Table D.1.d. Mental health outcomes and physical activity, pregnant and postpartum women

Black font is from original GRADE Evidence Profile from the systematic review (Davenport 2018 *(3)*) to support the 2019 Canadian Guideline for Physical Activity Throughout Pregnancy. Red font denotes additions based on WHO update using review of existing systematic reviews. One systematic review was identified that addressed the relationship between physical activity and postpartum depression *(20)*.

Quality assessment							№ of participants		Effect		Quality	Importance
№ of studies **Review (AMSTAR 2 rating)**	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**prenatal exercise**	**no exercise**	**Relative (95% CI)**	**Absolute (95% CI)**		
Association between exercise-only interventions and **prenatal depressive symptoms**												
15 (pooled estimate of effect, n =13; 2 studies reported narratively)	randomized trials	serious [a]	not serious	not serious	not serious	none	590	585	-	SMD **0.39 SD lower** (0.51 lower to 0.26 lower)	⊕⊕⊕◯ MODERATE	CRITICAL
							Narrative Synthesis: A superiority RCT comparing yoga (n=51) with non-yoga (n=45) antenatal exercises showed an improvement in depressive symptoms with yoga, but not with other antenatal exercise (Satyapriya 2013). In contrast, one RCT found no influence of prenatal exercise on the severity of depressive symptoms during pregnancy (exercise = 429, control = 426; Gustafsson 2015).					
4	non-randomized intervention studies	serious [b]	serious [c]	not serious	not serious	none	215	205	-	SMD **0.81 lower** (1.14 lower to 0.49 lower)	⊕◯◯◯ VERY LOW	CRITICAL
8 (pooled estimate of effect, n =3; 5 studies	cohort studies	serious [d]	not serious	not serious	serious [e]	none	94	170	-	SMD **0.16 SD lower** (0.47 lower to 0.14 higher)	⊕◯◯◯ VERY LOW	CRITICAL

Quality assessment							№ of participants		Effect		Quality	Importance
№ of studies **Review (AMSTAR 2 rating)**	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**prenatal exercise**	**no exercise**	**Relative (95% CI)**	**Absolute (95% CI)**		
reported narratively							Narrative Synthesis: Five cohort studies were included (n=5,060). 4/5 (n=4,982) reported a favourable effect of prenatal exercise on depressive symptoms (Gjestland 2013; Demissie 2011; Orr 2006; Downs 2008). 1/5 (n=78) reported no association between depression scores and physical activity (Tendais 2011).					
2 (pooled estimate of effect, n =1; 1 study reported narratively	case-control studies	not serious	serious [f]	not serious	not serious [g]	none	39	17	-	MD **0.2 lower** (0.49 lower to 0.09 higher)	⊕◯◯◯ VERY LOW	CRITICAL
							Narrative Summary: One case-control study was included (case, n=80; control, n=258) and indicated that women meeting the recommendations for 150 minutes/week of moderate intensity physical activity had similar depressive symptoms when compared to women not meeting the recommendations (OR = 1.94; 95%CI: 0.83, 4.56 adjusted for age, parity, education and pre-pregnancy body mass index. Kolu 2014)					
4 (pooled estimate of effect, n =1; 3 study reported narratively	cross-sectional studies	serious [d]	not serious	not serious	not serious	none	117	86	-	MD **11.26 lower** (14.36 lower to 8.16 lower)	⊕◯◯◯ VERY LOW	CRITICAL
							Narrative Synthesis: Three cross-sectional studies were included (n=439). 3/3 indicated an inverse association between prenatal physical activity level and prenatal depressive symptoms (Loprinzi 2012; Petrovic 2016; de Wit 2015).					
5	randomized trials	serious [h]	not serious	not serious	not serious	none	32/354 (9.0%)	72/329 (21.9%)	**OR 0.33** (0.21 to 0.53)	**134 fewer per 1 000** (from 90 fewer to 163 fewer)	⊕⊕⊕◯ MODERATE	CRITICAL

