelines; exercise; global; leisure activities; pregnancy; prenatal



Guidelines on physical activity during pregnancy provide recommendations for health professionals as to whether to prescribe physical activity and if so, in what manner.



trauma, or collisions. Six guidelines included indications for stopping exercise during pregnancy. Conclusion. This review contrasted pregnancy-related physical activity guidelines from around the world, and

### Introduction

Health benefits of physical activity during pregnancy include reduced risk of excessive gestational weight gain and conditions such as gestational diabetes,

DOI: 10.1177/1559827613498204. Manuscript received March 4, 2013; revised April 22, 2013; accepted May 14, 2013. From Department of Epidemiology, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina (KRE); Faculty of Physical Activity and Sports Sciences, INEF, Technical University of Madrid, Madrid, Spain (RB); School of Human Movement Studies, University of Queensland, St Lucia, Queensland, Australia (WJB); Inserm, Centre for Research in Epidemiology and Population Health (CESP), Université Paris-Sud, Villejuif, France (PD-M); Department of Midwifery and Women's Health, Division of Health Sciences & Nursing, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan (MH); Department of Clinical Epidemiology, Aarhus University Hospital, Aarhus, Denmark (EMM); R. Samuel McLaughlin Foundation-Exercise & Pregnancy Laboratory, School of Kinesiology, Faculty of Health Sciences, Department of Anatomy and Cell Biology, Schulich School of Medicine, Children's Health Research Institute, University of Western Ontario, London, Ontario, Canada (MFM); Department of Social Statistics, Statistics Norway, Oslo, Norway (KMO); School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, UK (EKR); and School of Nursing, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina (SY). Address correspondence to Kelly R. Evenson, PhD, MS, FACSM, Department of Epidemiology, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, 137 East Franklin Street, Suite 306, Chapel Hill, NC 27514; e-mail: kelly\_evenson@unc.edu.

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preeclampsia, preterm birth, varicose veins, and deep vein thrombosis.<sup>1-4</sup> There is some evidence that physical activity during pregnancy is associated with a reduced length of labor and delivery complications.<sup>4</sup> However, vigorous leisure activity is associated with reduced birth weight.<sup>5</sup> Psychological benefits to physical activity during pregnancy include reduced fatigue, stress, anxiety, and depression, as well as improved well-being.<sup>1-4</sup> From a public health perspective, women who are active during pregnancy are more likely to continue physical activity during postpartum.<sup>4</sup>

Physiologic responses to exercise, such as changes in heart rate, cardiac output, ventilation, and energy expenditure, are all greater during pregnancy than pre-pregnancy, and may become more pronounced as pregnancy progresses.<sup>6,7</sup> Hormonal changes increase joint laxity that may place a woman at increased risk for injury.<sup>8</sup> Adaptations to physical activity are needed to reduce the risk of injury for both the mother and baby.

Guidelines on physical activity during pregnancy provide recommendations for health professionals as to whether to prescribe physical activity and if so, in what manner. Guidelines from a variety of organizations help address questions about physical activity, such as how long, how far, how often, and at what intensity. The World Health Organization's guideline on physical activity recommends that adults aged 18 to 64 years should engage in at least 150 minutes of moderate-intensity aerobic activity throughout the week (in bouts of at least 10 minutes), or at least 75 minutes of vigorous-intensity aerobic activity, or an equivalent combination of the two.<sup>9</sup> Muscle strengthening should be done 2 or more days per week. The guideline states that pregnant women may need extra precaution and should seek medical advice before striving to achieve the recommendations.

More detailed guidelines for physical activity during pregnancy are available from several countries, with some guidelines based on evidence and others based on expert consensus. These

guidelines were produced by a range of professional bodies and government agencies, and were written for different target audiences, and at different times. The aim of this review was to summarize the different public health and clinical guidelines on physical activity during pregnancy from around the world. A summary of guidance across countries may stimulate national bodies to develop guidelines where they do not exist, share best practices, and update existing guidance. It could also facilitate the development of a global recommendation for physical activity during pregnancy.

## Methods

For this review, we searched PubMed (MedLINE) for published guidelines on physical activity during pregnancy. The search was narrowed to peer-reviewed studies published between 1990 and 2012. We cross-referenced with articles that referred to country-specific guidelines and then identified an expert in that country to work with on the project. Thus, each country included in this review was represented by at least one scientist. To narrow the scope of the review, we included only the most recent country-specific or clinical guidelines. Layman-oriented guidelines and those from other societies (such as dietetics) were excluded. A single author reduced all extraction forms into tables that coauthors subsequently checked.

