Public health guidelines for physical activity during pregnancy from around the world: a scoping review

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ABSTRACT

Background and objective Despite the known health benefits of physical activity (PA), pregnancy is a time of marked decline in PA levels. To provide women with reliable and trustworthy information, and to encourage greater participation in PA during pregnancy, many governments have developed guidelines for PA during pregnancy. Our aim was to synthesise the most recent public health guidelines on PA during pregnancy from different countries in order to understand the nature and extent of advice that is available.

Design Scoping review.

Data sources Search of the grey literature, direct contact with international experts, screening of relevant academic literature and citation searching.

Eligibility criteria Public health guidelines developed or endorsed by government departments published since 2010.

Results Our search located 30 eligible guidelines, published in 11 different languages. There is remarkable concordance in the advice offered. For women with uncomplicated pregnancy, guidelines recommend: 150–300 min/week of moderate intensity aerobic activity; pelvic floor and muscle strengthening exercises; modification of some exercises (eg, supine position); and provide lists of warning signs to cease activity (eg, persistent dizziness, vaginal bleeding) and activities that should be avoided (eg, if high risk of falling/collision). Few guidelines offer specific advice for highly active women (eg, athletes), or trimester-specific or culturally specific considerations.

Conclusions This review provides a summary of public health recommendations for PA during pregnancy around the world. The challenge is now to ensure that all who provide healthcare for women understand the guidelines and encourage safe participation in PA during pregnancy.

WHAT IS ALREADY KNOWN?

⇒ Physical activity during pregnancy is safe and is associated with a variety of health benefits for mother and baby/fetus; yet few women engage in sufficient activity during pregnancy.
⇒ Public health guidelines on physical activity during pregnancy are available in many countries but can be difficult to locate as many are 'hidden' in the grey literature.
⇒ It is unclear whether guidelines from different countries offer consistent evidence-based information to women and their healthcare providers.

WHAT ARE THE FINDINGS?

⇒ We identified public health guidelines on physical activity during pregnancy from 30 countries, published in 11 languages, in the grey and academic literature.
⇒ There is remarkable consistency in guidelines from different countries, in terms of advice on aerobic, muscle strengthening and pelvic floor exercises, in the context of safety for both the pregnant woman and developing fetus.
⇒ Few guidelines offer specific advice for highly active women (eg, athletes, including safe upper limits for intensity/duration), or trimester-specific or culturally specific considerations.

INTRODUCTION

Physical activity (PA) during pregnancy promotes beneficial maternal, fetal and neonatal health outcomes including reduced risk of excessive gestational weight gain, preterm birth, gestational diabetes mellitus, pre-eclampsia, and delivery and newborn complications.[1] Despite these known health benefits,[2 3] pregnancy is a time of marked decline in PA.[4 5] Around the world, pregnant women are encouraged to participate in at least 150 min of moderate intensity PA throughout the week for substantial health benefits.[6] Yet data from various population-based surveys show that fewer than 30% of pregnant women meet PA recommendations,[5 7–9] compared with around 45%–55% of non-pregnant women in most western developed countries.[10] Prospective data from the Brazilian Pelotas cohort study show that only 16% of pregnant women report any leisure-time PA, and only 8% of this cohort meeting PA/exercise guidelines 12 months following their child's birth.[11] This decline in PA during pregnancy may reflect anatomical and physiological changes, which are associated with fatigue and discomfort, or fear of harm to the developing fetus.[12–16]

Declines in PA during pregnancy may also be attributed to feelings of confusion and misconceptions about PA, as a result of receiving conflicting information from different sources,[12–15 17] or cultural beliefs in some countries that pregnancy is a time of vulnerability that requires rest and recouperation.[18] In an attempt to improve PA levels among pregnant women and provide reliable and trustworthy evidence-based information, some governments provide information for women on PA during pregnancy in the form of evidence-based guidelines. A 2014 review[19] found 11 public health, clinical and sports medicine guidelines from nine countries (Australia, Canada, Denmark, France, Japan, Norway, Spain, UK, USA), most of which

supported moderate-intensity PA/exercise during pregnancy with specific frequency and duration/time recommendations. However, epidemiological evidence on the health benefits of PA during pregnancy, and research into effects of different forms of PA during pregnancy have increased substantially since 2014.[19] As a result, there has been a proliferation of public health guidelines on PA during pregnancy since that review was conducted.

Therefore, the primary aim of this scoping review is to synthesise current public health guidelines on PA during pregnancy from different countries in order to understand the nature and extent of advice that is available to women around the world. This is important because the WHO specifies that the purpose of guidelines is to ensure the proper use of evidence and to help end users make informed decisions about whether, when, and how to take specific actions.[20] We specifically reviewed public health guidelines (ie, those that target public health practitioners and pregnant women) rather than clinical guidelines which are targeted to a range of health professionals.

METHODS

We used the five stage approach described by Arksey and O'Malley[21] to conduct this scoping review, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)-Scoping Review (ScR) checklist (see online supplementary material 1).[22]

Stage 1: identify the research question(s)

Following a preliminary literature search and author discussions, the primary research question was developed to reflect the population, context and content of the review: What is the nature and extent of advice on PA during pregnancy that is available to women around the world? Two secondary research questions were: How have the guidelines evolved since the original review in 2014[19]; and What knowledge gaps should be addressed in future research?

Stage 2: identifying relevant studies and search strategy

As many public health guidelines are not published in the academic literature, we first consulted a librarian (TB) with expertise in the conduct of structured systematic Google searches. Three authors (MH, KRE and WJB) conducted searches in 2021 of websites for each of the 194 recognised United Nations countries of the WHO[23] using the following key words in this search string: (country) AND (pregnancy OR pregnant OR postpartum) AND (guideline OR guidelines OR recommendation OR recommendations OR position statement OR position stand) AND (exercise OR physical activity OR physical activities). We then contacted international experts to check for additional guidelines which may have been missed in the initial search. Finally, academic literature, including previous reviews and comparisons of guidelines for PA and exercise during pregnancy were examined to ensure all guidelines were identified for potential inclusion in this review.[3 19 24] For guidelines in languages other than English, we asked a native speaker to translate the guidelines into English or to review our translation for accuracy. One author (MH) repeated the structured systematic Google search in January 2022 for all 194 countries, to ensure that recently released guidelines were included.

Stage 3: study selection

All guidelines identified by the search strategy were initially evaluated against the eligibility criteria by two authors. Specifically, guidelines were screened and excluded if they: (1) were not developed or endorsed by a government or government department; (2) were published prior to 2010; (3) primarily focused on a particular condition (such as gestational diabetes mellitus) where PA or exercise was recommended as treatment or; (4) provided generic broad-based advice (eg, PA/exercise is good for you during pregnancy) and did not include specific recommendations (eg, women should engage in at least 150 min of PA/exercise per week). In cases where eligibility was unclear, inclusion was decided by discussions between three authors (MH, KRE and WJB). An overview of the screening process is shown in figure 1.

Stage 4: charting the data

An extraction tool was designed by AN and KRE. Two authors (AN, EB-S) then piloted the tool by independently extracting data from two guidelines. The authors then met to discuss modifications to the extraction tool for improvement. Data were then extracted into Covidence[25] by AN and EB-S using the standardised data extraction tool and cross-checked by one another. Inconsistencies were reviewed in consultation with KRE and resolved by consensus.

Stage 5: collating, summarising and reporting the results

Data including PA recommendations (frequency, intensity, duration and type), considerations for inactive, active and highly active women, activities to avoid, additional safety considerations, warning signs to stop, contraindications and other relevant information (such as sedentary behaviour guidance/recommendations) were collated and summarised, and are reported below.

