Australian Guidelines for physical activity during pregnancy and postpartum

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Abstract

Objectives: To develop Australian guidelines on physical activity (PA)/exercise during pregnancy and the postpartum period.

Design: Critical 'umbrella' reviews of the scientific evidence, combined with adaptation of recently published guidelines.

Method: A five stage approach included: identification of key source documents (including national PA/exercise guidelines and position statements from professional organisations, published since 2010); narrative review of evidence relating to 27 health outcomes; summarising the evidence; development of draft guidelines and supporting information; and review and consultation to finalise the guidelines.

Results: Our evidence review found that PA/exercise during pregnancy and the postpartum period is safe, has health benefits for the woman and her unborn child, and may reduce the risks of some pregnancy related complications. Four specific guidelines were developed. These encourage all women without pregnancy complications to: (1) meet the Australian Physical Activity and Sedentary Behaviour Guidelines before, during and after pregnancy; (2) modify activities to accommodate the physical changes that occur as pregnancy progresses; (3) do pelvic floor exercises during and after pregnancy; (4) take an active role in shared decision-making about their physical activity/exercise during and after pregnancy. The review also identified warning signs and contraindications for PA/exercise during pregnancy.

Conclusions. All women who are pregnant or planning a pregnancy should be aware of the benefits of PA/exercise, and health professionals should encourage safe levels of activity and be familiar with the contraindications, signs and symptoms which suggest that PA/exercise should be modified or avoided.

Keywords: Exercise, pregnant woman, pregnancy care, recommendations

Introduction

Research has shown that 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 (GDM), preeclampsia, delivery complications, newborn complications and postpartum depression. [1] Despite these benefits, few pregnant women are sufficiently active.[2,3] In Australia, data from the 2011–12 Health Survey indicate that only 30% of pregnant women aged 18-45 meet the minimum level of moderate to vigorous PA (MVPA; at least 150 minutes per week) recommended in the national guidelines. In contrast, 47% of non-pregnant women of the same age are sufficiently active.[4]

The lower level of PA during pregnancy may reflect physiological changes, barriers such as fatigue and discomfort, fear of harm to the developing fetus, and a lack of knowledge among both women and health professionals about the benefits and risks of PA for the mother and baby.[5-7] Moreover, while some women may return to pre-pregnancy PA levels by 12 months after pregnancy,[8] many face constraints to regular PA during the postpartum period and some may never regain their pre-pregnancy activity levels.[9]

Given the low levels of PA during this life stage, in 2018 the Australian Government Department of Health funded the development of evidence-based guidelines on safe and beneficial levels of PA/exercise for pregnant women. Such guidelines could encourage women to continue optimal patterns of PA/exercise during pregnancy and in the postpartum period, and provide evidence-based guidance and information about risks and contraindications for health professionals. The aim of this paper is to describe the recently released Australian guidelines on physical activity during pregnancy and the processes and rationale used in their development. Full details are available in the government report on the Department of Health website.[10]

Methods

The overall process was adapted from the approach proposed by Okely et al. in 2017 for the Development of 24-Hour Movement Guidelines for the Early Years.[11] A five-stage approach was used.

Stage One involved literature searches (February-March 2019) to identify national guidelines and position statements from professional organisations, published since 2010. These were reviewed and included as *key source documents* if they provided a comprehensive review of the evidence.

Stage Two involved review of the *key source documents* to identify 'critical elements' (eg health outcomes such as gestational weight gain, urinary incontinence, etc), which had been the subject of at least one systematic review, for inclusion in a narrative review. Evidence from the systematic reviews and meta-analyses identified in the key source documents, and from additional reviews and important randomised controlled trials (RCTs) and cohort studies published since 2016, informed narrative reviews and summaries of the evidence on each critical element. One author with specialist knowledge of the topic prepared the evidence summary for each element, with critical review by all authors.

In *Stage Three* we assessed the quality of the evidence for each element, using criteria described by the GRADE researchers.[12,13] Sources of evidence were initially identified as (i) RCTs (where the rating starts at HIGH quality) or (ii) cohort studies and non-RCTs (where the rating starts at LOW quality). For each source, the decision to upgrade, downgrade, or maintain the initial rating was based on the original authors' summary, and the group's interpretation of risk of bias, imprecision, inconsistency and indirectness in the underlying studies.