## Results

### Background

We identified 11 guidelines representing 9 countries, including Australia,<sup>10,11</sup> Canada,<sup>3,12,13</sup> Denmark,<sup>14,15</sup> France,<sup>16</sup> Japan,<sup>17,18</sup> Norway,<sup>19</sup> Spain,<sup>20</sup> the United Kingdom,<sup>4</sup> and the United States<sup>2,21</sup> (Table 1). The guidelines represented or endorsed by obstetrics and gynecology (Australia, Canada, Denmark, Spain, United Kingdom, United States), public health (Canada, Denmark, France, Norway, United States), sports medicine (Australia,

Japan), and exercise physiology (Canada). Since the 2 Danish guidelines were essentially identical in their recommendations, they were coded in the remaining tables as one guideline,<sup>14,15</sup> The 2 US guidelines differed and thus coded separately: American College (now Congress) of Obstetricians and Gynecologists (ACOG)<sup>21</sup> and the US Department of Health and Human Services (USDHHS).<sup>2</sup>

Most guidelines included a comprehensive literature review, but not a quality assessment. However, Canada had a comprehensive rating of scientific evidence contributing to its guidelines, which included a quality assessment of the evidence (considering the study design in this process) to support each recommendation. The Danish Society of Obstetrics and Gynecologists guideline also rated the evidence for each issued recommendation.

### Contraindications to Exercise During Pregnancy

Absolute contraindications refer to conditions where exercise is not recommended. Relative contraindications refer to conditions where the risks of exercise may exceed the benefits. Guidelines from Canada, Japan, Spain, and the US ACOG described contraindications to exercise in absolute and relative terms; however, guidelines from Norway and the United Kingdom did not make these distinctions (Table 2). The guidelines from Australia, Denmark, France, and the USDHHS did not address contraindications, because they were intended for healthy women with normal pregnancies. Generally, where 2 or more countries identified contraindications, they agreed on whether it was an absolute or relative contraindication.

The 6 countries (Canada, Japan, Norway, Spain, United Kingdom, US ACOG) agreed on several contraindications to exercise, including anemia, persistent bleeding, cardiovascular disease, cerclage or incompetent cervix, multiple gestation, preeclampsia or pregnancy-induced hypertension, premature contractions or labor, premature rupture of membranes

**Table 1.** Development of Clinical and Public Health Guidelines for Physical Activity During Pregnancy.

		Guidelines										
		Australia	Canada	Denmark	Denmark	France	Japan	Norway	Spain	United Kingdom	United States (ACOG)	United States (USDHHS)
Reference(s)		10, 11	3, 12, 13	15	14	16	17	19	20	4	21	2
Year		2002, online 2009	2002-2003	2011	2008	2005	2003	2000	2001	2006	2002; reaffirmed in 2009 without changes	2008
Prior versions		None	1996	2004, 2005	None	None	None	None	1993	None	1985, 1994, 2002	None
Language of guidelines		English	English	Danish	Danish	French	Japanese	Norwegian	Spanish	English	English	English
Organization		Sports Medicine Australia; endorsed by the Royal Australian and New Zealand College of Obstetrics and Gynaecology	Society of Obstetricians and Gynaecologists of Canada; Canadian Society for Exercise Physiology	National Board of Health	Danish Society of Obstetrics and Gynaecology	National Authority for Health	Japanese Society of Clinical Sports Medicine	Norwegian Directorate of Health	Spanish Society of Gynecology and Obstetrics	Royal College of Obstetricians and Gynaecologists	American College (now Congress) of Obstetricians and Gynecologists	Department of Health and Human Services
Audience		All who are involved in management of active pregnant women, including health professionals and coaches, and the women themselves	Obstetricians, gynecologists, exercise physiologists	Health professionals, researchers, and others with interest in the field	Health professionals	Health professionals	Sports medicine physicians, health professionals, including obstetricians and gynecologists	Health professionals and policy makers	Obstetricians, gynecologists	Obstetricians, gynecologists	Obstetricians, gynecologists	Health professionals and policy makers

(continued)

**Table 1. (continued)**

Guidelines											
	Australia	Canada	Denmark	Denmark	France	Japan	Norway	Spain	United Kingdom	United States (ACOG)	United States (USDHHS)
Evidence process used	Narrative review of the evidence published in English to early 2002	MedLINE search 1966-2002; evidence reviewed by the societies and quantified using evaluation evidence from the Canadian Task Force on the Periodic Health Exam	A thorough review of the evidence on physical activity for pregnant women; an update of the literature reviewed in 2004 for the earlier version of the guideline	A thorough review of the evidence on physical activity for pregnant women, focusing on 8 specific pregnancy-related problems; evidence in relation to each problem is quantified	Adapted as a clinical guideline from the National Institute for Clinical Excellence (NICE) recommendation; further search of French literature and international databases	Literature from both Japanese- and English-language journals	A working group reviewed the scientific literature and summarized the relationship between physical activity and health that provided the scientific rationale for the guidelines	A working group provided advice on normal pregnancies	MedLINE search 1980-2004, also searched several other databases	Unknown, labeled as "committee opinion"	Physical Activity Guidelines Advisory Committee reviewed scientific literature (1995-1998/2007) that prepared a report and provided scientific rationale for the guidelines