RESULTS

A total of 22 244 records were identified after systematically screening the grey literature and other sources. Of these, 41 guidelines were retrieved for full-text review and 30 were eligible based on the inclusion criteria. These were from: Australia,[26] Austria,[27] Belgium,[28] Brazil,[29] Brueni,[30] Canada,[2] Chile,[31] Cyprus,[32] Denmark,[33] Estonia,[34] Fiji,[35] Finland,[36] France,[37] Greece,[38] Iceland,[39] Kenya,[40] Latvia,[41] Malaysia,[42] New Zealand (NZ),[43] Norway,[44] Portugal,[45] Qatar,[46] Singapore,[47] Slovenia,[48] Spain,[49] Sri Lanka,[50] Switzerland,[51] the UK,[52] the USA[53] and Uruguay[54] (see table 1). The guidelines are published in 11 different languages, between 2010[30] and 2021.[36] They are authored by public health departments, Ministries of Sport or Education, obstetricians and gynaecologists, sports medicine practitioners, chief medical officers and non-profit organisations.

The focus of the 30 guidelines varies, with most written for 'pregnant women' or 'stakeholders' which include pregnant women, policy makers and clinicians. Fifteen are population-based PA guidelines (written for the entire population, including pregnant women)[27–31 37 38 42 44 46 49 50 52–54]; seven focus specifically on PA[2 26 36 39 47 48 51]; three address a variety of lifestyle behaviours including PA[32 33 45]; three are nutrition focused population-based guidelines but include PA recommendations for pregnant women[34 40 43] and two are nutrition focused[35 41] but include PA. Fourteen guidelines also provide recommendations or brief advice on sedentary behaviour.[26–29 32 34–36 41 43 46 49 51 54]

As shown in table 1, 16 guidelines report using an evidence-based development process, most commonly literature reviews (with or without quality assessment, such as Grading of Recommendations, Assessment, Development and Evaluation[55] or Appraisal of Guidelines for Research and Evaluation,[56] steering

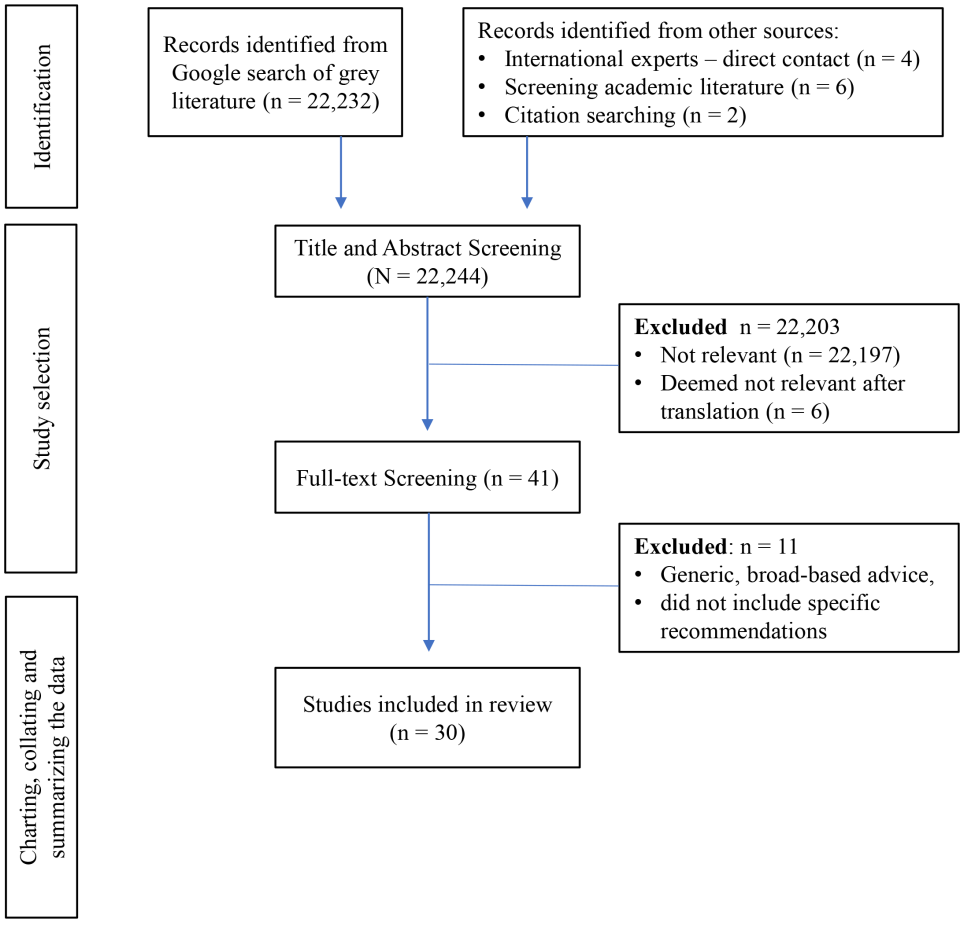

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for scoping reviews flow chart. *Based on scoping review process described by Arksey and O'Malley[21] and PRISMA guidelines.[22]

committees and/or consultation with experts and/or stakeholders (including pregnant women).[2 26 31 34 37 40 41 43 45 47 49–54] Only four countries acknowledged the source of funding for development of their guidelines.[2 26 40 45]

Recommendations included in guidelines on PA during pregnancy

The key components of PA and exercise prescription, namely frequency, intensity, duration and type were abstracted from each guideline and are summarised in table 2.

Frequency

Twenty-four guidelines include a recommendation on frequency of PA (online supplemental material 2).[2 26 28 30 32–34 36–38 41 43 47–51 53] Of these, 16 guidelines provide a specific recommendation ranging from daily[28 33 34 41 48] to 3 or more[2 36 37 43 47] days per week. Eight guidelines provide general guidance about frequency, including 'on most, preferably all days of the week' (Australia[26] and Greece,[38] 'on most days of the week' (Cyprus[32] or 'spread throughout the week' (Brunei,[30] Spain,[49] Sri Lanka,[50] Switzerland[51] and the USA.[53]

Duration

Total duration

Twenty-nine guidelines include a specific recommendation on total weekly or daily duration of PA (online supplemental material 3).[2 26–40 42–54] Of these, 16 recommend accumulating at least 150 min/week of PA, while those from Estonia,[34] NZ[43] and Spain[49] recommend 150 min/week. Only the Australian guidelines recommend a range of 150–300 min/week.[26] Ten guidelines recommend a daily duration, ranging from 20–30 to 40–60 min/day.[31–33 35 37–39 46–48]

Session bouts

Nine guidelines include a recommendation on PA or exercise bouts (online supplemental material 4). Five recommend a specific bout duration,[30 31 37 42 48] ranging from 'bouts of ≥10 min' (Chile[31] and France[37]) to 'exercise sessions should last at least 30–60 min' (Slovenia).[48] Conversely, guidelines from Brunei[30] and Malysia[42] suggest that sessions should not exceed 30 min. While not specific recommendations, four guidelines suggest that daily PA duration can be broken down into small blocks, to make the daily goal more achievable.[29 43 47 49] For example, the NZ guidelines suggest 'breaking up activity each day into smaller, more frequent and manageable chunks, such as 10 min at a time (known as 'snacktivity').[43]