Stage Four involved developing the guidelines and supporting information. Specific recommendations or statements in the *key source documents* were summarised into three categories: (1) general recommendations; (2) the 'dose' of PA/exercise (duration, frequency, intensity and type); and (3) aspects of medical and health care. We used a consensus process, based on the evidence reviews, expert judgements on issues relating to benefits and potential harms, and selected adoption or adaptation of the text used in the *key source documents*, to draft the proposed new Australian recommendations. We then assigned an overall grade to each recommendation to denote how well the body of evidence could be trusted to guide practice.[14] Finally, the *key source documents* were reviewed to identify appropriate information for inclusion as *Supporting Information* to aid interpretation, safety precautions and contraindications.

Stage Five included review of the draft guidelines, with recommended evidence categories and supporting information by: (1) an 11-member International Advisory Group in September 2019; (2) a 'round table' of informed medical practitioners in December 2019; and (3) State and national policy makers and practitioners in government departments of Health, Sport and Recreation and Maternity Services (January 2020). Collectively, the authors and reviewers represented expected users of the Guidelines, including consumers, health professionals, researchers, and representatives of government and non-government agencies, and professional organisations. All reviewers were invited to comment on the appropriateness and clarity of the wording and the evidence ratings, and

to make suggestions for changes which would facilitate understanding for pregnant women, while maintaining evidence-based information for health professionals.

Results and Discussion

Of the eight sources identified in *Stage One,*[15-22] five included comprehensive reviews of the evidence, published in English between 2015 and March 2019, and were used as the main sources of evidence for *Stage Two.*[15,17,20-22] We selected 27 critical elements for narrative review of the effects of PA/exercise on maternal, fetal and neonatal health outcomes during pregnancy and in the postpartum period:

- *Effects of physical activity/exercise during pregnancy on pregnant women*: cardiorespiratory fitness; gestational weight gain; gestational diabetes; gestational hypertension and pre-eclampsia; low back and pelvic girdle pain; urinary incontinence; mental health problems (including depression/depressive symptoms and anxiety); and sleep.
- *Effects of physical activity/exercise during pregnancy on fetal development and birth*: developmental concerns; miscarriage and peri-natal mortality; gestational age and preterm birth; labour and birth; pelvic floor muscle injury; APGAR scores; and birthweight.
- *Effects of physical activity/exercise during pregnancy and postpartum on postpartum issues:* weight retention/weight loss; breastfeeding; urinary incontinence; post-natal mental health problems (depression/depressive symptoms, anxiety, body image dissatisfaction); musculoskeletal complaints; infant neurodevelopment and longer-term development of Non-Communicable Diseases (NCDs) in the mother and child.
- *Effects of sedentary time and occupational physical activity on maternal and infant health outcomes*.

In the review of relationships between PA/exercise and each of the 27 elements, a quality rating of 'high' (consistent evidence from systematic reviews which included high quality RCTs and cohort studies) was only assigned for gestational weight gain and prevention of urinary incontinence, during and following pregnancy. A quality rating of 'moderate' or 'low' was assigned to most of the other elements, reflecting the low quality or limited amount of underlying evidence. A summary of the review findings is provided in Table 1 and the full narrative review is available in the report on the Australian Government Department of Health website.[10]

Overall, we found that PA/exercise during pregnancy and the postpartum period is safe, has health benefits for the woman and her unborn child, and reduces the risks of some pregnancy related complications. We initially proposed five guidelines and supporting information about the

recommended types (aerobic, strengthening) and intensity of PA/exercise, safety precautions and medical contraindications. Following extensive expert and stakeholder review, a final set of four guidelines, with one overarching evidence statement, was agreed (see Box 1). The overarching statement, and guidelines 1 and 3 were rated as 'evidence based' and guidelines 2 and 4 were considered to be consensus-based recommendations.[12]

Box 1: The Australian Guidelines for Physical Activity/Exercise during Pregnancy

Physical activity/exercise during pregnancy and the postpartum period is safe, has health benefits for the woman and her unborn child, and reduces the risks of some pregnancy related complications.

1 All women without contraindications should be encouraged to meet the Australian Physical Activity and Sedentary Behaviour Guidelines before, during and after pregnancy.