**Table 2.** Absolute and Relative Contraindications to Exercise During Pregnancy.<sup>a</sup>

	Guidelines						
	Canada	Japan	Norway <sup>b</sup>	Spain	United Kingdom <sup>b</sup>	United States (ACOG)	
Absolute contraindications							
Abnormal amniotic fluid		X					
Bleeding, persistent	Second to third trimester	X	Months 4-9	X	Second to third trimester		Second to third trimester
CVD	Serious	X	X	Active CVD, cardiac failure, rheumatic disease	X	Hemodynamically significant	
Cerclage, incompetent cervix	X	X	X	X	Cervical weakness	X	
Diabetes mellitus	Uncontrolled type 1						
Fetal abnormality				X			
Fetal growth restriction		X		X			
History of fetal growth restriction	X				X	Reduce in second to third trimester	
History of miscarriage, ≥3		X					
History of preterm birth				X			
History of preterm labor					X	Reduce in second to third trimester	
Hypertonia, poorly controlled			X				
Infectious disease, acute				X			
Lung disease, restrictive			X	X	X	X	X

(continued)

**Table 2. (continued)**

		Guidelines						
		Canada	Japan	Norway <sup>b</sup>	Spain	United Kingdom <sup>b</sup>	United States (ACOG)	
Multiple gestation		Triplets and higher	X	X	X	X	X	
Placenta previa		Symptomatic bleeding	X		X	After 26 weeks	After 26 weeks	
Preeclampsia, pregnancy-induced hypertension		X	X	X	X	X	X	
Premature contractions or labor		X	X	X	X	X	X	
Premature rupture of membranes		X	X	X	X	X	X	
Respiratory disease, serious		X			Pulmonary embolism			
Rh+/Rh- immunologic disorder					X			
Systemic disorder, uncontrolled		X						
Thyroid disease, uncontrolled		X						
Thrombophlebitis					X			
Relative contraindications								
Anemia		Hemoglobin <100 g/L	Or other bleeding disorder	X	Severe	Hemoglobin <100 g/L	Severe	
Arrhythmia			X	Nonassessed		Unevaluated	Unevaluated	
Bronchitis, chronic		X		X		X	X	
Cardiovascular disorder, mild to moderate		X		X	X			
Diabetes mellitus			X	Poorly controlled		Poorly controlled	Poorly controlled type 1	

(continued)



**Table 2. (continued)**

	Guidelines					
	Canada	Japan	Norway <sup>b</sup>	Spain	United Kingdom <sup>b</sup>	United States (ACOG)
Eating disorder	X	Anorexia	X		X	
History of extremely sedentary lifestyle		X			X	X
History of fetal growth restriction		X				
History of preterm birth	X	X				
History of preterm labor	X	X				
History of spontaneous abortion	X					
Hypertension	X	X			Poorly controlled	Poorly controlled
Intrauterine growth restriction			X		X	X
Malnutrition	X		X		X	
Multiple gestation, twins	After 28 weeks					
Obesity, morbid (BMI >40 kg/m <sup>2</sup> )		X	X	X	X	X
Orthopedic limitation			X		X	X
Respiratory disorder, mild to moderate	X			X		
Seizures, poorly controlled			Epilepsy		X	X
Smoker, current			>20 cigarettes/day		>20 cigarettes/day	Heavy smoker
Thyroid disease		X	X	X	Poorly controlled	Poorly controlled hyperthyroidism
Underweight, extreme (BMI <12 kg/m <sup>2</sup> )		Extreme thinness		Extreme thinness		X

Abbreviations: ACOG, American College (now Congress) of Obstetricians and Gynecologists; BMI, body mass index; CVD, cardiovascular diseases.  
<sup>a</sup>The Australia, Denmark, France, and US Department of Health and Human Services guidelines did not include contraindications, as the guidelines were all geared toward healthy women with normal pregnancies.  
<sup>b</sup>Distinction between relative and absolute contraindications not made.

and thyroid disease. Four or five of the 6 guidelines identified contraindications for diabetes mellitus, eating disorder, morbid obesity, and placenta previa.

