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Abstract

The potential beneficial effects of physical activity during pregnancy on postpartum depressive symptoms (PPD) remain inconclusive. Using data from two prospective French birth cohorts, we aimed to examine the relationship between domain-specific physical activity (including leisure-time sedentary behavior) in pregnancy and the occurrence of postpartum depressive symptoms. Participants of the ELFE cohort (N=15538) completed the Pregnancy Physical Activity Questionnaire (PPAQ), which assesses the following physical activity/sedentary behavior domains: household/caregiving, occupational, sports/exercise, transportation and leisure-time sedentary behavior during the third pregnancy trimester. In the EDEN cohort (n = 1745) women completed the Baecke Questionnaire (BQ) measuring occupational, sports/exercise, and leisure-time/locomotive activity during the first trimester of pregnancy. Depressive symptoms in the first postpartum year were measured using the Edinburgh Postnatal Depression Scale in both cohorts. Associations of physical activity/sedentary behavior with PPD symptoms were determined by logistic regression analysis, with adjustment on potential confounding factors. In the adjusted models, higher levels of household/ caregiving activities (OR=1.10 (95% CI 1.01-1.19) and leisure-time sedentary behavior (OR= 1.16 (95% CI 1.06-1.23)), in the third pregnancy trimester were associated with an increased odds of PPD. No significant associations were found for physical activity domains during the first pregnancy trimester. Higher levels of household and caregiving activities and leisure time sedentary behavior in the last trimester of pregnancy appear to increase the likelihood of postpartum depression. Purpose and context of physical activity should be taken into account when encouraging physical activity as a strategy to help prevent postpartum mental health problems from pregnancy onwards.

Introduction

Postpartum depression (PPD) is an important public health issue, with 2.6 to 35.0 % of women experiencing major or minor depression sometime in the first year after giving birth (1, 2). PPD negatively affects women's functioning, personal relationships, and children's social and cognitive developmental outcomes (3). Engaging in regular exercise and physical activity has been demonstrated as a successful treatment modality for major and minor depression in the general population (4), and the potential benefits of exercise on perinatal depression are beginning to emerge as well. Several systematic reviews and meta-analyses, found evidence that exercise may be effective in reducing depression during both pregnancy (5) and the postpartum (6,7). Outcomes of a recent review, although based on a small number of studies, suggest that physical activity during pregnancy may likewise serve to prevent subsequent PPD (8).

Physical activity (PA) may include a variety of activities other than recreational ones, such as occupational, transportation, care-giving and household activities (9). Leisure-time physical activity in particular may be most beneficial in terms of mental health promotion and the prevention of mental ill-health compared to other domains (10). The role of domain-specific PA is equally important when studying its effects in reducing the risk for postnatal depression. Previous research has either focused on future mothers' total or leisure-time physical activities, ignoring other domains, in particular household and child-care activities, which comprise a substantial portion of women's PA (11). Further, studies show that most pregnant women do not practice any form of exercise and many of them decrease previously established levels of activity both in intensity and duration across domains from the first to the third trimester (9, 12). Therefore, to determine their potential impact on PPD, it is important to look at physical activity domains beyond total or leisure- time activities. To our knowledge, the study by Demissie et al (13) is the only one to investigate the role of physical activity domains during pregnancy in the development of depressive symptoms among postpartum women. In a prospectively followed sample of 529 women, they found no significant associations between total or domain-specific physical activity at either 17–22 weeks or 27–30 weeks' gestation and postpartum depressive symptoms. Further studies with larger samples of women are needed to confirm the influence of physical activity across different domains on postpartum depressive symptoms.

Likewise, emerging evidence indicates a relationship between sedentary behavior and depression in both the general and pregnant populations (14, 15). Sedentary behavior is any waking behavior characterized by an energy expenditure ≤1.5 metabolic equivalents (METs), while in a sitting, reclining or lying posture (16). While it has been reported that pregnant women spent more than 50% of their time (range 57% to 78%) in sedentary activities (17), research exploring sedentary behaviors as a potential risk factor for postpartum depression is limited.