2 Modifications to physical activity/exercise may be required to accommodate the physical changes that occur as the pregnancy progresses. If there are any concerns (including warning signs and contraindications), women are advised to seek advice from a qualified health professional.

3 All pregnant women are advised to do pelvic floor exercises during and after pregnancy

4 Health professionals should support women to take an active role in shared decision-making about their physical activity/exercise during and after pregnancy. All health professionals who provide care during pregnancy should be familiar with contraindications, signs and symptoms which suggest that physical activity/exercise should be modified or avoided.

The main differences between these new Guidelines and other recently released guidelines from Canada and the USA are that we explicitly refer to the Australian Physical Activity and Sedentary Behaviour Guidelines for Adults.[23] These include recommendations on moderate-vigorous intensity physical activity, muscle strengthening activities, and on reducing and breaking up time spent in prolonged sitting. In addition to the general muscle strengthening activities, we included a specific recommendation that advises all pregnant women to do pelvic floor exercises during and following pregnancy. A similar recommendation is made in the Canadian Guidelines[20] and the Sports Medicine Australia position statement.[18] We also included a recommendation on the role of health professionals, which is similar to those in the guidelines from the American[15] and Australian/NZ Colleges[16] of Obstetrics & Gynaecology. However, we changed the emphasis to reflect contemporary

practice which suggests that women should be actively involved in shared decision making about their PA/exercise during and after pregnancy. The final guideline emphasises the need for all health professionals who provide care during pregnancy to be familiar with contraindications, signs and symptoms which suggest that physical activity/exercise should be modified or avoided.[24]

Overall, we found no evidence of adverse outcomes of PA/exercise in any of the reviews, most of which included data from women with normal pregnancies. On balance, for women who participated in the hundreds of RCTs and cohort studies which were summarised in the reviews that informed the development of our Guidelines, the health benefits of participation in leisure time or transport PA/exercise before, during and after pregnancy were confirmed.

Introductory statement

The initial statement in the Guidelines is intended to assure women with healthy pregnancies that PA/exercise is safe and beneficial. It is similar to statements made in the key source documents. Our evidence review confirmed benefits for women during pregnancy in terms of cardiorespiratory fitness, gestational weight gain, GDM, low back and pelvic girdle pain, urinary incontinence (UI) and mental health problems. We also found benefits relating to gestational age and preterm birth, mode of delivery and birthweight, and for reduced risk of UI and depression postpartum[10] (Table 1). Whatever level of PA/exercise women wish to do, it is likely that the amount (volume, intensity, etc) will decrease as pregnancy progresses, because activities become more uncomfortable in the later stages of pregnancy. More large-scale dose-response studies, which assess types and volumes of PA, before and during early and late pregnancy, and in the postpartum period, are required to clarify long term health outcomes.[25]

Guideline One

We found no evidence to suggest that women without contraindications (see Table 2) should not participate in PA/exercise in line with the current Australian Physical Activity and Sedentary Behaviour Guidelines for Adults.[23] The advice on aerobic activity is slightly different from that in the US Physical Activity Guidelines report, which suggests a minimum of 150 minutes (aerobic and muscle strengthening activities) 'spread throughout the week'.[22] The overall amount of PA/exercise is in line with the recently published World Health Organisation[26] and the 2014 Australian PA and SB Guidelines, which recommend 150 to 300 minutes at moderate intensity, or 75–150 minutes at vigorous intensity, or any equivalent combination, on most days each week.[23] Evidence suggests that this higher amount of PA/exercise is beneficial for prevention of excess weight gain during pregnancy.[27] Previously inactive women, whether pregnant or not, are advised to start with lower than recommended levels and increase amounts of PA/exercise gradually.