Intensity

Twenty-eight guidelines provide a recommendation to guide intensity (online supplemental material 5).[2 26–37 39–44 46–54] Of these, 25 recommend that pregnant women engage in moderate intensity PA, while the Latvian[41] guidelines recommend 'average intensity' and those from Fiji[35] recommend 'lighter' intensity PA only. In addition to moderate intensity activity, guidelines from Qatar[46] also include low intensity PA, while those from Australia,[26] Brazil[29] and Spain[49] also list vigorous intensity PA

Table 1 Summary of public health guidelines for PA during pregnancy from 30 countries

	Country year of publication	Language	Guideline type*	Organisation	Target audience†	Evidence process used‡
1	Australia 2020	English	PA specific to pregnancy	Department of Health, Australian Government	Stakeholders, pregnant, and postpartum women	Review (GRADE) and consultation§
2	Austria 2020	English	PA, population-based inclusive of pregnancy	Austrian Health Promotion Fund	Not specified: 'women should'	Not described
3	Belgium 2021	Dutch	PA, population-based inclusive of pregnancy	Landers Institute for Healthy Living and Flanders Agency for Care and Health	Stakeholders	Consultation
4	Brazil 2020	Portuguese	PA, population-based inclusive of pregnancy	Ministry of Health	Pregnant and postpartum women	Not described
5	Brunei 2011	English	PA, population-based inclusive of pregnancy	Health Promotion Centre and Ministry of Health	Stakeholders	Consultation
6	Canada 2018	English	PA specific to pregnancy	Society of Obstetricians and Gynaecologists of Canada's and the Canadian Society for Exercise Physiology	Stakeholders and pregnant women	Review (AGREE II) and consultation§
7	Chile 2017	Spanish	PA, population-based inclusive of pregnancy	Ministry of Sports, Ministry of Health, Ministry of Education, and Government of Chile	Not specified: 'you should'	Consultation
8	Cyprus 2019	English	Lifestyle, specific to pregnancy	Cyprus National Addictions Authority, Republic of Cyprus Ministry of Health	Not specified: 'you should'	Not described
9	Denmark 2015	English	Lifestyle, specific to pregnancy	National Board of Health	Pregnant women	Not described
10	Estonia 2015	Estonian	Nutrition and PA, population-based inclusive of pregnancy	National Institute for Health Development	Not specified: 'women should'	Consultation
11	Fiji 2019	English	Nutrition specific to pregnancy, inclusive of PA	Public Health Division of the Pacific Community	Stakeholders	Not described
12	Finland 2021	English	PA specific to pregnancy	UKK Institute-Centre for Health Promotion Research	Pregnant women	Not described
13	France 2016	French	PA, population-based inclusive of pregnancy	General Directorate of Health	Not specified: 'women should'	Review (primary) and consultation
14	Greece (unknown)	Greek	PA, population-based inclusive of pregnancy	Institute of Preventative Medicine, Environment and Occupational Health	Pregnant women	Not described
15	Iceland 2018	English	PA specific to pregnancy	Health Service Executive	Not specified: 'you should'	Not described
16	Kenya 2017	English	Nutrition and PA, population-based inclusive of pregnancy	Ministry of Health	Stakeholders	Consultation
17	Latvia 2017	English	Nutrition specific to pregnancy, inclusive of PA	Ministry of Health	Stakeholders	Consultation
18	Malaysia 2017	Malay	PA, population-based inclusive of pregnancy	Ministry of Health	Not specified: 'women should'	Not described
19	NZ 2020	English	Nutrition and PA, population-based inclusive of pregnancy	Ministry of Health	Stakeholders	Review (other guidance) and consultation§
20	Norway 2019	Norwegian	PA, population-based inclusive of pregnancy	Norwegian Directorate of Health	Not specified: 'women should'	Not described
21	Portugal 2020	English	Lifestyle, specific to pregnancy	Casa do Brasil de Lisboa	Pregnant women	Consultation
22	Qatar 2021	English	PA, population-based inclusive of pregnancy	Aspetar Zone Foundation	Stakeholders, pregnant and postpartum women	Review (primary) and consultation
23	Singapore 2020	English	PA specific to pregnancy	Obstetrical and Gynaecological Society of Singapore and Exercise is Medicine Singapore	Stakeholders	Review (primary)
24	Slovenia 2015	Slovenian	PA specific to pregnancy	Ministry of Health	Not specified: 'women should'	Not described
25	Spain 2015	Spanish	PA, population-based inclusive of pregnancy	Ministry of Health	Pregnant women	Consultation
26	Sri Lanka 2018	English	PA, population-based inclusive of pregnancy	Institute of Sports and Exercise Medicine, Ministry of Sports	Stakeholders	Review (primary)
27	Switzerland 2018	German	PA specific to pregnancy	Health Promotion Switzerland	Stakeholders and pregnant women	Review (primary) and consultation
28	UK 2019	English	PA, population-based inclusive of pregnancy	Department of Health and Social Care and Chief Medical Officers'	Stakeholders	Review (GRADE) and consultation§
29	US 2018	English	PA, population-based inclusive of pregnancy	Department of Health and Human Services	Stakeholders	Review (umbrella) and consultation
30	Uruguay 2019	Spanish	PA, population-based inclusive of pregnancy	Ministry of Health	Not specified: 'women should'	Review (other guidance)

*Guideline Type: PA guidelines are written for the primary purpose of providing PA recommendations. Lifestyle guidelines are written for the purpose of providing recommendations across a variety of lifestyle behaviours and may include recommendations relating to nutrition and dietary supplementation, personal care, environment, workplace, smoking and alcohol, PA, etc. Guidelines specific to pregnancy are written for the primary purpose of providing pregnant women, with pregnancy specific recommendations. Population-based guidelines are written for the entire population and can include recommendations for a variety of populations including children, adolescents, adults, older adults and pregnant women.
†Target Audience: When the target audience was not specified, we recorded whether the guideline was written in second person 'you should' or third person 'pregnant women should'. Stakeholders include policymakers, healthcare providers such as medical practitioners and midwives, etc.
‡Evidence process used in development: Review=Review of Literature (eg, AGREE II, GRADE, primary, umbrella, other guidance where key documents were reviewed), Consultation=Consultation, steering committee and/or expert opinion.
§Consultation inclusive of pregnant women.
AGREE, Appraisal of Guidelines for Research and Evaluation; GRADE, Grading of Recommendations, Assessment, Development and Evaluation; PA, physical activity.

or exercise within their recommendations. Some guidelines do not provide specific intensity advice, but suggest that the 'intensity of exercise should be comfortable' (Iceland)[39] or that 'if women prefer to engage in moderate intensity they should do so' (Brazil).[29] Guidelines from France,[37] Latvia[41] and Uruguay[54] specifically state that women should *not* participate in vigorous intensity PA.