Taking these knowledge gaps into account, our main objective was to examine the relationship between total and domain-specific physical activity in pregnancy and postpartum depressive symptoms. We hypothesized that the purpose and context of physical activity might be more important than the overall level of physical activity for reducing the presence of postnatal depressive symptoms with, for instance, higher levels of leisure-time physical activity being associated with a decreased risk of PPD, but higher levels of household/care-giving being associated with an increased risk of postpartum depression. Our secondary objective was to explore the potential effect of leisure-time sedentary behavior during pregnancy on postpartum depressive symptoms.

The results of this study will add to the limited literature on the role of domain-specific physical activity and sedentary behavior in pregnancy and their associations with PPD. From a public health perspective, pregnancy is a period wherein women may be more apt to incorporate changes into their routine and offers a window of opportunity for prevention (18). Therefore, women may more readily incorporate changes in PA habits during the pregnancy period (19). Our results may help to inform the development of potentially feasible strategies for preventing depression in new mothers, as well as refining public health recommendations concerning appropriate physical activity engagement for mental health benefits.

Methods

Study design and sample

The ELFE (*Etude Longitudinale Française depuis l'Enfance*) study is a multidisciplinary, nationally representative birth cohort, which included 18,312 children born in 349 maternity units in France in 2011. The protocol, design and recruitment procedures of the ELFE survey have been previously described (20). Participating mothers and children were recruited in maternity wards and have been followed up since then. Exclusion criteria were stillbirth, birth <33 weeks of gestation, multiple births, plans to move out of mainland France in the following 3 years. Mothers had to be capable of giving informed consent in one of the study languages (French, English, Arabic, and Turkish). Maternity data were collected using standardized interviews conducted by trained interviewers and through self-completed questionnaires. Information about obstetrical characteristics was collected from maternal recall and from medical records. At two months postpartum, data were collected via phone interviews. The ELFE study received approval from bodies overseeing ethical aspects of data collection in France (*Comission nationale informatique et liberté-CNIL* and *Comité Consultatif sur le Traitement des Informations pour la Recherche en Santé – CCTIRS).*

The EDEN (*Etude sur les déterminants pré et postnataux précoces du Développement et de la santé de l'ENfant*) mother-child cohort assesses the pre- and postnatal nutritional, social, and environmental determinants of infant and child development and health (21). Pregnant women (n=2002) were

recruited before 24 weeks of gestation from two maternity wards (Poitiers and Nancy University hospitals) between September 2003 and January 2006. Exclusion criteria were multiple pregnancies**,** a known history of diabetes, inability to speak and read French or plans to move out of the study region in the following 3 years. During pregnancy and after birth, socio-demographic and biomedical data on the mother and child were gathered from a) medical records, b) face-to-face interviews and c) self-completed questionnaires. Written consent was obtained from the mother for herself at inclusion and for her newborn child after delivery. The EDEN study was approved by the *Comité Consultatif de Protection des Personnes pour la Recherche Biomédicale* (CPP, Ethics Committee, Kremlin Bicêtre Hospital) and by the *CNIL*.

Symptoms of postpartum depression

Depressive symptoms during the first year after the child's birth were assessed using the Edinburgh Postnatal Depression Scale (EPDS), a 10-item questionnaire designed to detect postnatal depression (score ranging 0-30) (22). In this study we used the cut-off ≥12, which has been recommended for the French translation and has demonstrated its validity for research purposes (23). EPDS scores were available at 2 months postpartum for the ELFE cohort and at 4, 8 and 12 months postpartum for the EDEN cohort.

Physical activity measures

In the ELFE cohort, 15, 575 women completed the Pregnancy Physical Activity Questionnaire (PPAQ), a self-administered questionnaire specifically designed to assess physical activity levels among pregnant women and validated in this population (24, 25). Respondents reported the time spent participating in 32 activities during the last three months of pregnancy characterizing household/caregiving, occupational settings, sports/exercise, transportation, and "inactivity". This last domain includes questions regarding the following activities: watching TV or a video, sitting and using a computer or writing (while not at work) and sitting and reading, talking or on the phone (while not at work). As these items are typical sedentary behaviors, we will refer to this domain as leisure-time sedentary activity. Self-reported time spent in each activity is multiplied by its intensity (pregnancy-specific estimates for walking and light- to moderate intensity household tasks, and Ainsworth compendium-based Metabolic Equivalent of Task (MET) values (26) for the remainder of the PPAQ activities) to arrive at a measure of average weekly energy expenditure (MET-hr/wk)) attributable to each activity and domain or as total activity (sum of all domain scores).