A systematic review of the effects of vigorous intensity PA/exercise (which included 5 RCTs and 10 cohort studies) concluded that vigorous exercise appears to be safe in the third trimester of pregnancy, but that further research on vigorous PA/exercise in the earlier stages of pregnancy is required.[28] As it is extremely difficult to conduct research to assess the maximal safe levels of PA/exercise during pregnancy, there was little evidence on which to base any recommendation about the typically high intensity or prolonged PA/exercise training that is characteristic of athletes and sportswomen. Restrictions on vigorous activity (based on keeping the heart rate [HR] below 140 bpm, and restricting exercise to 15-minute bouts) have now been removed from most guidelines worldwide, but athletes are advised to consult with informed health professionals and to review training loads throughout pregnancy on an individual basis. Whilst vigorous intensity activity is now considered safe for most women, most current guidelines recommend moderate intensity PA/exercise during pregnancy and advise that intensity should be based on ratings of perceived exertion. We recommend using perceived exertion of 3-7 (on a scale of 1-10), or using the talk test, to indicate moderate to vigorous intensity activity.[10]

Physical activity choices during pregnancy should reflect individual preferences and pre-pregnancy activities. However, given that only about one quarter of non-pregnant women aged 18-45 report any muscle strengthening activities,[29] and that this proportion is likely to be lower during pregnancy, this life-stage may be a good time to emphasise the importance of the 'twice weekly muscle strengthening activities' recommendation in the Australian adult guidelines. While there is strong evidence for some health benefits (eg cardiorespiratory fitness, urinary incontinence) in pregnant women who participated in combined exercise programs (aerobic + resistance), there is insufficient evidence to draw conclusions about the health benefits of resistance training alone in pregnant women.[30] We found no evidence to suggest that pregnant women should not use light weights or resistance bands to improve muscle strength and endurance. However, we suggest that heavy lifting and intense repetitive isometric exercises are not recommended during pregnancy, because there is some evidence in the occupational activity literature of adverse associations between repeated heavy lifting and indicators of poor fetal and maternal health outcomes.[31]

Emerging research on the effects of sedentary behaviour during pregnancy shows mixed evidence of associations between sitting and indicators of maternal and fetal health outcomes. However, while we have no reason to suspect that the adverse effects of prolonged sitting would be different in pregnant and non-pregnant women, it is likely that the circulatory effects (eg venous pooling) may be exacerbated during pregnancy.[21] In general population samples, daily sitting for greater than eight hours is associated with increased risks of several NCDs, but these risks are attenuated by moderate-high levels of physical activity.[32] There are however metabolic and circulatory benefits

when prolonged periods of sitting are interrupted by short periods of light activity.[33] Given that many women continue to work late into pregnancy, the guidelines recommend that pregnant women minimise amounts of prolonged sitting and break up long periods of sitting as often as possible (as advised in the Australian PA and SB guidelines for adults). To date, the Swiss guidelines are the only others to have included a recommendation on sitting time ("make breaks/interrupt long seated periods").[19]

Guideline Two

The second guideline acknowledges that, as pregnancy progresses, anatomical and physiological/metabolic changes mean that modifications to some activities/exercises are required. This is in line with recommendations made in the ACOG statement[15] and in the Swiss guidelines.[19] The Canadian Guidelines[20] suggest that yoga and/or gentle stretching may be beneficial during pregnancy, and the Swiss guidelines also suggest that 'adjusted' stretching can be beneficial for health and well-being. Others suggest that flexibility exercises should be individualised to reduce susceptibility to joint injury.[21] Both the IOC[17]and UpToDate® series[21] raise the issue of exercise in the supine position, and potential compromises to venous return of blood from exercising lower limb muscles. However, a recent Canadian review found there was insufficient evidence to ascertain whether maternal exercise in the supine position is safe or not, highlighting ethical difficulties of conducting research in which adaptations are not made.[34] In terms of types of activity, it is common sense to avoid physical activity/exercises with high risk of falls or blunt trauma.[10]

Guideline Three

To date only the Canadian Guidelines and the Sports Medicine Australia statement have included a specific recommendation on pelvic floor muscle (PFM) exercises. Given the prevalence of urinary incontinence (UI) during pregnancy and postpartum (30– 50%), its impact on quality of life and exercise participation[35,36] and the strong possibility that the condition will persist into older age, we included a specific recommendation that all women should do PFM strengthening exercises during and following pregnancy. The evidence on PFM strengthening and prevention of UI is based on high quality RCTs which show that starting PFM exercises before the birth reduces the risk of postpartum UI. For treatment of UI, supervised PFM exercise has greater effects.[37] Clinical consensus suggests that continuing PFM exercises, whether pregnant or not, may prove to be beneficial in later life.