Intensity measurement

Nineteen guidelines[2 26 29–31 33 36–39 41–43 46–49 52 53] provide advice on how to assess intensity (online supplemental material 6), using a variety of approaches, including the use of recognised intensity measures such as heart rate (HR) ranges (beats/min), metabolic equivalent of task (METs),[57] rating of perceived exertion (RPE)[58] and the Talk Test.[59] Specifically, four guidelines recommend using

Table 2 Overview of recommendations included in the guidelines

Country		Frequency (days/week)	Intensity	Total duration of PA/ exercise (minute)		Classification of activity			Recommendations based on activity levels prior to pregnancy			Activities to avoid	Warning signs	Contraindications	Sedentary behaviour
				Weekly	Daily	Aerobic	Muscle strengthening	PFMT	Inactive	Active	Highly active				
1	Australia	X	X	X		X	X	X	X	X	X	X	X	X	X
2	Austria		X	X		X	X	X	X	X	X				X
3	Belgium	X	X	X		X	X	X		X	X	X			X
4	Brazil		X	X				X	X			X		X	X
5	Brunei	X	X	X		X	X		X	X	X	X		X	
6	Canada	X	X	X		X	X	X	X	X	X	X	X	X	
7	Chile	X	X		X	X	X	X				X	X		
8	Cyprus	X	X		X	X						X	X	X	X
9	Denmark	X	X		X	X	X	X	X	X		X			
10	Estonia	X	X	X				X	X	X		X			X
11	Fiji	X	X		X										X
12	Finland	X	X	X			X		X	X	X	X	X		X
13	France	X	X		X	X	X		X			X			
14	Greece	X			X				X	X		X	X		
15	Iceland	X	X		X	X		X	X	X		X		X	
16	Kenya		X	X		X			X			X	X	X	
17	Latvia	X	X									X			X
18	Malaysia	X	X	X			X		X	X	X	X			
19	NZ	X	X	X		X	X	X		X	X	X			X
20	Norway		X	X				X	X	X	X	X			
21	Portugal	X		X				X				X			
22	Qatar	X	X		X	X	X		X			X	X	X	X
23	Singapore	X	X	X	X	X	X		X	X		X	X	X	
24	Slovenia	X	X		X		X	X	X	X		X		X	
25	Spain	X	X	X			X	X	X	X	X	X	X		X
26	Sri Lanka	X	X	X		X				X					
27	Switzerland	X	X	X			X	X	X	X		X			X
28	UK		X	X			X		X	X					
29	USA	X	X	X		X	X		X	X		X			
30	Uruguay		X	X		X	X	X				X			X
Total (out of 30)		24	28	20	10	17	19	16	21	20	10	26	11	**10**	**14**

NZ, New Zealand; PA, physical activity; PFMT, pelvic floor muscle training.

maternal HR ranges, including those from Chile[31] ('HR should not exceed 140 beats per minute'), Canada[2] (HR ranges based on age group and intensity level), Singapore[47] ('not exceeding 90% of maximum HR'), and Slovenia[48] ('it is best to use a combination of HR and subjective feelings of effort'). Four guidelines recommend using RPE,[26 47 48 53] but specific details vary. Four guidelines recommend the Talk Test[2 26 47 53] including Canada[2] who recommend 'the woman is at a comfortable intensity if she is able to maintain a conversation during PA and should reduce the intensity if this is not possible.' Only NZ[43] and Slovenia[48] recommend the use of METs to determine intensity. While no specific intensity measurement tool is recommended, the remaining 12 guidelines[29 30 33 36–39 41 42 46 49 52] provide descriptive guidance for measuring intensity. For example, 'moderate intensity activity means moving at a pace which leaves you slightly out of breath' (Denmark),[33] 'if you can't talk and exercise at the same time, then your exercise is too intense and you should slow down' (Iceland[39]).

Type

Aerobic PA

Seventeen guidelines provide an aerobic PA or exercise recommendation (online supplemental material 7).[2 26–28 30–33 37 39 40 43 46 47 50 53 54] Of these, seven[28 30 37 40 50 53 54] provide details on specific amounts. For example, the Brunei[30] guidelines recommend ≥150 min/week of aerobic PA/exercise, while the French[37] guidelines recommend ≥30 min of cardiorespiratory PA/exercise 3 times/week. The other 10 guidelines[2 26 27 31–33 39 43 46 47] provide more general recommendations, such as 'cardio exercises are generally considered acceptable in national guidelines, and they are recommended during pregnancy' (Cyprus),[32] and 'to promote and maintain health, aerobic activity is recommended' (Austria).[27]

Twenty-two guidelines provide examples of aerobic activities (online supplemental material 8).[2 26 29–33 35–43 45–48 52 54] Of these, all except the Finnish[36] guidelines specifically mention walking, while 16 recommend swimming[26 29–33 35 38–40 42 45–48 52] and 14 recommend cycling[2 26 29 30 32 33 40–42 46–48 52] (4 specify stationary cycling.[2 26 39 47] Other examples of aerobic PA/exercise include cross-country skiing, dancing, gymnastics, hiking, household activities (ie, gardening, cooking and washing the car) and water aerobics.

Muscle strengthening

Nineteen guidelines provide a muscle strengthening (also referred to as strength training or resistance training) recommendation (online supplemental material 9),[2 26–28 30 31 33 36 37 42 43 46–49 51–54] and 12 of these provide details. For example, eight include frequency (ranging from 1 to 3 sessions per week),[26 27 31 36 37 43 46 54] six include intensity (ranging from light-moderate),[26 31 37 46 51 53] one includes number of sets (ranging from 1 to 2 per session),[46] one includes number of exercises (ranging from 8 to 10)[46] and five include number of repetitions (ranging from 8 to 20 per exercise per set).[31 37 46 48 49] The other six guidelines provide more general recommendations.[2 28 30 33 47 52] For example, the UK[52] guidelines suggest 'PA choices should include…strength training'.

Twelve guidelines provide examples of muscle strengthening exercises (online supplemental material 10).[26 30 31 33 36 37 40 42 45 47 48 54] Of these, seven suggest weights[26 30 31 33 37 40 47] while four suggest body weight exercises[26 30 37 47] and/or resistance bands.[26 42 47 48] Other examples of muscle strengthening exercises include postural exercises, sit-ups, planks, squats and gym training.

Pelvic floor strengthening

Sixteen guidelines provide advice about pelvic floor muscle training (PFMT) (online supplemental material 11). Of these, 7[27 28 31 39 45 48] include 'prescription' details for PFMT such as '3 times per day consisting of 10 repetitions, where each repetition is held for 5–10 s' (Iceland[39] or '3–4 times per day, with each set consisting of 8–12 repetitions, where each repetition is held for 6–8 s'(Slovenia).[48] Guidelines from Austria[27] and Belgium[28] encourage daily PFMT. The remaining 10 guidelines provide more general PFMT recommendations,[2 26 29 33 34 43 44 49 51 54] such as 'it is a good idea to do PFMT, as it maintains and strengthens pelvic floor muscles' (Denmark)[33] or 'it is advisable to perform exercises to strengthen the pelvic floor muscles' (Spain[49]).

Other types of PA/exercise

Guidelines from 15 countries recommend additional activities such as those which improve balance and flexibility, including Pilates, yoga and stretching (online supplemental material 12).[2 28–32 36 39 42 45 47–49 51 52]

PA considerations for inactive, active and highly active women during pregnancy

Twenty-four guidelines provide targeted advice on PA during pregnancy based on previous behaviours (online supplemental material 13).[2 26–30 33 34 36–40 42–44 46–53] Twenty-one provide a specific recommendation for previously inactive women.[2 26 27 29 30 33 34 36–40 42 44 46–49 51–53] For example, the Swiss[51] guidelines advise that 'Every step towards more activity is important and promotes health of mother and child, it is recommended to start with a lower intensity or duration and to slowly increase this until you reach the basic recommendations.' Twenty guidelines provide guidance relevant to previously active women, suggesting 'previously active women can continue to be active during pregnancy'.[26–28 30 33 34 36 38 39 42–44 47–53] Ten guidelines provide advice for highly active women, who are likely to engage in PA that exceeds current recommendations.[2 26–28 30 36 42–44 49] In three instances, a recommendation is provided that is relevant to both active and highly active women.[27 30 43] All except the Austrian[27] guidelines advise the active involvement/supervision of an appropriately qualified health professional if highly active women wish to continue with their PA/exercise during pregnancy.