### Activities to Avoid During Pregnancy

For women who received physician clearance to exercise during pregnancy, all reviewed guidelines described specific characteristics of activities to avoid and specific sports to avoid (Table 3).

**Falls or Trauma.** All guidelines generally ruled out sports involving risks of falls, trauma, or collisions. A sport's safety was determined based on the movements required to participate in it. One concern was that the ligaments become relaxed because of increasing hormone levels, making joints more prone to injury (Australia, Canada). The Norwegian guideline was the only one to warn against high loads during strengthening exercises because of the risk of pressure reflex.

**Position.** All but 2 guidelines (France, Spain) warned against activities in the supine position (lying on one's back) because of the chance of decreased cardiac output and orthostatic hypotension caused by the enlarged uterus, which may obstruct venous return or blood flow from the abdominal aorta. As a result, these guidelines recommended avoiding the supine position during physical activity after the first trimester or 16 weeks' gestation. Canada's guideline suggested modifying the position of the exercise to instead be on one's side, sitting, or standing. Denmark's guidelines recommended a seated position during strength training.

**Altitude and Depth.** Four guidelines included recommendations about physical activity or exercise at altitude. Canada's guideline accepted moderate exercise at altitudes up to 6000 to 8250 feet (1800-2500 meters). The US ACOG guideline stated that exercise up to 6000 feet (1800 meters) appeared safe, but exercise at higher altitudes carried risk. It also stated that women should be informed of the signs of altitude sickness and advised that

if it develops, to stop exercising and descend from altitude to seek medical attention. Norway and the United Kingdom guideline suggested women at altitudes above 8250 feet (2500 meters) obtain 4 to 5 days of exposure at that altitude to avoid exertion and to regulate uterine blood flow. Seven guidelines specifically warned against scuba diving during pregnancy, because the fetus is not protected from decompression sickness and the fetal pulmonary circulation cannot filter bubble formation in the maternal bloodstream.

**Heat and Cold.** The Australian and Norwegian guideline warned of excessive body heat during exercise for pregnant women. Several other guidelines (Canada, Japan, Spain, United Kingdom) warned of exercising in hot or humid weather.

**Sedentary Behavior and Motionless Standing.** The United Kingdom guideline specifically mentioned avoiding a sedentary lifestyle, stating that "women and care providers should consider the effects of a sedentary lifestyle during pregnancy . . ." <sup>4(p3)</sup> because it can contribute to a number of adverse maternal outcomes. The Norwegian and US ACOG guidelines were the only ones to advise against motionless standing due to its association with decreased cardiac output.

**Avoidance of Vigorous-Intensity Activity.** Regarding vigorous activity, the Canadian and Norwegian guidelines cautioned against athletic competition, whereas the Australian guideline advised close monitoring by a physician. For both Japan and Norway, the recommended rating of perceived exertion categories did not include the vigorous intensity range. The USDHHS guideline stated that women not already highly active or engaged in vigorous activity should focus on moderate-intensity activity. The Denmark guidelines cautioned against vigorous activity for women not engaged in it prior to pregnancy. These guidelines also advised that pregnant women accustomed to high-intensity physical activity during prepregnancy could continue this activity as long as they felt well. The

Spanish guideline recommended no more than 15 minutes of vigorous activity and to decrease intensity by 20% to 30% for pregnant athletes. The French guideline mentioned that women engaged in jobs that involved hard or strenuous aspects or long travel time should refer to her occupational or family physician and consider specific adjustments to job tasks.

### Activities to Perform During Pregnancy

Most guidelines recommended activities to engage in during pregnancy (Table 4). All but the French and Spanish guidelines indicated duration or total time and all but the Australian and French guidelines indicated frequency of physical activity. For most all guidelines, intensity was indicated as moderate or vigorous, or in absolute (eg, heart rate) or relative (eg, rating of perceived exertion) indicators.

**Type.** All but the French guidelines specified aerobic activities as an acceptable modality. Guidelines from Australia, Canada, Denmark, Norway, and the United Kingdom also recommended strengthening exercises. Other specific activities that were recommended are summarized in Table 4. Only Spain provided a list of activities to perform with caution.