Guideline Four

The aim of the final guideline is to encourage shared decision making between women and their health professionals on issues relating to physical activity/exercise during pregnancy. This guideline was the focus of extensive debate during the review process, largely because earlier guidelines have

suggested that pregnant women should be screened before exercising. For example, the ACOG statement suggests that a thorough clinical evaluation should be conducted,[15] and the RANZCOG statement advises that potential contraindications should be identified,[16] before recommending an *exercise program*. In contrast, our review found that healthy women should not be required to seek clearance from a health professional if they choose to be *physically active* during pregnancy, especially if they were active prior to pregnancy, and provided they have no contraindications and remain asymptomatic. However, women who are considering exercise at levels above those recommended in the PA guidelines (ie high intensity, prolonged duration, etc) should consult a health professional who is knowledgeable about the effects of high level training on maternal and fetal outcomes, for screening and ongoing review.[24,38]

It is highly likely that most women, including athletes and sports women, will modify their activities as pregnancy progresses. As there will be cases when it is unsafe for women to exercise during pregnancy, the second part of the final guideline suggests that all health professionals should be familiar with indications for not commencing, and for ceasing activity (Table 2).

Methodological constraints

In light of the difficulties of doing research that focuses on the developing fetus, many of the included systematic reviews focussed on the effects of PA/exercise on pregnant women's health and on birthweight. Interpretation of the evidence relating to some critical elements (including gestational hypertension, GDM and post-natal depression) was challenging, because several key sources used the same systematic reviews to shape the evidence on a specific topic, but their conclusions did not always concur. When we re-reviewed the contributing systematic reviews, we often found limitations and sources of bias in the included studies. For example, inclusion of heterogeneous volunteer samples of pregnant women in RCTs introduced biases in terms of health, wealth and education. Inclusion of primiparous and multiparous women, healthy weight and overweight/obese women, and women with and without risk factors (eg hypertension, hyperglycaemia), in the same trial, without sufficient sample size for sub-sample analyses, also creates challenges to interpretation of the evidence. Moreover, many of the effects of PA/exercise during pregnancy are not independent of each other (eg women who develop gestational diabetes are more likely than other women to have large babies, which then impacts on birthweight and mode of delivery). Few studies considered these synergistic effects when considering multiple outcomes.[10]

In many cases the effects of physical activity alone could not be deduced in lifestyle interventions with multiple components, such as activity/exercise and diet (which are important for weight related

outcomes). In some reviews the effects of supervised and unsupervised interventions were not considered separately, and in many studies the effects of bias due to drop out (high attrition) and of variable or poor compliance with intervention instructions were not considered. In some studies, data were collected in three different trimesters (from different participants), even though effects may vary at different stages of pregnancy (because the developing embryo may potentially be more susceptible to changes in maternal physiological and metabolic parameters during the first trimester of pregnancy).

Public health implications

A recent analysis of National Health Survey data by the Australian Institute of Health and Welfare has shown that the median weekly duration of physical activity for fitness, recreation, sport or transport, in non-pregnant women, is 149 minutes, compared with 90 minutes in pregnant women.[4] Most of the difference is accounted for by lower levels of vigorous intensity PA, but there appear to be some reductions in moderate intensity activity as pregnancy progresses.[39] Amounts of walking for transport are similar in pregnant and non-pregnant women, presumably because many women continue their paid work until just before the birth and most transport-related walking occurs during the daily commute. Amounts of recreational walking are only slightly lower in pregnant than in non-pregnant women.[4] Notwithstanding, overseas studies have shown significant declines in physical activity during pregnancy in Brazilian[40] and in Danish[41] women.

In recent years the global obesity epidemic has focussed attention on rates of weight gain during young adulthood. There is evidence to suggest that having a baby is associated with marked 10 year weight gain,[42] and that high rates of weight gain at this life stage may be associated with weight gain during pregnancy that is not subsequently lost.[43] Our review confirmed that physical activity prior to and during pregnancy will help to ensure that overall weight gain is in line with recommendations. This is important because excess weight gain during pregnancy increases the risk of gestational diabetes, which is associated with a seven fold increase in risk of developing type 2 diabetes after pregnancy.[44] Weight gain at this life stage is also strongly linked with the development of UI, independent of parity.[45]

Although it seems intuitive to suggest that sleep is extremely important during pregnancy, results of the few studies of physical activity and sleep in pregnant women have shown mixed results, with positive, negative or null associations. The findings reflect the subjective measures of both PA/exercise and various sleep indices, as well as huge variability in sleep patterns and quality at different stages of pregnancy. Potential bidirectional associations between sleep and PA/exercise are also problematic, particularly in cross-sectional studies. In the absence of systematic review level

evidence on the combined effects of PA/exercise and sleep at different stages of pregnancy, and the wide heterogeneity of results in studies to date, we were not able to draw any conclusions about the relationships between sleep, PA and health outcomes during pregnancy.[10] More high quality research is clearly required.