Sedentary behaviour

Fourteen guidelines provide advice on sedentary behaviour (online supplemental material 14).[26–29 32 34–36 41 43 46 49 51 54] Most offer general advice such as 'avoid a sedentary lifestyle during pregnancy' (Cyprus),[32] 'break up long periods of sitting as often as possible' (Australia)[26] and '…a sedentary lifestyle is a risk factor for disease including obesity and premature mortality' (Latvia).[41]

Activities to avoid during pregnancy

Guidelines from 26 countries list at least one PA which should be avoided during pregnancy (online supplemental material 15).[2 26 28–34 36–49 51 53 54] Of these, 21 recommend avoiding activities that may increase risk of falling[2 26 28–30 32–34 36 39 40 42 44–49 51 53 54] including horseback riding, skiing, and martial arts; 20 recommend avoiding activities that may increase risk of contact or collision[2 26 28–30 32–34 36 39 40 42 44 45 47–49 51 53 54] (such as contact sports like basketball or soccer); 14 recommend avoiding activities that result in significant changes in barometric pressure[2 26 28 29 32–34 36 41 42 44 45 47 49] (such as scuba diving); and 13

recommend that any or prolonged PA or exercise in extreme heat, humidity or cold be avoided.[2 26 28 30 32 36 38 39 42 46–48 54] Of the 15 guidelines that discuss activity in the supine position, four advise avoiding activity in the supine position altogether,[28 32 40 42] seven advise avoiding it after the first trimester (specifically after the fourth month of gestation[30 39 46 47 47–49 53] and five advise avoiding it if it results in feeling dizzy, light-headed, nauseous and/or unwell.[2 26 29 36 47]

Additional safety considerations for PA/exercise during pregnancy

Of the 24 guidelines that recommend activities to avoid, 17 provide additional safety considerations.[2 26 28 31 34–36 38–40 42 45–48 52] For example, 13 guidelines highlight the importance of hydration/avoiding dehydration,[2 26 28 29 31 35 36 38–40 45–47] 4 recommend warming-up and cooling-down to prevent injury,[36 39 47 48] 3 recommend PA/exercise in heated water (28–32°C)[39 46 48] and 4 caution against PA/exercise at high altitude.[2 26 36 48] Additionally, all except the Finnish[36] guidelines state that women who are trained for high altitude activities may continue to do so after consulting with a healthcare professional. The Chilean[3131] guidelines list the importance of sun protection and air quality when exercising outdoors, while the Australian guidelines[26] also warn that some stretches may require modification due to hormone-induced flexibility changes during pregnancy. In addition to these safety considerations, inadequate nutritional intake is discussed in four guidelines.[26 29 46 47]

Warning signs to stop

Eleven guidelines list warning signs for stopping PA during pregnancy (online supplemental material 16).[2 26 31 32 36 38 40 43 46–48] Most include persistent dizziness,[2 26 31 32 36 40 43 47 48] vaginal bleeding,[2 26 31 32 36 43 47 48] excessive shortness of breath,[2 26 31 32 36 40 43 47 48] chest pain,[2 26 36 40 43 47 48] painful uterine contractions,[2 26 31 32 36 43 47] loss of fluid from the vagina[2 26 40 43 47 48] or severe headache.[26 31 36 40 47 48]

Contraindications to PA/exercise during pregnancy

Twenty-six absolute (PA is not recommended) and relative (when the benefits may not exceed the risks) contraindications to PA/exercise during pregnancy are included in guidelines from 10 countries (online supplemental material 17).[2 26 29 32 39 40 43 46–48] Although there is general agreement on the classification of each condition as an absolute or relative contraindication, there are inconsistencies in the risk categories for spontaneous history of preterm labour/preterm birth, placenta previa, ruptured membranes, poorly/uncontrolled type 1 diabetes and symptomatic anaemia. The Icelandic guidelines list contraindications but are the only country that do not distinguish between absolute or relative contraindications.[39]

DISCUSSION

Our main aim was to synthesise current public health guidelines on PA during pregnancy from different countries, in order to understand the nature and extent of advice that is available to women around the world. We found that 30 of the 194 countries recognised by the WHO now have PA guidelines for pregnant women, either as sections of other public health guidelines, or as specifically targeted guidelines for pregnant women. We acknowledge that numerous additional clinical guidelines exist, and that sometimes the distinction between clinical and public health guidelines is blurred.

Because our aim was to review public health guidelines, it is not surprising that most of the guidelines included here focused on PA, which is the inclusive term for all movement, including the more planned and structured exercise, which was the focus of most earlier public health guidelines and those included in the 2014 review.[19] Notwithstanding, almost all the 'pregnancy' guidelines incorporate an exercise prescription approach, with recommendations about frequency (eg, daily, most days), intensity (usually moderate) and accumulation of an overall weekly duration (most commonly ≥150 min/week). In general, we found that guidelines published earlier in the time span we reviewed were more cautious than more recent guidelines with respect to the frequency, duration, and intensity of PA. The types of PA listed in the more recent public health guidelines also extend beyond the 'aerobic' recreational activities observed in earlier guidelines, to include gardening and housework, thereby supporting the public health notion that 'doing some PA is better than doing none'.[60]

In terms of intensity of PA/exercise, almost all these guidelines recommend moderate intensity activities. Although most discuss the pros and cons of vigorous intensity activity, few countries specifically include the word 'vigorous' in their guidelines.[26 29 49] While the literature on vigorous activities during pregnancy is accumulating,[61–63] several recently published guidelines[2 26 36 53] recommend that women who are accustomed to higher intensity exercise can continue to do this for as long as they feel comfortable, with appropriate healthcare guidance. This is in line with the WHO PA guidelines (2020) which suggest that women who habitually engaged in vigorous intensity PA/exercise before pregnancy can continue to do so during pregnancy, based on strong strength and moderate certainty of evidence.[60] This is a marked change from when, for example, the previous Norwegian guidelines (published in 2000) did not even include 'vigorous' on their perceived exertion scale.[19] Inclusion of guidance on vigorous intensity PA/exercise is vital for elite athletes and other women who may wish to continue exercising at high intensity during pregnancy.[64 65] Importantly, modifications to PA/exercise may be required to accommodate the physical changes that occur as the pregnancy progresses, but these are explained in few guidelines.

The way in which intensity is assessed varies across guidelines. In view of limitations about HR ranges estimated from age and/or resting HR,[66] only four guidelines[2 31 47 48] recommend the use of HR ranges to assess intensity, and few now include an upper limit for exercising HR, which was common in earlier guidelines.[19] Confirming this move away from HR-based recommendations, almost all guidelines now recommend a second intensity measurement tool, such as a an RPE scale or the Talk Test.