In the EDEN cohort, women completed an adapted French version of the Baecke Questionnaire (BQ), a validated measure of habitual physical activity for adults (27, 28). This questionnaire was administered at the 24-28 week pregnancy visit and refers to the frequency of physical activity performed during the first trimester of pregnancy. BQ includes a total of 16 questions scored on a five-point Likert scale and classified into three domains: Occupational, Sports, and

Leisure-time activity. The Occupational and Sports scales include some comparative and self-analytical questions that have previously been reported as difficult to answer (29) and have been omitted from the French version. Scoring for the three domains follows the system described by Baecke et al (27) with scores ranging from 1 (low) to 5 (high). The three domain scores can be summed to create an overall score of physical activity (range 3-15). Additionally, women reported whether they had interrupted their regular sport practice since the beginning of their pregnancy.

Covariates

Our analyses were adjusted for several socio demographic, psychosocial and pregnancy-related characteristics identified in the literature and significantly associated ($p < .10$) with both physical activity and postnatal depressive symptoms in our samples. *Sociodemographic* characteristics included maternal age at delivery, nationality (French vs. other), highest educational level, family situation (married/cohabitating with partner vs. separated), employment in pregnancy (no vs. yes), average household income in Euros per month (ordered categorically: 1: <800, 2: 800-1500, 3: 1500-2300, 4: 2300-3000, 5: 3000-3800, 6: >3800), financial difficulties (no vs. yes) and study center. *Psychosocial characteristics* included history of mental health problems (no vs. yes), psychological distress during pregnancy (no vs. yes), maternal smoking and alcohol use during pregnancy, social support (no vs. yes). *Health and pregnancy related characteristics* included presence of chronic health conditions, maternal pre-pregnancy body mass index (BMI) (kg/m^2), average gestational weight gain (kg), parity, at least one pregnancy complication (derived from medical chart, no vs. yes), hospitalization during pregnancy (no vs. yes). Finally, we included prenatal care utilization (*n* prenatal visits/scans) and attendance to birth preparation classes (no vs. at least once).

Statistical analyses

Logistic regression modeling was utilized to calculate odds ratios (OR) and 95% confidence intervals (CIs) for associations between total physical activity and domain-specific scores on the one hand, and postpartum depressive symptoms on the other hand. Unadjusted and adjusted logistic regression models were computed with the adjusted model controlling for previously listed covariates. Outcomes were analyzed separately for the EDEN and ELFE cohorts. To be able to interpret the ORs of the ELFE study in a clinically meaningful way, they are based on an 1.5 MET hr/wk increase in physical activity, which corresponds, for instance, to 30 minutes of moderate intensity activity per week. Rates of missing data on maternal, child and family characteristics ranged from 0.2% to 35.9% (psychological distress in pregnancy), and were accounted for using multiple imputations models with fully conditional specification. Excluding individuals with missing data from our analyses did not significantly alter our results. Analyses were conducted with SPSS version 20 and SAS 9.4.

Results

Data on postpartum depression were available for 15,538 and 1,745 women in the ELFE and EDEN cohorts respectively. In the ELFE study, factors associated with attrition from study baseline included parental low occupational grade and unemployment, young maternal age and multiparity. For EDEN, attrition was highest in young mothers, those with low educational level, low income and financial difficulties, of non-French origin, who did not live with the father of their child, as well as those with prenatal depression. Sociodemographic and pregnancy related characteristics of both samples are summarized in **Table 1**. Women were on average 30 years old at time of delivery and mainly of French origin (91.7% for ELFE and 98.1% for EDEN). The majority of women was married or cohabiting (94.5% and 92.1%), had on average 13 years of education and was employed at the time of enrolment (77.8% and 77.2%). About 11% reported having experienced mental health problems before pregnancy and 13% reported psychological distress during pregnancy.