Conclusions

These Guidelines provide evidence-based best practice recommendations on PA/exercise during pregnancy for Australian women and those who provide healthcare during pregnancy, including health professionals, as well as coaches, trainers and fitness/recreation professionals who may be asked for advice about PA/exercise during pregnancy. They may be used to correct myths and misconceptions about PA/exercise during pregnancy and to improve the quality of information provided to women by health and exercise professionals. Given women's increased engagement with the healthcare system during and following pregnancy, this life stage is an opportune time for implementation of health promotion and disease prevention strategies which will improve the health of mothers and their babies.[46]

Practical Implications

- These Guidelines build on recently published international guidelines, and on the advice offered by Australian professional organisations. They also complement the lifestyle considerations section of the Australian Clinical Practice Guidelines for Pregnancy Care.[47]
- All pregnant women who do not have pregnancy complications should be encouraged to commence or continue being active during and following pregnancy.
- In addition to aerobic PA/exercise, pregnant women are encouraged to do muscle strengthening activities, and pelvic floor muscle exercises.
- Women who are physically active during pregnancy may be more likely to continue with life-long activity, which has countless health, social and economic benefits for themselves, their children and the health system.

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Table 1: Summary of the narrative review findings with quality ratings of the evidence.

Issue and evidence summary*	Comments	Quality rating
Effect of physical activity/exercise during pregnancy on the pregnant woman		
Cardiorespiratory Fitness Regular PA/exercise during pregnancy maintains or improves cardiorespiratory fitness.	Required exercise dose for different populations (overweight/obese, younger/older mothers, previously inactive, well-trained or elite athletes) remains to be determined.	**Moderate**
Gestational Weight Gain PA/exercise prior to and during pregnancy is associated with lower weight gain (about 1kg less) and improves compliance with weight gain in accordance with IOM Guidelines.	Focus of most reviews is on either prevention of excess weight gain, or gaining weight as recommended. No evidence of different results in overweight or obese populations.	**High**
Gestational Diabetes Mellitus Regular PA/exercise before and during pregnancy (and especially in early pregnancy) *may* have a protective effect on the development of gestational diabetes and may assist with regulation of blood glucose in diagnosed gestational diabetes.	Prior to 2018 evidence suggested protective effects, especially for exercise before and in early pregnancy. Newer reviews suggest dose-response relationships are unclear. Results confounded by methodological heterogeneity.	**Moderate**
Gestational hypertension and pre-eclampsia There is limited evidence that regular PA/exercise is associated with reduced risk of incident gestational hypertension, and that PA/exercise may lower maternal arterial pressure. The effects of PA/exercise on pre-eclampsia are unclear.	Inconsistent results range from no effects to significant risk reductions. Quality rating reflects downgraded RCTs and upgraded cohort studies.	**Moderate**
Low Back Pain and Pelvic Girdle Pain		**Moderate**

Issue and evidence summary*	Comments	Quality rating
There is little evidence to show that PA/exercise (on land or in water) prevents pregnancy related low back and pelvic girdle pain, but it may help to reduce the severity of these musculoskeletal symptoms.	There is evidence of positive effects of exercise on pain management and sick leave related to these conditions. Large heterogeneity in the quality of studies in the systematic reviews gives an evidence rating of moderate (downgraded RCTs).	
Urinary Incontinence (prevention) Regular pelvic floor exercise during pregnancy has a clinically relevant effect on prevention of UI and reduces the risk of UI in late pregnancy, especially when exercise is supervised.	High quality RCT evidence supports the inclusion of pelvic floor exercises in the guidelines for PA/exercise during pregnancy (for prevention of UI).	**High**
Urinary Incontinence (treatment) It is unclear whether pelvic floor exercise during pregnancy is effective for *treatment* of urinary incontinence in pregnant women.	Pelvic floor exercise, as a therapeutic approach, may require supervision and more intense exercise, and should be targeted to high-risk pregnant women (such as multiparous, overweight/obese or women of advanced maternal age).	**Moderate**
Depression and depressive symptoms There is limited evidence that PA/exercise during pregnancy is associated with reduced risk and severity of depressive symptoms during pregnancy.	RCT evidence from low-moderate quality trials with significant heterogeneity.	**Moderate**
Anxiety PA/exercise during pregnancy does not reduce the risk of anxiety during pregnancy.	Limited evidence to suggest an inverse relationship between PA/exercise and anxiety.	**Low**
Sleep		**Low**