While almost two-thirds of the guidelines provide advice on muscle strengthening, the majority lack detail on prescription characteristics (ie, repetitions and sets). Instead, they offer general advice such as 'at least twice a week', which align with public health guidelines for non-pregnant populations. This may reflect the paucity of studies in this area, especially in relation to heavy lifting. Studies published in the occupational PA literature suggest that repeated and prolonged heavy lifting may be associated with increased risk of miscarriage, preterm birth and other pregnancy-related adverse outcomes.[67 68] This may explain why some guidelines explicitly advise against lifting heavy weights. A specific form of strength exercises, which is identified in 16 of the guidelines included here, is PFMT. This reflects growing recognition of the importance of pelvic floor strengthening for preventing urinary incontinence and for long-term health benefits.[69]

Our review identified five additional areas for discussion that illustrate changes in guidelines since the original 2014 review.[19] First, there is a shift away from avoiding towards appropriate modification of maternal exercise in the supine position in more recent guidelines. This reflects the findings of a recent review which found there was insufficient evidence to confirm adverse circulatory effects of supine exercise.[70] Second, two-thirds of the guidelines provide specific advice for inactive, active and/or highly active women. A recent scoping review found that this type of more targeted messaging, and the provision of specific advice on safe and unsafe activities, are more likely to increase PA/exercise behaviours.[71] Third, some of the more recently released guidelines now recommend active involvement of both healthcare professionals and women themselves in decision making about PA/exercise during pregnancy. This is important because pregnant women consider health professionals to be trustworthy and reliable sources of information and may be more likely to engage in PA/exercise with health professional recommendation.[72–74] Fourth, only 14 of the 30 guidelines we reviewed included advice about sedentary behaviour. This may reflect the lack of research on the effects of prolonged periods of uninterrupted sitting time during pregnancy. Finally, many earlier guidelines did not provide details of the processes used in their development, or of the quality of the underlying evidence. In contrast, the more recently released guidelines from Australia, Canada, NZ and the UK provide details of both methodology and of evidence quality appraisal.

Strengths and limitations

This is the first scoping review to synthesise current public health guidelines on PA during pregnancy from different countries, in order to understand the nature and extent of advice that is available to women around the world. We used the five stage approach described by Arksey and O'Malley,[21] guided by the PRISMA-ScR checklist[22] to identify documents developed by government agencies that may not be published in the academic literature. Strengths include the use of a standardised data extraction tool, with cross-checking by two or more researchers, to collate and summarise the findings, and inclusion of guidelines in languages other than English. This approach resulted in inclusion of 25 guidelines that have not been included in any previous review.[3 75–77] Limitations were that, despite our extensive and systematic search approach, we may not have identified all PA guidelines from around the world, as some internet content (eg, government websites) is censored and not readily available to other countries. We purposely did not include clinical guidelines, such as those from the American College of Obstetricians and Gynecologists[78] and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists,[79] or guidelines developed by professional health organisations or societies. Despite our best efforts, some content may have been misinterpreted during translation of non-English guidelines.

Knowledge gaps and future research

Our findings suggest several important knowledge gaps that should be addressed in future research, and then included in updates of existing guidelines or development of new ones. These include:

- The benefits and harms of vigorous intensity activity in each trimester, and how best to assess PA intensity during pregnancy.
- More specific details on efficacious muscle strengthening and pelvic floor exercises.
- Trimester-specific advice for pregnant women.
- The effects of occupational activity and sedentary behaviours during pregnancy on maternal and fetal outcomes.
- Attention to cultural differences which may impact PA and sedentary behaviours during pregnancy.

CONCLUSIONS AND IMPLICATIONS

Thirty countries now have public health-oriented guidelines for PA during pregnancy and these are published in at least 11 languages. All agree that PA during pregnancy is safe for women with uncomplicated pregnancy and has health benefits for both the woman and her unborn child. All health professionals should therefore encourage pregnant women to follow the guidelines. In brief this means recommending 150–300 min/week of moderate intensity aerobic activity, plus pelvic floor and muscle strengthening exercises at least twice each week. Health professionals should be aware that it is safe for previously inactive women to start a graduated programme of activity, and that exercises in some positions (eg, supine position) may need to be adjusted (but not avoided). All women and their health professionals should be aware of warning signs for stopping activity (eg, persistent dizziness, vaginal bleeding), and of activities that should be avoided (eg, when there is high risk of falling/collision). As few guidelines provide advice for highly active women or offer clear safe upper limits relating to intensity and duration, more research is needed with elite athletes. This is important, as participation rates of women in sport are increasing across the world, and many female athletes wish to compete during their childbearing years.[80] The challenges are now to ensure that pregnant women are aware of and understand the guidelines and that all who provide healthcare for women during pregnancy actively encourage safe participation in PA during pregnancy.

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REFERENCES

1 Brown WJ, Hayman M, Haakstad LAH, *et al*. Australian guidelines for physical activity in pregnancy and postpartum. *J Sci Med Sport* 2022;25:511–9.