**Frequency and Duration.** Most guidelines (with the exception of those from France) included information on frequency and/or duration of exercise. Specifically, Canada and United Kingdom indicated a minimum of 15-minute sessions for 3 times per week, progressing to 30 minutes, 4 times per week even if intensity was reduced. Denmark recommended at least 30 minutes of moderate intensity activity daily. Japan recommended aerobic exercise for up to 60 minutes, 2 to 3 times per week. Norway recommended 30 minutes per day of aerobic activity. Spain recommended a frequency of 3 times per week with no duration specified. The US ACOG recommended accumulating 30 minutes or more of moderate exercise on most if not all days of the week. The USDHHS indicated that

**Table 3.**  
Activities to Avoid During Pregnancy.

	Guidelines									
	Australia	Canada	Denmark	France	Japan	Norway	Spain	United Kingdom	United States (ACOG)	United States (USDHHS)
General activities to avoid										
Abdominal trauma or pressure	Blunt trauma	Fetal trauma	X	X	X		X			
Altitude		X				X		X	X	
Contact or collision sports	X	X	X	X	X	4-6 months	X	X	X	X
Excessive body heat	X					X				
Excessive joint stress		X		X			X			
Falls or fall-related sports	X	X		X	X	X	X	X	X	X
Hot or humid weather	Hot conditions	Especially in first trimester			X	X	X	X		
High impact		X		X	X		X			
High loads during strengthening						X				
Hyperthermia							X	X		
Sedentary								X		
Standing, motionless									X	
Supine position (lying on back)	Not after the first trimester	Not after 16 weeks; modify position	Use a seated position during strength training		Not after 16 weeks	Not after 16 weeks		Not after 16 weeks	Not after the first trimester	Not after the first trimester
Uneven load during stretching		Stretch with controlled movements				X	Avoid extreme positions			

(continued)

**Table 3. (continued)**

Guidelines										
	Australia	Canada	Denmark	France	Japan	Norway	Spain	United Kingdom	United States (ACOG)	United States (USDHHS)
Vigorous intensity activities		No training for athletic competition	If not done before pregnancy		Implied based on Borg scale	Implied based on Borg scale	No more than 15 minutes per session			If not already highly active or doing vigorous intensity activity
Examples of specific activities to avoid										
Basketball					X				X	X
Bicycling outdoors	X	X						X		
Combat sports (eg, boxing, karate)							X			
Floor or roller hockey							X			
Gymnastics		X		X	X	X		X	X	
Horseback riding		X	X		X	X		X	X	X
Ice hockey		X				X	X	X	X	
Isometric exercises		X								
Mountain biking			X							
Mountain climbing					X					
Race car driving							X			
Racquet sports, vigorous				X					X	
Rugby							X			
Running, long distance			X							
Scuba diving		X		X	X	X	X	X	X	

(continued)

**Table 3. (continued)**

	Guidelines									
	Australia	Canada	Denmark	France	Japan	Norway	Spain	United Kingdom	United States (ACOG)	United States (USDHHS)
Surfing							X			
Skating						X				
Skiing			X							
Skiing, downhill	X	X				X	X	X	X	X
Skiing, water					X		X			
Soccer							X		X	X
Volleyball					X					

**Table 4.** Guidance on Exercise Prescription and Activities to Perform During Pregnancy.

	Guidelines									
	Australia	Canada	Denmark	France	Japan	Norway	Spain	United Kingdom	United States (ACOG)	United States (USDHHS)
General exercise recommendations										
Cool down		X				X	X			
Duration or total time, specified	X	X	X		X	X		X	X	X
Drink water or stay hydrated	X	X				X	X			
Flat place					X					
Frequency, specified		X	X		X	X	X	X	X	X
Intensity										
Moderate		X	X	X		X			X	X
Vigorous		X	X							X
Absolute (heart rate)		X			X		X	X		
Relative (rating of perceived exertion)		X			X	X		X		
Start new exercise program	X	X	X	X	X	X	X	X		X
Time (10 AM to 2 PM)					X					
Warm-up		X				X	X			
Wear light clothes						X				

(continued)

**Table 4. (continued)**

		Guidelines									
	Australia	Canada	Denmark	France	Japan	Norway	Spain	United Kingdom	United States (ACOG)	United States (USDHHS)	
Examples of specific activities to do											
Aerobic activities	X	Low impact	Implied by duration and intensity		X	X	X	X	Implied by duration and intensity	X	
Cross-country skiing		X									
Nordic walking						X					
Pelvic floor exercise		X	X			X					
Stationary cycling		X					X				
Strengthening	X	X	X			X		X			
Stretching	X	X			X	X					
Walking		X			X	X	X				
Water exercise, swimming	X	X			X	X	X	X			
Yoga					X						
Examples of activities to do with caution											
Bowling							X				
Cross-country skiing							X				
Horseback riding							X				
Golf							X				
Gymnastics							X				
Jogging, mild							X				
Racquet sports							X				

healthy women who are not already highly active or doing vigorous-intensity activity should get at least 150 minutes (2 hours and 30 minutes) of moderate-intensity aerobic activity per week during pregnancy and the postpartum period. Preferably this activity should be spread throughout the week.<sup>2(p42)</sup>