Issue and evidence summary*	Comments	Quality rating
It is not possible to draw any conclusions about the joint effects of physical activity and sleep on health outcomes during pregnancy at this time.	Studies with heterogeneous designs, measures and quality show mixed effects.	
Body image dissatisfaction Limited research suggests women who exercise may have slightly better body image satisfaction.	Mixed effects reported in one systematic review of 4 prospective studies.	**Low**
Effect of physical activity/exercise during pregnancy on fetal development and birth		
Developmental concerns There is no evidence of detrimental effects of PA/exercise on fetal development.	Concerns have been raised about hyperthermia and neural tube defects (spina bifida) in the first trimester, but many women are unaware of pregnancy at this time and there are few studies. PA/exercise is associated with changes in fetal HR – which may reflect normal physiological responses to changes in uterine blood flow.	**Low**
Miscarriage PA/exercise is not associated with increased risk of miscarriage.	There is serious risk of bias in many studies and the effects of long duration PA/exercise remain unclear.	**Low**

Issue and evidence summary*	Comments	Quality rating
Gestational age and preterm birth PA/exercise does not have any meaningful effect on gestational age and may have very small protective effects on preterm birth.	Reported association between long work hours and preterm birth was based on low quality studies. Studies have shown small beneficial effects of leisure time, but not commuting or domestic PA, on reducing the risk of preterm birth.	**Moderate**
Labour and birth PA/exercise during pregnancy protects against unplanned caesarean section, and may reduce the risk of instrumental delivery, but does not impact on duration of labour. There is no consensus on the effects of PA/exercise on injury during labour.	Four meta-analyses show lower rates of caesarean section and/or higher rates of normal vaginal birth with PA/exercise in the second and third trimesters. No differences in the overall duration of labour among exercise and control groups have been reported. There have been few studies on the effects of PA/exercise on pelvic floor muscle injury during labour.	**Moderate**
APGAR scores PA/exercise during pregnancy is not associated with APGAR scores.	Studies show no differences in 1- and 5-minute APGAR scores in exercising and control group women.	**Moderate**
Birthweight There is consistent evidence that PA/exercise does not have a clinically relevant effect on birthweight. PA/exercise may reduce the risk of macrosomia and 'large for gestational age' infants.	Women who exercise during pregnancy have appropriate gestational weight gain, and appropriate birthweight infants. Evidence that PA/exercise during pregnancy might prevent macrosomia and babies born large for gestational age is low quality.	**Moderate**

Effects of physical activity/exercise during pregnancy and postpartum (6 months) on postpartum issues

Issue and evidence summary*	Comments	Quality rating
Weight Retention / Weight Loss The effects of postpartum PA/exercise on postpartum weight retention (PPWR) and weight loss are confounded by multiple factors which make it difficult to assess whether PA/exercise alone impacts on PPWR or weight loss in the postpartum period.	Very few studies have examined whether PA *alone* affects PPWR. In overweight and obese women PA/exercise in postpartum results in greater weight loss (about 1 kg less), but it is unclear whether the effects are from diet, PA/exercise or a combination. Effects are confounded by initial weight and weight gain during pregnancy.	**Moderate**
Breastfeeding There is no evidence to show that PA/exercise affects either the quality or quantity of breast milk.	There is very little evidence on PA/exercise and breast feeding. Moderate intensity PA/exercise has no adverse effects on lactation hormone levels.	**Very Low**
Urinary Incontinence ***Prevention*** PFMT during and following pregnancy is effective in reducing risk of UI postpartum.	*Prevention*: Continent women who start a PFMT program before the birth are 30% less likely to develop UI postpartum.	**High**
Treatment Intensive supervised PFMT is recommended as a conservative strategy for treatment of postnatal UI.	*Treatment:* High heterogeneity in programs and adherence. Effects are stronger if PFMT is supervised.	**Moderate**
Depression and depressive symptoms Post-natal PA/exercise improves mild-to-moderate depressive symptoms and increases the likelihood that mild-to moderate depression will resolve in the postpartum period.	Benefits are more pronounced in women with greater symptomatology, and in co-interventions (eg with dietary change or social support). Overall quality of the RCTs included in the systematic reviews is low.	**Moderate**