2 Mottola MF, Davenport MH, Ruchat S-M, *et al*. 2019 Canadian guideline for physical activity throughout pregnancy. *Br J Sports Med* 2018;52:1339–46.
3 Evenson KR, Mottola MF, Artal R. Review of recent physical activity guidelines during pregnancy to facilitate advice by health care providers. *Obstet Gynecol Surv* 2019;74:481–9.
4 Hayman M, Short C, Reaburn P. An investigation into the exercise behaviours of regionally based Australian pregnant women. *J Sci Med Sport* 2016;19:664–8.
5 Borodulin K, Evenson KR, Herring AH. Physical activity patterns during pregnancy through postpartum. *BMC Womens Health* 2009;9:32–9.
6 Bull FC, Al-Ansari SS, Biddle S, *et al*. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med* 2020;54:1451–62.
7 Gjestland K, Bo K, Owe KM, *et al*. Do pregnant women follow exercise guidelines? Prevalence data among 3482 women, and prediction of low-back pain, pelvic girdle pain and depression. *Br J Sports Med* 2013;47:515–20.
8 Hesketh KR, Evenson KR. Prevalence of U.S. pregnant women meeting 2015 ACOG physical activity guidelines. *Am J Prev Med* 2016;51:e87–9.
9 Evenson KR, Wen F. National trends in self-reported physical activity and sedentary behaviors among pregnant women: NHANES 1999-2006. *Prev Med* 2010;50:123–8.
10 Guthold R, Stevens GA, Riley LM, *et al*. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1·9 million participants. *Lancet Glob Health* 2018;6:e1077–86.
11 Mielke GI, Crochemore-Silva I, Domingues MR, *et al*. Physical activity and sitting time from 16 to 24 weeks of pregnancy to 12, 24, and 48 months postpartum: findings from the 2015 Pelotas (Brazil) birth cohort study. *J Phys Act Health* 2021;18:587–93.
12 Evenson KR, Bradley CB. Beliefs about exercise and physical activity among pregnant women. *Patient Educ Couns* 2010;79:124–9.
13 Melton B, Marshall E, Bland H, *et al*. American rural women's exercise self-efficacy and awareness of exercise benefits and safety during pregnancy. *Nurs Health Sci* 2013;15:468–73.
14 Duncombe D, Wertheim EH, Skouteris H, *et al*. Factors related to exercise over the course of pregnancy including women's beliefs about the safety of exercise during pregnancy. *Midwifery* 2009;25:430–8.
15 Stickford ASL, Taylor EK, Rodriguez DV, *et al*. Exercise behaviors and beliefs among pregnant women in rural communities. *Am J Lifestyle Med* 2021.
16 Harrison AL, Taylor NF, Shields N, *et al*. Attitudes, barriers and enablers to physical activity in pregnant women: a systematic review. *J Physiother* 2018;64:24–32.
17 Ferrari RM, Siega-Riz AM, Evenson KR, *et al*. A qualitative study of women's perceptions of provider advice about diet and physical activity during pregnancy. *Patient Educ Couns* 2013;91:372–7.
18 Guelfi KJ, Wang C, Dimmock JA, *et al*. A comparison of beliefs about exercise during pregnancy between Chinese and Australian pregnant women. *BMC Pregnancy Childbirth* 2015;15:345.
19 Evenson KR, Barakat R, Brown WJ, *et al*. Guidelines for physical activity during pregnancy: comparisons from around the world. *Am J Lifestyle Med* 2014;8:102–21.
20 World Health Organisation (WHO). WHO guidelines. Available: https://www.who.int/publications/who-guidelines [Accessed 10 Sep 2022].
21 Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* 2005;8:19–32.
22 Tricco AC, Lillie E, Zarin W, *et al*. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med* 2018;169:467–73.
23 World Health Organisation (WHO). Available: https://www.who.int/countries/ [Accessed 18 Mar 2021].
24 Budzynski-Seymour E, Milton K, Mills H, *et al*. A rapid review of communication strategies for physical activity guidelines and physical activity promotion: a review of worldwide strategies. *J Phys Act Health* 2021;18:1014–27.
25 Veritas Health Innovation. Covidence systematic review software [program]. Melbourne, Australia; 2020. www.covidence.org [Accessed 20 Dec 2020].
26 Department of Health Australian Government. Evidence-based physical activity guidelines for pregnant women: report for the Australian government department of health, 2020. Available: https://www.health.gov.au/resources/publications/evidence-based-physical-activity-guidelines-for-pregnant-women [Accessed 7 Jan 2022].
27 Austrian Health Promotion Fund. Austrian physical activity recommendations - Key messages (Volume 17(1) of scientific reports), Vienna, 2020. Available: https://fgoe.org/sites/fgoe.org/files/2020-09/fgoe_wb17_bewegungsempfehlungen_E_bfrei.pdf [Accessed 16 Jan 2022].
28 Vlaams Instituut Gezond Leven. Vlaamse gezondheidsaanbevelingen 2021 sedentair gedrag (Lang stilzitten), beweging en slaap, 2021. Available: https://www.gezondleven.be/meer-beweging [Accessed 19 Jan 2022].
29 Secretaria de atenção primária saúde (Saps). Consulta pública: Guia de Atividade Física para População Brasileira, 2021. Available: http://189.28.128.100/dab/docs/portaldab/documentos/Guia_Atividade_Fisica_Consulta_Publica.pdf [Accessed 19 Jan 2022].
30 Ministry of Health Brueni Darussalam. National physical activity guidelines for Brunei Darussalam, 2011. Available: http://www.moh.gov.bn/SitePages/Materials%20for%20the%20National%20Physical%20Activity%20Guidelines.aspx [Accessed 19 Jan 2022].
31 Ministerio del deporte, Ministerio de salud, Ministerio de salud. Recomendaciones para La práctica de actividad física según curso de vida, 2017. Available: http://selloseligevivirsano.cl/wp-content/uploads/2019/03/guia-de-recomendaciones-af-curso-de-vida.pdf [Accessed 18 Jan 2022].
32 Cyprus National Addictions Authory. Healthy lifestyle during pregnancy and breastfeeding periods, 2019. Available: http://www.cyprushospitals.org/wp-content/uploads/2019/10/ENGLISH.pdf [Accessed 19 Jan 2022].
33 Sundhedsstyrelsen og Komiteen For Sundhedsoplysning. Healthy habits before, during and after pregnancy, 2015. Available: https://www.sst.dk/-/media/Udgivelser/2015/Sunde-vaner-fremmedsprog/Sunde_vaner_2015_Engelsk.ashx [Accessed 2015].
34 Pitsi T, Zilmer M, Vaask S, *et al*. Eesti toitumis- JA liikumissoovitused, 2015. Available: https://intra.tai.ee/images/prints/documents/149019033869_eesti%20toitumis-%20ja%20liikumissoovitused.pdf [Accessed 19 Jan 2022].
35 Public Health Division of the Pacific Community. Pacific guidelines for healthy eating during pregnancy: a Handbook for health professionals and educators, 2019. Available:. Available: https://www.spc.int/updates/blog/2018/07/pacific-guidelines-for-healthy-living [Accessed 17 Jan 2022].
36 UKK Institute. Physical activity recommendation during pregnancy, 2021. Available: https://ukkinstituutti.fi/en/products-services/physical-activity-recommendations/ [Accessed 17 Jan 2022].
37 l'Agence Nationale de Sécurité Sanitaire de l'alimentation de l'environnement et du travail. Actualisation des repèresdu PNNS - Révisions des repères relatifs l'activité physique et la sédentarité: Avis de l'Anses Rapport d'expertise collective, 2016. Available: https://www.anses.fr/fr/content/actualisation-des-rep%C3%A8res-du-pnns-r%C3%A9visions-des-rep%C3%A8res-relatifs-%C3%A0-l%E2%80%99activit%C3%A9-physique-et-%C3%A0 [Accessed 17 Jan 2022].
38 Ινστιτούτο ροληπτικής κΕΙ, Prolepsis. Εθνικός Διατροφικός Οδηγός για Γυναίκες, Εγκύους και Θηλάζουσες, unknown. Available: http://www.diatrofikoiodigoi.gr/?Page=systaseis [Accessed 17 Jan 2022].
39 Iceland Health Service Executive. Keeping well during pregnancy: exercise, 2018. Available: https://www2.hse.ie/wellbeing/pregnancy-and-birth/keeping-well/exercise/ [Accessed 18 Jan 2022].
40 Ministry of Health. National guidelines for healthy diets and physical activity, 2017. Government of Kenya. Available: http://www.fao.org/nutrition/education/food-dietary-guidelines/regions/countries/kenya/en/ [Accessed 18 Jan 2022].
41 Meija L, Rezeberga D. Proper maternal nutrition during pregnancy planning and pregnancy: a healthy start in life, 2017. Available: https://www.euro.who.int/en/countries/latvia/publications/proper-maternal-nutrition-during-pregnancy-planning-and-pregnancy-a-healthy-start-in-life-2017 [Accessed 18 Jan 2022].
42 Bahagian Pendidikan Kesihatan Kementerian Kesihatan Malaysia. Garis panduan aktiviti fizikal Malaysia, 2017. Available: http://www.moh.gov.my/english.php/pages/view/536 [Accessed 18 Jan 2022].
43 Ministry of Health New Zealand. Eating and activity guidelines for new Zealand adults, 2020. Available: https://www.health.govt.nz/system/files/documents/publications/eating-activity-guidelines-new-zealand-adults-dec20.pdf [Accessed 18 Jan 2022].
44 44 Helsedirektoratet. Fysisk aktivitet for barn, unge, voksne, eldre OG gravide, 2019. Available: https://www.helsedirektoratet.no/faglige-rad/fysisk-aktivitet-for-barn-unge-voksne-eldre-og-gravide/fysisk-aktivitet-for-gravide#gravide-bor-delta-i-fysisk-aktivitet-av-moderat-intensitet-i-minst-150-minutter-i-uken [Accessed 18 Jan 2019].
45 Casa do Brasil de Lisboa. Guidelines for pregnancy and following giving birth in Portugal, 2020. Available: http://casadobrasildelisboa.pt/wp-content/uploads/2020/06/Guidelines-for-Pregnancy-English.pdf [Accessed 18 Jan 2022].
46 Research and Scientific Support Department - Aspetar Orthopaedic and Sports Medicine Hospital. *Qatar national physical activity guidelines*. 2nd ed, 2021. https://www.aspetar.com/AspetarFILEUPLOAD/UploadCenter/637736948034432931_QATAR%20NATIONAL%20PHYSICAL%20ACTIVITY%20GUIDELINES_ENGLISH.pdf
47 Lee R, Thain S, Tan K, *et al*. Perinatal society of Singapore guidelines on physical activity & exercise in pregnancy, 2020. Available: http://perinatal.sg/exercise.pdf [Accessed 18 Jan 2022].
48 Videmšek M, Vrtačnik EB, Šćepanović D, *et al*. Priporočila za telesno dejavnost nosečnic, 2015. Available: https://vestnik.szd.si/index.php/ZdravVest/article/download/1220/1005/ [Accessed 16 Jan 2022].
49 Ministerio de Sanidad Servicios Socialese Igualdad. Actividad física para salud Y reducción del sedentarismo. Recomendaciones para La población. Estrategia promoción Y prevención de la salud en El sns, 2015. Available: https://www.mscbs.gob.es/profesionales/saludPublica/prevPromocion/Estrategia/docs/Recomendaciones_ActivFisica_para_la_Salud.pdf [Accessed 15 Jan 2022].
50 Institute of Sports Exercise Medicine Ministry of Sports Sri Lanka. Physical activity and sedentary behaviour guidelines for Sri Lanka, 20182018. Available: http://www.health.gov.lk/moh_final/english/public/elfinder/files/publications/publicNotices/GeneralNotice/2017/Physical%20Activity%20Guidelines%20for%20Sri%20Lankans.pdf
51 Kahlmeier S, Hartmann F, Martin-Diener E, *et al*. Schweizer bewegungsempfehlungen für schwangere und postnatale frauen, 2018. Available: https://www.rosenfluh.ch/media/ernaehrungsmedizin/2018/04/Schweizer-Bewegungsempfehlungen-fuer-schwangere-und-postnatale-Frauen.pdf [Accessed 18 Jan 2022].
52 Department of Health and Social Care. UK chief medical officers' physical activity guidelines, 2019. Available: https://www.gov.uk/government/publications/physical-activity-guidelines-uk-chief-medical-officers-report [Accessed 7 Jan 2022].