**Intensity.** For absolute intensity, heart rate guidance was the provided by Canada, Japan, Spain, and the United Kingdom. Guidelines from Canada and the United Kingdom specified heart rates accounting for age; however, Japan and Spain recommended heart rates less than 150 and 140 beats per minute, respectively. The Canadian guideline advised working in the lower ends of the heart rate zone if starting a new exercise program or in late pregnancy. The target heart rate zones provided by Canada represented 60% to 80% of maximal aerobic capacity. The United Kingdom guideline advocated for an “upper range of 60% to 90% maximal heart rate for women wishing to maintain fitness during pregnancy,”<sup>4(p4)</sup> and 60% to 70% of maximal heart rate for women who were sedentary prior to pregnancy. The Norwegian guideline recommended that aerobic exercise intensity should not exceed 70% to 75% of maximal oxygen uptake, instead advising use of a talk test (being able to talk while exercising) or the Borg’s rating of perceived exertion scale.<sup>22</sup> Canada and the United Kingdom also mentioned the usefulness of the “talk test.” The lowest guidance on intensity was from Spain, which recommended not exceeding 50% of maximal oxygen consumption.

For relative intensity, Canada, Norway, and the United Kingdom recommended perceived exertion of 12 to 14, just above or below “somewhat hard,” which generally coincided with moderate intensity. Japan recommended a perceived exertion less than 13 (somewhat hard) or 14, and for continuous exercise to be less than 11 (fairly light) or 12.

The French guideline recommended that beginning or continuing moderately intense sport physical activity during

pregnancy was possible. The USDHHS guideline indicated that

pregnant women who habitually engage in vigorous-intensity aerobic activity or are highly active can continue physical activity during pregnancy and the postpartum period, provided that they remain healthy and discuss with their health-care provider how and when activity should be adjusted over time.<sup>2(p42)</sup>

The Australian guideline condoned this: for healthy women not highly active or engaging in vigorous activity, then moderate intensity was recommended. The US ACOG stated that pregnant women should engage in regular, moderate intensity physical activity in the absence of contraindications.

**Starting a New Exercise Program.** All but the US ACOG guidelines included guidance for women starting a new exercise program during pregnancy. The Australian guideline suggested that women could begin a light to moderate exercise program in consultation with their doctor, and the Canadian guideline stated that for uncomplicated pregnancies “women with or without a previously sedentary lifestyle should be encouraged to participate in aerobic and strength-conditioning exercises as part of a healthy lifestyle.”<sup>3(p334)</sup> It indicated this generally was “in the second trimester, when the nausea, vomiting, and profound fatigue of the first trimester have passed and before the physical limitations of the third trimester begin.”<sup>3(p335)</sup> In Japan, the guideline indicated that if a pregnant woman started a sport during pregnancy, she should initiate it after 12 weeks’ gestation and confirm a normal pregnancy.

In Norway and the United Kingdom, women engaging in new exercise programs during pregnancy were encouraged to begin gradually with shorter sessions of 15 minutes for 3 times per week, then increase gradually to 30-minute sessions 4 times a week, and eventually to daily sessions. Spain recommended only initiating exercise

slowly for previously sedentary women, but did not provide specifics. The US ACOG guideline indicated that previously inactive women should be evaluated before physical activity recommendations are made and to increase the amount of physical activity gradually over time. The USDHHS guideline also indicated that

when beginning physical activity during pregnancy, women should increase the amount gradually over time. The effects of vigorous-intensity aerobic activity during pregnancy have not been studied carefully, so there is no basis for recommending that women should begin vigorous-intensity activity during pregnancy.<sup>2(p42)</sup>

**Other Exercise Guidance.** The guidelines from Canada, Norway, and Spain suggested warming up and cooling down before and after exercise, respectively. Australia, Canada, Norway, and Spain also mentioned hydration during exercise. Norway’s guideline also suggested wearing light clothes during exercise. Japan’s guideline described environmental characteristics of the exercise, such as choosing a flat place and exercising between 10 AM and 2 PM, supported by studies finding natural uterine contractions to be lower during that time period.<sup>23,24</sup>

### Signs and Symptoms to Stop Exercise

Six guidelines included indications for stopping exercise during pregnancy (Table 5), whereas Denmark, France, and the USDHHS did not. All 6 guidelines indicated ceasing exercise with dizziness or presyncope, dyspnea before exertion, or vaginal bleeding. Five of the 6 guidelines recommended ceasing exercise if there was indication of abdominal or back pain, amniotic fluid leakage, or excessive shortness of breath. The remaining signs or symptoms in Table 5 were only indicated in 1, 2, 3, or 4 of the guidelines.