Quality assessment							№ of participants		Effect		Quality	Importance
№ of studies Review (AMSTAR 2 rating)	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	prenatal exercise	no exercise	Relative (95% CI)	Absolute (95% CI)		
Association between exercise-only interventions and **prenatal depression**												
1	non-randomized intervention study	serious [i]	serious [f]	not serious	not serious [g]	none	13/50 (26.0%)	41/50 (82.0%)	**OR 0.08** (0.03 to 0.20)	**553 fewer per 1 000** (from 343 fewer to 700 fewer)	⊕◯◯◯ VERY LOW	CRITICAL
1	cohort study	serious [j]	serious [f]	not serious	not serious [g]	none	3/53 (5.7%)	24/127 (18.9%)	**OR 0.26** (0.07 to 0.90)	**132 fewer per 1 000** (from 16 fewer to 173 fewer)	⊕◯◯◯ VERY LOW	CRITICAL
1	cross-sectional study	serious [d]	serious [f]	not serious	not serious [g]	none	Narrative Summary: Bowen (2009) found that women who did at least 20 minutes of exercise per day during pregnancy were less likely to experience prenatal depression (assessed using the Edinburgh Postnatal Depression Scale) than women who exercise occasionally (OR 2.23, 95%CI 1.26, 3.92) or did not exercise during pregnancy (OR 3.18, 95%CI 1.47, 6.87).				⊕◯◯◯ VERY LOW	CRITICAL
Association between exercise-only interventions and **postnatal depressive symptoms**												
4	randomized trials	serious [k]	not serious	not serious	serious [e]	none	537	496	-	SMD **0.01 lower** (0.13 lower to 0.12 higher)	⊕⊕◯◯ LOW	CRITICAL

Quality assessment							№ of participants		Effect		Quality	Importance
№ of studies Review (AMSTAR 2 rating)	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	prenatal exercise	no exercise	Relative (95% CI)	Absolute (95% CI)		
Nakamura 2019 *(20)* Moderate 6 randomized trials 11 cohort studies 4 cross-sectional studies		serious [s]	serious [c]	not serious	not serious	none	17/21 studies were included in meta-analysis (6 trials and 11 observational studies). When all study designs were combined, there was a significant association between physical activity and **postpartum depression scores** (SMD = -0.22 [95% CI, -0.42 to -0.01]), I^2=86.4%). Physical activity interventions showed a significant inverse relationship with PA during pregnancy and symptoms of post-partum depression (MD = -0.58 [95% CI, -1.09 to -0.08], I^2=90.7%). Observational evidence also showed an inverse, but not significant relationship between PA during pregnancy and post-partum depression scores (SMD = -0.07 [95% CI, -0.20 to 0.06], I^2-74.4%).				⊕⊕◯◯ LOW	CRITICAL
3 (pooled estimate of effect, n =2; 1 study reported narratively	non-randomized intervention studies	serious [l]	serious [c]	not serious	serious [e]	none	135	117	-	MD **0.69 lower** (1.91 lower to 0.52 higher)	⊕◯◯◯ VERY LOW	CRITICAL
							Narrative Summary: One non-randomized intervention including depressed women (intervention, n=34)(Battle 2015) demonstrated that a 10 week yoga intervention had a clinically meaningful decrease in depression severity. Using regression analysis, a dose-response relationship was observed where the more time spent practicing yoga, the greater reduction in depressive symptoms in a given week.					
1	cohort studies	serious [m]	serious [f]	not serious	not serious [g]	none	26	8	-	MD **2.71 lower** (4.93 lower to 0.49 lower)	⊕◯◯◯ VERY LOW	CRITICAL

Quality assessment							№ of participants		Effect		Quality	Importance
№ of studies Review (AMSTAR 2 rating)	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	prenatal exercise	no exercise	Relative (95% CI)	Absolute (95% CI)		
1	cross-sectional studies	very serious [n]	serious [f]	not serious	not serious [g]	none	Narrative Summary: Data from the North Carolina Pregnancy Risk Assessment Monitoring System 2004-2005 found no significant association between third trimester exercise and postnatal depressive symptoms (Ersek 2009). However, women who were physically active both before pregnancy and during the third trimester of pregnancy had a reduction in severity of depressive symptoms (OR 0.66, 95%CI 0.49, 0.87; after controlling for age and marital status).				⊕◯◯◯ VERY LOW	CRITICAL
Association between exercise-only interventions and **postnatal depression**												
2	randomized trials	serious [k]	not serious	not serious	serious [e]	none	7/417 (1.7%)	13/376 (3.5%)	**OR 0.48** (0.18 to 1.22)	**18 fewer per 1 000** (from 7 more to 28 fewer)	⊕⊕◯◯ LOW	CRITICAL
1	cohort study	serious [o]	serious [f]	not serious	not serious [g]	none	419/26494 (1.6%)	886/44372 (2.0%)	**OR 0.79** (0.70 to 0.89)	**4 fewer per 1 000** (from 2 fewer to 6 fewer)	⊕◯◯◯ VERY LOW	CRITICAL
							Narrative Summary: Additional data from the Danish National Birth Cohort (Strom 2009) could not be included in the meta-analysis. They showed that women had a decreased odds of postpartum depression diagnosis if they were vigorously active (OR 0.81, 95%CI 0.66, 0.99), exercising 2-3 hours per week (OR 0.75, 95% CI 0.58-0.98) or achieving 8-15 MET h/week (OR 0.79, 95%CI 0.63, 0.99 compared to no exercise). All ORs were adjusted for maternal age, parity, pre-pregnancy BMI, alcohol intake, smoking, occupation, education, home ownership, marital status, social support and history of previous depression.					