-- TABLE 1—

Prevalence of depressive symptoms was 12.3% at 2 months postpartum in the ELFE cohort, and ranged between 10.6% and 12.60 in the year following the birth for women in the EDEN cohort. During the first pregnancy trimester 22.9% of EDEN women practiced at least one sport/exercise activity. However, by the second trimester 29.8% of expectant mothers reported interrupting their pre-pregnancy sports practice. ELFE cohort women were spending most of their total physical activity in the third trimester on household/caregiving (46.4%) and occupational activities (14.6%) and were spending the smallest proportion on sports/exercise (3.6%). Moreover, a considerable proportion (23.6%) was dedicated to sedentary behaviors.

In the ELFE cohort, univariate analyses showed significant associations between postpartum depression at 2 months and women's Total physical activity (OR=1.20 (95% CI 1.11-1.26)) during the last 3 months of pregnancy **(Table 2)**. These associations remained significant in the multivariate model (OR=1.12 (95% CI 1.03-1.19)). In the EDEN cohort, the physical activity sum score was inversely associated with odds for depressive symptoms in the first postpartum year ($OR^{4\ months}$ = 0.79 (95% CI 0.67-0.94); $OR^{8\ months}$ = 0.79 (95% CI 0.63-0.99); $OR^{12\ months}$ = 0.78 (95% CI 0.64-0.94)) in unadjusted analyses, but these became non-significant after adjustment.

When examining effects of specific activity domains in the ELFE cohort, Household/ caregiving activities (OR=1.23 (95% CI 1.16-1.31)) and Transportation (OR=1.16 (95% CI 1.08-1.21)), as well as Leisure-time sedentary behavior (OR=1.16 95% CI 1.07-1.22)) were significantly associated with postpartum depression in the univariate analyses. In the multivariate model, associations remained significant for Household/ caregiving activities (OR=1.10 (95% CI 1.01-1.19)) and Leisure-time sedentary behavior (OR= 1.16 95% CI 1.06-1.23)).

In the EDEN cohort, occupational physical activity during the first trimester was inversely associated with odds for depressive symptoms in the first postpartum year while no associations were found for Leisure time/locomotive and Sport activities in the unadjusted logistic regression models. These effects all became statistically non-significant after taking into account covariates **(table 2)**.
-- TABLE 2-

In sensitivity analyses, we re-ran all adjusted models for domain-specific measures of physical activity, adding a covariate for all physical activity outside of the specific domain of interest to account for potential confounding. The models did not substantially change when other domains were included as covariates. Further, we tested for possible differential effects of physical activity between women already reporting psychological difficulties during pregnancy and those who did not. The relationship between physical activity and PPD did not change when stratifying by prenatal psychological difficulties (data available upon request).

Discussion

Using data from two large prospective birth cohorts, we explored the relationship between domain-specific physical activity as well as sedentary behavior in pregnancy and postpartum depressive symptoms. No significant associations were found between domain-specific physical activity during the first pregnancy trimester and postpartum depressive symptoms. However, higher levels of Household/ caregiving activities, Leisure-time sedentary behavior and Total activities in the third trimester were associated with increased likelihood of depressive symptoms at 2 months postpartum. Overall, our findings suggests that physical activity is not automatically associated with greater mental health and reduced mental ill-health, and that contextual factors associated with several physical activity domains are probably crucial to such relationships.

Domain specific physical activity and postpartum depression

Few studies have examined the association between PA in pregnancy and postpartum depression. In addition, the majority of prior studies focused on leisure-time activity and did not examine other activity domains. While we found no associations between domain-specific physical activity in the first trimester and depressive symptoms in the first postpartum year, women spending more time on household and caregiving activities during the third pregnancy trimester have higher odds for PPD. For every additional 30 minutes per week of household and caregiving activities, women have a 10% increased likelihood of experiencing postpartum depression. It should be noted though that this risk remains modest and that our large sample partly contributed to finding significant associations. Importantly, and consistent with previous cross-sectional studies (30, 31), household/caregiving activities constituted the largest source of physical activity energy expenditure in our population. It has been suggested that household activities, in comparison to leisure-time activities, are not usually

performed for enjoyment or by choice and could be stressful or burdensome, thereby contributing to women's depressive symptoms (10, 32). Molarius et al (33) reported that the odds of being depressed or anxious increased as the more burdensome the participants rated their domestic work. This might especially be true in the third trimester, when pregnancy related complaints such as tiredness, pain, and a growing belly are more frequent. To tease out whether the timing of prenatal physical activity might impact the risk of postnatal depression, it may be important to assess levels of PA over the entire length of pregnancy or even from pre-pregnancy onwards.