### Discussion

The earliest formal recommendations for physical activity during pregnancy can



**Table 5.** Signs and Symptoms to End Exercise During Pregnancy.<sup>a</sup>

	Guidelines					
	Canada	Japan	Norway	Spain	United Kingdom	United States (ACOG)
Abdominal pain	X	X	Strong	Back pain	Particularly in back/pubuc area	X
Amniotic fluid leakage	X	X	X		X	X
Calf pain or swelling (rule out thrombophlebitis)	X		X		X	X
Cervical enlargement		X				
Chest pain	X		Also tightness		Also palpitations	X
Decreased fetal movement		X	X		X	X
Dizziness or presyncope	X	X	X	X	X	X
Dyspnea, before exertion	X	X	X	X	X	X
Fatigue			Excessive	Excessive	Excessive	
Gush of vaginal fluid, suggesting premature rupture of membranes	X					
Headache			X		X	X
Hypertension		Blood pressure >140/90 mm Hg				
Muscle weakness			X	X	X	X
Pain, general				X		
Palpitations, tachycardia				X		

(continued)

**Table 5. (continued)**

	Guidelines						
	Canada	Japan	Norway	Spain	United Kingdom	United States (ACOG)	
Pelvic pain		X	Strong	X	Pelvic girdle pain		
Preeclampsia		X					
Preterm labor		X			X	X	
Shortness of breath, excessive	X	X	X	X	X		
Sign of impending miscarriage and premature delivery		X					
Uterine contractions	Painful	X	Painful, premature		Painful		
Vaginal bleeding	X	X	X	X	X	X	

<sup>a</sup>Australia, Denmark, France, and the US Department of Health and Human Services guidelines did not include specific symptoms to end exercise. For example, the Danish guidelines were intended for healthy women with healthy pregnancies.

be documented from the 18th century, which largely reflected the cultural and social norms of the times, rather than scientific evaluation.<sup>25,26</sup> The earliest studies on maternal physical activity and birth outcomes were conducted in the late 19th and early 20th centuries.<sup>26,27</sup> Corresponding with the developing science, recommendations on physical activity during pregnancy continue to be created and updated to provide guidance to health professionals. In this review, we identified, summarized, and contrasted 11 clinical or public health guidelines for physical activity during pregnancy from around the world.

Generally, we found that the content of the guidelines varied depending on the date of publication and target audience (ie, clinicians vs public health professionals). There were commonalities as well. For example, almost all guidelines supported moderate-intensity physical activity during pregnancy (Spain implied it through heart rate recommendations but not through oxygen consumption). Most guidelines also suggested that women should seek advice from their health care provider before starting or continuing an exercise program. All ruled out sports involving either risks of falls, trauma, or collisions during pregnancy. The 6 more clinically focused guidelines included contraindications to exercise, including signs and symptoms that should indicate stopping. In terms of exercise prescription, most of the guidelines included specific type, frequency, and duration or time for physical activity or exercise during pregnancy.

A difference across guidelines was the use of relative and absolute intensity to guide the exercise. Canada, Japan, and the United Kingdom all provided guidance for intensity using both heart rate (absolute intensity) and ratings of perceived exertion (relative intensity). In contrast, Denmark, France, US ACOG, and USDHHS indicated neither. However, the US ACOG prior guidelines from 1985 statement did include heart rate guidance<sup>28</sup> that was removed in 1994.<sup>29</sup>

Only guidelines from Canada, Denmark, and USDHHS provided any

recommendation on vigorous-intensity physical activity. This reflects the lack of accumulated evidence from well-designed studies on vigorous activity and pregnancy outcomes.<sup>30</sup> To date, most studies on vigorous-intensity physical activity during pregnancy are laboratory based or observational, often with insufficient statistical power to detect findings on relatively rare outcomes. In addition, lack of recommendations about vigorous activity could be due to discrepancies in the definition for this level of intensity.

While most guidelines focused on aerobic exercise, 5 countries indicated strengthening exercises. Only a few studies have investigated the safety and efficacy of strength training during pregnancy.<sup>31,32</sup> Given the potential health-related benefits of strength training during pregnancy, more work is needed to clarify the safest prescription in terms of volume and intensity. The Canadian guideline suggest using lighter weights and more repetition, not lifting while lying flat on one's back, and avoiding the Valsalva maneuver.

Sedentary behavior is modifiable and comprises time spent in periods of little or no movement while awake, such as sitting, ranging from 1.0 to 1.5 metabolic equivalents.<sup>33-35</sup> The concept that sedentary behavior is not equivalent to lack of physical activity has only recently emerged in the health literature, since one can be physically active *and* accumulate large amounts of sedentary time. Only the United Kingdom guideline mentioned sedentary behavior in the context of reducing it. Future pregnancy guidelines could consider more specific recommendations on sedentary behavior, particularly as research evidence is accumulated around this topic for pregnant women. In addition, none of the guidelines discussed indications for bed rest, despite its prescription to many women.<sup>36</sup> However, indication of bed rest implies a higher risk pregnancy, and these guidelines were usually geared toward women with normal pregnancies.