53 U.S. Department of Health and Human Services. 2018 physical activity guidelines advisory committee scientific report, 2018. Available: https://health.gov/sites/default/files/2019-09/Physical_Activity_Guidelines_2nd_edition.pdf [Accessed 07 Jan 2022].
54 Urugury Ministry of Health. ¡A MOVERSE! Guía de actividad física, unknown. Available: https://www.paho.org/uru/dmdocuments/WEB%20-%20Guia%20de%20actividad%20fisica2%20-%20MSP-compressed.pdf [Accessed 16 Jan 2022].
55 Guyatt G, Oxman AD, Akl EA, *et al*. Grade guidelines: 1. Introduction-GRADE evidence profiles and summary of findings tables. *J Clin Epidemiol* 2011;64:383–94.
56 Brouwers MC, Kho ME, Browman GP, *et al*. Agree II: advancing guideline development, reporting and evaluation in health care. *CMAJ* 2010;182:E839–42.
57 Jetté M, Sidney K, Blümchen G. Metabolic equivalents (METS) in exercise testing, exercise prescription, and evaluation of functional capacity. *Clin Cardiol* 1990;13:555–65.
58 Borg GA. Psychophysical bases of perceived exertion. *Med Sci Sports Exerc* 1982;14:377–81.
59 Reed JL, Pipe AL. The talk test: a useful tool for prescribing and monitoring exercise intensity. *Curr Opin Cardiol* 2014;29:475–80.
60 World Health Organization (WHO). Who guidelines on physical activity and sedentary behaviour, 2020. Available: https://www.who.int/publications/i/item/9789240015128 [Accessed 27 March 2021].
61 Beetham KS, Giles C, Noetel M, *et al*. The effects of vigorous intensity exercise in the third trimester of pregnancy: a systematic review and meta-analysis. *BMC Pregnancy Childbirth* 2019;19:281–99.
62 Kimber ML, Meyer S, McHugh T-L, *et al*. Health outcomes after pregnancy in elite athletes: a systematic review and meta-analysis. *Med Sci Sports Exerc* 2021;53:1739–47.
63 Wowdzia JB, McHugh T-L, Thornton J, *et al*. Elite athletes and pregnancy outcomes: a systematic review and meta-analysis. *Med Sci Sports Exerc* 2021;53:534–42.
64 Bø K, Artal R, Barakat R, *et al*. Exercise and pregnancy in recreational and elite athletes: 2016/17 evidence summary from the IOC expert group meeting, Lausanne. Part 4-Recommendations for future research. *Br J Sports Med* 2017;51:1724–6.
65 Bø K, Artal R, Barakat R, *et al*. Exercise and pregnancy in recreational and elite athletes: 2016/2017 evidence summary from the IOC expert group meeting, Lausanne. Part 5. recommendations for health professionals and active women. *Br J Sports Med* 2018;52:1080–5.
66 Evenson KR, Hesketh KR. Monitoring physical activity intensity during pregnancy. *Am J Lifestyle Med* 2021.
67 MacDonald LA, Waters TR, Napolitano PG, *et al*. Clinical guidelines for occupational lifting in pregnancy: evidence summary and provisional recommendations. *Am J Obstet Gynecol* 2013;209:80–8.
68 Croteau A. Occupational lifting and adverse pregnancy outcome: a systematic review and meta-analysis. *Occup Environ Med* 2020;77:496–505.
69 Woodley SJ, Boyle R, Cody JD, *et al*. Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women. *Cochrane Database Syst Rev* 2017;12:Cd007471.
70 Mottola MF, Nagpal TS, Bgeginski R, *et al*. Is supine exercise associated with adverse maternal and fetal outcomes? A systematic review. *Br J Sports Med* 2019;53:82–9.
71 Williamson C, Baker G, Mutrie N, *et al*. Get the message? A scoping review of physical activity messaging. *Int J Behav Nutr Phys Act* 2020;17:51–66.
72 Andersen RE, Blair SN, Cheskin LJ, *et al*. Encouraging patients to become more physically active: the physician's role. *Ann Intern Med* 1997;127:395–400.
73 Hayman M, Reaburn P, Alley S, *et al*. What exercise advice are women receiving from their healthcare practitioners during pregnancy? *Women Birth* 2020;33:e357–62.
74 Hayman MJ, Reaburn P, Alley SJ, *et al*. Insight into the exercise advice pregnant women receive from their medical practitioners. *Aust J Rural Health* 2019;27:264–5.
75 Yang X, Li H, Zhao Q, *et al*. Clinical practice guidelines that address physical activity and exercise during pregnancy: a systematic review. *J Midwifery Womens Health* 2022;67:53–68.
76 Rudin LR, Dunn L, Lyons K, *et al*. Professional exercise recommendations for healthy women who are pregnant: a systematic review. *Womens Health Rep* 2021;2:400–12.
77 Tsakiridis I, Bakaloudi DR, Oikonomidou AC, *et al*. Exercise during pregnancy: a comparative review of guidelines. *J Perinat Med* 2020;48:519–25.
78 The American Congress of Obstetricians and Gynecologists (ACOG). Exercise during pregnancy and the postpartum period, number 804, 2020. Available: https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2020/04/physical-activity-and-exercise-during-pregnancy-and-the-postpartum-period [Accessed 10 Sep 2022].
79 The Royal Australian New Zealand College of Obstetricians and Gynaecologists (RANZCOG). Exercise during pregnancy, C-Obs 62, 2020. Available: https://ranzcog.edu.au/ Exercise-during-pregnancy.pdf [Accessed 10 Sept 2022].
80 Bø K, Artal R, Barakat R, *et al*. Exercise and pregnancy in recreational and elite athletes: 2016 evidence summary from the IOC expert group meeting, Lausanne. Part 1-exercise in women planning pregnancy and those who are pregnant. *Br J Sports Med* 2016;50:571–89.