A further key finding from this study is that women who engage in more sedentary behaviors at the end of their pregnancy have an increased likelihood of postpartum depression. This is of particular importance given the fact that pregnant women spend at least 70% of time awake in sedentary behaviors (34) and that sedentary time increases even in those that maintain recommended physical activity levels during pregnancy (30). We are aware of only one other study that examined the association between sedentary behavior in pregnancy and postpartum depression risk. Guida et al (35) reported that sedentary behavior during pregnancy increases the odds of PPD symptoms by approximately 34%, compared to 10% in our sample. However, they defined antenatal sedentary behavior as engaging in less than one day of physical activity per week, while the inactivity score on the PPAQ questionnaire corresponds more closely to the definition for sedentary behaviors (16). Psychosocial mechanisms have been suggested as possible mediators in the association between sedentary behaviors and depression with passive sedentary activities encouraging social isolation (14). As research investigating the association between sedentary behavior and postnatal depressive symptoms remains limited, further studies are needed to confirm this relationship.

Previous studies indicate that leisure-time physical activities pursued before or after birth reduce the risk for postpartum depression (36, 37). They possibly results in changes in physical self-worth and self-esteem due to mastering new tasks, having a greater sense of personal control, or distraction from negative or more stressful aspects of everyday life (11). Additionally, recreational exercise may be performed in a group, which could be a source of support for pregnant women by reducing their symptoms through social mechanisms. Yet, our results did not indicate a protective effect of leisure-time/sport activities in either the first or the third trimester on the occurrence of postpartum depression. This could be attributed to the fact that activities in the sports/exercise domains contributed relatively little to the total activity score, especially during the last trimester of pregnancy. While 22.9% of the EDEN participants practiced at least one sport at the beginning of their pregnancy, a considerable part discontinued their habitual sports practice subsequently. Some women may discontinue physical activity because of physical or emotional difficulties that may predict depression risk. As discontinuation of sport practice was not associated with previous or current mental health problems for the EDEN participants, future research is needed to confirm these hypotheses.

Methodological considerations

Previously, Demissie et al (13) failed to establish any correlation between domain-specific activity during pregnancy and risk for postpartum depression. As they evaluated levels of moderate to vigorous physical activity, few women in their sample reached these activity levels resulting in low variation in the total activity score. By taking into account all possible PA intensities in our analyses, we were able to evaluate more globally habitual activity levels in pregnant women. Also, the proportion of physical activity across domains reported by Demissie differed from our study, with a smaller percentage of women engaging in household or caregiving activities. While reporting on physical activity in the first trimester gives a reasonable representation of women's habitual level of physical activity, decreasing levels of overall and recreational activity during pregnancy have been reported in previous studies (38, 39). Unfortunately, we did not have information on the evolution of physical activity scores on the BQ questionnaire throughout pregnancy. Conversely, it is very likely that participants of the ELFE cohort who were physically active in their third trimester were equally so during their first trimester.

Strengths and limitations

Our study has several strengths, including its prospective design and the use of two birth cohorts, making it one of very few studies of this magnitude to study physical activity in pregnancy and subsequent depression. We used validated physical activity measures assessing the type, frequency, and duration of different domains of activity and studied their association with subsequent depression, which has rarely been done in a population of perinatal women. Finally, we controlled for a number of important confounding factors, including prenatal depression. However, we need to acknowledge some limitations. First, both cohorts suffered from selective attrition, which might have impacted the generalizability of our findings to more disadvantaged populations. Secondly, maternal depressive symptoms were ascertained using women's self-reports, rather than clinical diagnoses. However, the EPDS was designed with the purpose of identifying women who are depressed after childbirth and is widely used as a screening tool for PPD, with satisfactory sensitivity, specificity and positive predictive value (40). Third, physical activity measurement relied on self-report tools which might be subject to recall bias. Actual measures of physical activity or energy expenditure, such as activity monitoring using an accelerometer, heart rate monitor or double-labeled water could give more objective outcomes (41). However, these measures do not make it possible to characterize different domains of physical activity, which might be more pertinent for mental health effects than their intensity (42). Also, the Baecke Questionnaire was not specifically designed for use with pregnant women and did not include household and caregiving activities or inactivity which are particularly relevant for pregnant populations. Furthermore, the leisure-time activity score of the BQ is a mixture of sport activities, active locomotive activities and a sedentary behavior. This makes the score on this domain difficult to interpret compared to the distinct domains described by the PPAQ questionnaire,