Quality assessment							№ of participants		Effect		Quality	Importance
№ of studies Review (AMSTAR 2 rating)	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	prenatal exercise	no exercise	Relative (95% CI)	Absolute (95% CI)		
1	case-control study	serious [o]	serious [f]	not serious	not serious [g]	none	Narrative Summary: One case-control study (n=57) (Sexton 2012) reported higher prenatal exercise frequency in women who were likely to be depressed during pregnancy (Beck Depression Index, BDI-II >10) predicted postpartum recovery of depression (OR 1.23, 95%CI 0.08, 0.92).				⊕◯◯◯ VERY LOW	CRITICAL
1	cross-sectional study	serious [o]	serious [f]	not serious	not serious [g]	none	Narrative Summary: One cross-sectional study (n=6,330) (Guida 2012) showed that women who did not exercise during the third trimester of pregnancy were more likely to experience postpartum depression than women who exercised 5 or more days per week (OR 1.36, 95% CI 1.15, 1.62). Exercising 1-4 times per week had no observable effect on postpartum depression (OR 1.10, 95% CI 0.93, 1.32).				⊕◯◯◯ VERY LOW	CRITICAL
Association between exercise-only interventions and **prenatal state anxiety symptoms**												
6 (pooled estimate of effect, n =5; 1 study reported narratively)	randomized trials	serious [p]	not serious	not serious	serious [d]	none	136	140	-	SMD **0.03 SD higher** (0.21 lower to 0.27 higher)	⊕⊕◯◯ LOW	CRITICAL
							Narrative Summary: A superiority RCT comparing yoga (n=51) with non-yoga (n=45) antenatal exercises showed an improvement in state anxiety symptoms with yoga, but not other antenatal exercise (Satyapriya 2013).					
1	non-randomized intervention studies	serious [q]	serious [f]	not serious	not serious [g]	none	Narrative Summary: Beddoe (2009) showed that seven weeks of a mindfulness-based yoga intervention did not reduced state anxiety symptoms, whether the intervention was introduced in 2nd or 3rd trimester of pregnancy (n=16).				⊕◯◯◯ VERY LOW	CRITICAL

Quality assessment							№ of participants		Effect		Quality	Importance
№ of studies Review (AMSTAR 2 rating)	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	prenatal exercise	no exercise	Relative (95% CI)	Absolute (95% CI)		
1	cohort studies	serious [j]	serious [f]	not serious	not serious [g]	none	38	142	-	SMD **0.36 lower** (0.72 lower to 0)	⊕◯◯◯ VERY LOW	CRITICAL
1	cross-sectional studies	not serious	serious [f]	not serious	not serious [g]	none	117	86	-	SMD **0.82 lower** (1.11 lower to 0.53 lower)	⊕◯◯◯ VERY LOW	CRITICAL
Association between exercise-only interventions and **prenatal trait anxiety symptoms**												
3 (pooled estimate of effect, n =2; 1 study reported narratively)	randomized trials	serious [r]	not serious	not serious	serious [e]	none	49	41	-	SMD **0.21 SD lower** (0.63 lower to 0.2 higher)	⊕⊕◯◯ LOW	CRITICAL
							Narrative Summary: A superiority RCT comparing yoga (n=51) with non-yoga (n=45) antenatal exercises showed an improvement in trait anxiety symptoms with yoga, but not other antenatal exercise (Satyapriya 2013).					
1	non-randomized intervention study	serious [q]	serious [f]	not serious	not serious [g]	none	Narrative Summary: Beddoe (2009) reported that 7 weeks of a mindfulness-based yoga intervention reduced trait anxiety symptoms when the intervention was introduced in the third (but not second trimester) (n=16).				⊕◯◯◯ VERY LOW	CRITICAL
1	cross-sectional study	not serious	serious [f]	not serious	not serious [g]	none	117	86	-	SMD **0.82 SD lower** (1.11 lower to 0.53 lower)	⊕◯◯◯ VERY LOW	CRITICAL
1	case-control study	not serious	serious [f]	not serious	not serious [g]	none	17	39	-	MD **0.19 lower** (0.4 lower to 0.02 higher)	⊕◯◯◯ VERY LOW	CRITICAL