A challenge across several guidelines was a lack of clarity in terminology used

to describe exercise. For example, several guidelines (Denmark, Norway, United Kingdom, US ACOG) interchanged the terms "exercise" with "physical activity." Physical activity is a broad term that is defined as any bodily movement produced by contraction of skeletal muscles that results in increased energy expenditure above a basal level.<sup>37</sup> Exercise is a subcategory of physical activity that is planned, structured, and purposive to maintain or improve one or more components of physical fitness. Some of the terminology issues arise from cultural differences. For example, in the Danish guidelines "physical activity" and "exercise" are interchanged, and other terms are used as well (physical training, motion, fitness training), which are difficult to translate directly. Other terminology discrepancies reflect the differing target groups, for example athletes and sportswomen, who usually "exercise" and the general population, who are encouraged to "be active."

Despite variations in the specific amount of physical activity recommended during pregnancy, pregnant women worldwide often do not meet the recommendations. Studies in each country represented in this review have shown that many pregnant women do not obtain as much physical activity or exercise as recommended in their country (examples of studies follow but are not exhaustive):

- Australia (Australian Longitudinal Study on Women's Health<sup>38</sup>)
- Canada (surveillance study of Ontario<sup>39</sup>)
- Denmark (Danish birth cohort study<sup>40</sup>)
- France<sup>41</sup>
- Japan (convenience sample of pregnant women from 5 facilities in Kanto, Tokyo<sup>42</sup>)
- Norway (pregnant women participating in a birth cohort study near Oslo<sup>43</sup>)
- Spain<sup>44</sup>
- United Kingdom (cohort study in southwest England<sup>45</sup>)
- United States (surveillance studies of the entire country<sup>46-49</sup>)

Data from these countries indicate that a higher priority should be placed on promoting physical activity during pregnancy, including both education and addressing barriers to physical activity. More work is needed to understand the advice offered to pregnant women by their health care providers and how that advice is received and used.<sup>50</sup> Future studies across countries can elucidate the reasons behind the differences in beliefs, explore whether cultural reasons contribute to these differences, and determine whether tailored messages are more effective than general educational approaches.

Further work is also needed to enhance our understanding and use of pregnancy-related physical activity guidelines by health care providers. To facilitate the use of guidelines in practice, the Physical Activity Readiness Medical Examination (PARmed-X) for Pregnancy tool was developed to open communication between the health care provider, fitness professional, and the pregnant woman.<sup>12</sup> The 4-page form includes a pre-exercise checklist the woman can fill out, contraindications to exercise the health care provider completes, and a health evaluation form that can be used by the prenatal fitness professional. It also includes information on prescribing aerobic activity, muscular conditioning, and active living. This screening tool facilitates implementation of the guidelines by providing a convenient checklist and prescription for health care providers to use in evaluating pregnant women who want to start a prenatal fitness program. Use of this tool may increase adherence to the physical activity guidelines by both providers and their patients.<sup>51,52</sup>

### Limitations

Several limitations of this review should be acknowledged. The review was narrowed in scope and not all inclusive; we hypothesize that there are other guidelines that met our review criteria were not captured with our search efforts, particularly those not found in PubMed. For example, the review did not include guidelines from lower

income nations, indicating either the recommendations were not captured by our search procedures or do not exist. Another limitation was that one person was unable to review all the original guidelines because of language differences. This problem was diminished by using a standardized extraction form. It should also be noted that while the abstraction was based on the published guideline, many countries created supplemental documents geared toward laypersons and often available in print or on the Internet. Although these materials may contain additional information, they were not reviewed herein. Despite these limitations, to our knowledge, this review is the first to summarize and compare current guidelines for physical activity during pregnancy from 9 different countries around the world. This review can be expanded as guidelines are developed, updated, and better accessed.

### Conclusion

This review contrasted pregnancy-related physical activity guidelines from around the world and may help to inform the creation of new guidelines, or updates of older ones. It could also facilitate the development of a worldwide guideline. The guidelines we reviewed were important sources of information at the national level for promoting physical activity and exercise during pregnancy. Recognizing contraindications to physical activity, the guidelines can be used to advise and encourage pregnant women to take part in physical activity either by maintaining their prepregnancy levels of activity or, for previously sedentary women, by starting a new exercise program during pregnancy.

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