which is one of the few validated questionnaires designed to assess physical activity among pregnant women. Finally, despite its prospective design and the control for a large number of potential confounders, we cannot entirely rule out the possibility of residual confounding, in particular due to non-measured postnatal characteristics (for instance maternal sleep quality). However, we did control for prior history of mental health problems and psychological distress during pregnancy, making it less plausible that our results are due to reverse causality.

Conclusions

Our results add to the very limited number of studies examining the relationship between physical activity domains during pregnancy and levels of depressive symptoms postnatally. Our study does not support findings from previous work that physical activity during pregnancy may help ameliorate mood disorders in postpartum mothers once confounding factors have been taken into account. Additionally, higher levels of household and caregiving activities and in particular sedentary behavior appear to increase the risk of postpartum depression. This indicates that it is important for studies on physical activity and mental health to look beyond indicators of total energy expenditure and also consider more nuanced aspects of the context in which PA is performed (43). Nevertheless, remaining active during pregnancy provides benefits for maternal health and quality of life and may also have a positive effect on fetal growth and fetal adaptation (44). Moreover, physical activity promotion efforts targeting this period may be linked to reduced risk of antenatal depression (5), which in turn is an important predictor for postnatal depression (1). While current recommendations for exercise during pregnancy support moderate intensity physical activity for a minimum of 15–30 minutes at least 3–5 times weekly (45), pregnant women are generally inclined to reduce their physical activity levels. Health care providers may need to be careful when recommending increasing physical activity as its purpose and context appears to be important in promoting mental wellbeing. Further, targeting reductions in sedentary behavior may be a propitious strategy for better mental health in this population. This may seem more attainable than participating in physical activity toward the end of pregnancy when a mother is likely to be most uncomfortable. Theory-based, face-to-face, telephone, and print-based lifestyle interventions effectively increase exercise levels among sedentary adults and could potentially be effective for pregnant and postpartum women (46). Additionally, modifications in sedentary behavior may be more easily maintained and could represent an important strategy to help manage postpartum mental health problems among women.

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Table 1 Characteristics of ELFE and EDEN cohort study participants (N (%) or mean (sd)), France 2003-2011				
	ELFE (n=15538)		**EDEN (n=1745)**	
	N (%)	mean (SD)	N (%)	mean (SD)
Sociodemographic characteristics				
Maternal age at delivery (years)		30.64 (5.06)		29.48 (4.89)
Nationality (Other than French)	1467 (8.27)		33 (1.89)	
Highest educational level (years)		13.33 (2.29)		13.58 (2.67)
Family situation (Separated)	978 (5.50)		151 (7.93)	
Employment in pregnancy (no)	3875 (22.21)		436 (22.8)	
Household income (1-6)		4.36 (1.34)		3.71 (1.31)
Financial difficulties (Yes)	8888 (49.13)		382 (20.02)	
Psychosocial characteristics				
History of mental health problems (yes)	1280 (10.79)		209 (10.96)	
Psychological distress during pregnancy (yes)	2222 (12.56)		264 (13.84)	
Substance use (smoking/alcohol) during pregnancy (yes)	4526 (25.36)		867 (49.68)	
Chronic health conditions (yes)	2391 (13.56)		293 (15.36)	
Social support (no)	1401 (8.93)		15 (0.85)	
Pregnancy related characteristics				
Parity				
0	8116 (45.94)		854 (44.80)	
1	6153 (34.78)		689 (36.11)	
2+	3407 (19.28)		264 (19.09)	
Pre-pregnancy body mass index (BMI) (kg/m^2)		23.48 (4.81)		23.27 (4.63)
Average gestational weight gain (kg)		13.17 (5.61)		13.41 (4.84)
Delivery type (C-section)	3173 (20.4)		301 (17.24)	
At least one pregnancy complication (yes)	5351 (30.49)		1102 (63.15)	
Hospitalization during pregnancy (yes)	2828 (18.20)		458 (26.24)	
Number of prenatal visits		8.60 (3.09)		8.67 (2.33)
Number of Echographies		4.70 (2.34)		4.13 (1.50)
Any birth preparation classes (no)	9765 (55.38)		859 (49.22)	
Physical activity during pregnancy * :				
Scores from Baecke Questionnaire (1^{st} trimester of pregnancy) (*range 1-5*)				
Occupational				2.40 (1.30-3.40)
Leisure-time				2.25 (2.00-2.75)
Sports/exercise				1.00 (1.00-1.00)
Sum score of the above 3 scores; range 3-15				5.85 (4.40-6.90)
Scores from Pregnancy Physical Activity Questionnaire (3^{rd} trimester of pregnancy) *($MET\text{-}h.wk^{-1}$)*				
Household/caregiving		69.47 (41.1-110.25)		
Occupational		19.00 (0.00-49.46)		
Transportation		9.50 (3.60-19.00)		
Leisure-time sedentary behavior		35.70 (19.95-55.65)		
Sports/exercise		3.38 (1.16-8.45)		
Total *(sum of the above 5 scores)*		158.46 (116.97-211.32)		