Issue and evidence summary*	Comments	Quality rating
Anxiety PA/exercise during pregnancy does not reduce the risk of anxiety during the postnatal period.		**Very low**
Musculoskeletal complaints PA/exercise initiated during pregnancy does not appear to reduce the risk of musculoskeletal complaints (eg back pain, pelvic girdle pain, diastasis recti) postpartum.	Wide heterogeneity in design, intervention strategies (mostly clinical treatment trials), measures and quality of the research in this area. (Pelvic floor muscle injury is considered in 'labour and birth' above).	**Low**
Infant neurodevelopment PA/exercise during pregnancy is not associated with infant neurodevelopment.	Cohort follow up was 1-8 years post birth and RCT follow up 20 months. Longer term follow-up is required.	**Very Low**
Longer term development of NCDs in the mother and child There is limited evidence on the effects of PA/exercise during pregnancy on the long term development of NCDs in mothers or their offspring.	It is difficult to assess effects of PA/exercise during pregnancy on long term development of NCDs because of effects of confounding chronic or continuing inactivity and other risk factors on NCD risk.	**Moderate**
Effects of sedentary time and occupational physical activity on maternal and infant health outcomes		
Sedentary Time (ST) Although this evidence base is rapidly increasing, it is difficult to draw conclusions about the effects of high ST during pregnancy on pregnancy-related outcomes at this time.	Low quality research shows inconsistent associations between ST during pregnancy and indicators of infant and maternal health risks. There is wide heterogeneity in study designs, measures, quality and findings, and few studies assess the	**Low**

Issue and evidence summary*	Comments	Quality rating
	potential confounding effects of PA/exercise or BMI on outcomes.	
Occupational Physical Activity (OPA)		**Low**
There is limited and mixed evidence on associations between OPA and fetal/ maternal health outcomes.	Inconsistent associations found between indicators of OPA (work hours, shift work, lifting, standing, and physical workload) and: preterm birth; low birthweight; small for gestational age; pre-eclampsia; gestational hypertension.	

*The full narative review and references for each statement can be found in the evidence report[10].

Table 2: Information on risks and contraindications*

Absolute Contraindications

Pregnant women who have any of the following are advised not to exercise until individually tailored advice has been sought:

- Poorly controlled Type 1 diabetes, hypertension or thyroid disease
- Other serious cardiovascular, respiratory or systemic disorder
- Pre-eclampsia
- Incompetent cervix
- Ruptured membranes, preterm labour
- Persistent second or third trimester bleeding
- Placenta previa
- Evidence of intrauterine growth restriction
- Multiple gestation (triplets or higher number)

Relative Contraindications

Pregnant women with a history of, or who develop, the following conditions during pregnancy should discuss starting or continuing PA/exercise with their health professional:

- Pregnancy induced hypertension
- Mild/moderate cardiovascular or chronic respiratory disease
- Type 1 diabetes
- Symptomatic anemia
- Poorly controlled seizure disorder
- History of spontaneous miscarriage, preterm labour or fetal growth restriction
- Malnutrition, significantly underweight or eating disorder
- Twin pregnancy after the 28th week
- Other significant medical conditions

Warning signs to stop PA/exercise

Pregnant women who experience any of the following symptoms during physical activity /exercise should stop, and seek advice from their health professional before continuing with a PA/exercise program:

- Chest pain
- Persistent excessive shortness of breath – that does not resolve with rest
- Severe headache
- Persistent dizziness / feeling faint – that does not resolve with rest
- Regular painful uterine contractions
- Vaginal bleeding
- Persistent loss of fluid from the vagina – indicating possible ruptured membranes

*Symptoms and conditions were extracted from key source documents(11-17).