Quality assessment							№ of participants		Effect		Quality	Importance
№ of studies Review (AMSTAR 2 rating)	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	prenatal exercise	no exercise	Relative (95% CI)	Absolute (95% CI)		
Association between exercise-only interventions and **postnatal State anxiety symptoms**												
1	randomized trial	serious [p]	serious [f]	not serious	not serious [g]	none	39	40	-	SMD **0.01 higher** (0.43 lower to 0.45 higher)	⨁⨁◯◯ LOW	CRITICAL

* Unless otherwise stated, all studies are included in the pooled estimate.

Abbreviations: CI = confidence interval; MD = mean difference; OR = odds ratio; SMD = standardised mean difference;

[a] Serious risk of bias. High risk of performance bias and attrition bias. Unclear risk of selection bias; it was unknown if allocation adequately concealed. Reporting bias was an issue in one study and one study did not have a non-exercise control group (superiority trial); results were reported narratively.
[b] Serious risk of bias. High risk of performance bias (compliance to the intervention not reported; women who did not complete the majority of the intervention [>75%] were excluded) and attrition bias.
[c] Serious inconsistency. High heterogeneity (I2 > 50%).
[d] Serious risk of bias. High risk of performance bias (potentially flawed measurement of the exposure; unknown validity of physical activity measure) and reporting bias (incomplete reporting of data in four studies such that they could not be included in the meta-analysis; results were reported narratively).
[e] Serious imprecision. The 95% CI crosses the line of no effect, and is wide, such that the interpretation of the data would be different if the true effect were at one end of the CI or the other.
[f] Serious inconsistency. Only one study was included.
[g] No serious imprecision; only one study but already downgraded for serious inconsistency for this reason.
[h] Serious risk of bias. High risk of attrition bias. Unclear risk of selection bias; it was unknown if allocation was adequately concealed.
[i] Serious risk of bias. High risk of performance and attrition bias (all women who did not complete the majority of the intervention [80%] were excluded). Unclear risk of selection bias; it was unknown if the methods of sequence generation and allocation concealment were adequate.
[j] Serious risk of bias. High risk of performance bias (potentially flawed measurement of the exposure; unknown validity of physical activity measure).
[k] Serious risk of bias. High risk of performance bias.
[l] Serious risk of bias. High risk of performance and attrition bias (women who did not complete the majority of the intervention [>75%] were excluded; active and inactive groups made on the basis of compliance to physical activity recommendation at the end of the intervention). Reporting bias was an issue in one study (incomplete reporting of data such that it could not be included in the meta-analysis; results were reported narratively).
[m] Serious risk of bias. High risk of attrition and of other bias (extreme imbalance in baseline data between the groups likely to influence the outcome).
[n] Very serious risk of bias. High risk of performance bias (potentially flawed measurement of the exposure; unknown validity of retrospective physical activity measure), detection bias (potentially flawed measurement of the outcome; unknown validity of postnatal depression symptoms measure). Reporting bias was an issue in this study (incomplete reporting of data such that it could not be included in the meta-analysis; results were reported narratively).
[o] Serious risk of bias. High risk of performance bias (potentially flawed measurement of the exposure; unknown validity of physical activity measure). Reporting bias was an issue in one study (incomplete reporting of data such that it could not be included in the meta-analysis; results were reported narratively).
[p] Serious risk of bias. High risk of performance bias and attrition bias. Unclear risk of selection bias; it was unclear if sequence generation and allocation concealment were adequate.
[q] Serious risk of bias. High risk of performance and attrition bias. This study has no control group such that it could not be included in the meta-analysis; results were reported narratively.
[r] Serious risk of bias. High risk of attrition bias. Unclear risk of selection bias; it was unclear if sequence generation was adequate.
[s] Serious risk of bias. High risk of performance bias (potentially flawed measurement of the exposure; unknown validity of physical activity measure), attrition bias, and reporting bias.