Interruption of sport practice since the beginning of pregnancy (yes)	--		568 (29.78)	
Postpartum depression (EPDS) (*cut-off score ≥12*)				
2 months	1902 (12.27)		--	
4 months	--		240 (12.60)	
8 months	--		220 (11.56)	
12 months	--		202 (10.60)	
* Physical activity scores are presented as Median (IQR- interquartile range) due to their non-normal distribution				

Table 2 Univariate and multivariate logistic regression analysis between physical activity in pregnancy and postpartum depressive symptoms, France 2003-2011								
	ELFE (n= 15,538)		**EDEN (n=1,745)**					
Physical activity during pregnancy	**PPD 2 months**		**PPD 4 months**		**PPD 8months**		**PPD 12 months**	
	Unadjusted OR (95%CI)	Adjusted[1] OR (95%CI)	Unadjusted OR (95%CI)	Adjusted[1] OR (95%CI)	Unadjusted OR (95%CI)	Adjusted[1] OR (95%CI)	Unadjusted OR (95%CI)	Adjusted[1] OR (95%CI)
PPAQ scores (3rd trimester of pregnancy) per 1 *MET-h.wk* increase								
Household/caregiving	1.23 (1.16-1.31)	1.10 (1.01-1.19)						
Occupational	0.92 (0.82-0.99)	0.99 (0.91-1.08)						
Transportation	1.16 (1.08-1.21)	1.08 (1.00-1.15)						
Leisure-time sedentary behavior	1.16 (1.07-1.22)	1.16 (1.06-1.23)						
Sports/exercise	0.98 (0.90-1.06)	1.02 (0.93-1.09)						
Total	1.20 (1.11-1.26)	1.12 (1.03-1.19)						
Baecke scores (1st trimester of pregnancy) per 1 point increase								
Occupational			0.81 (0.66-1.00)	0.93 (0.69-1.24)	0.83 (0.67-1.04)	1.05 (0.81-1.36)	0.81 (0.69-0.96)	1.05 (0.84-1.31)
Leisure-time			0.91 (0.78-1.07)	1.01 (0.86-1.19)	0.89 (0.75-1.08)	1.02 (0.84-1.23)	0.81 (0.59-1.12)	0.90 (0.64-1.28)
Sports/exercise			0.94 (0.81-1.09)	0.99 (0.85-1.16)	0.93 (0.81-1.08)	0.98 (0.84- 1.15)	0.91 (0.75- 1.10)	0.95 (0.78-1.17)
Total			0.79 (0.67-0.94)	0.94 (0.79-1.12)	0.79 (0.63-0.99)	0.99 (0.77-1.28)	0.78 (0.64-0.94)	0.98 (0.76-1.28)

[1] Adjusted for: age at delivery, nationality, maternal educational level, family situation, average household income, financial difficulties, study center, employment in pregnancy, history of mental health problems, psychological distress in pregnancy, smoking and alcohol use during pregnancy, social support, chronic health problems, pre pregnancy BMI, averages gestational weight gain, parity, pregnancy complications; hospitalization during pregnancy, prenatal care utilization

PPD: Postpartum Depression; PPAQ: Pregnancy Physical Activity Questionnaire

1