

Precarious working conditions and psychosocial work stress act as a risk factor for symptoms of postpartum depression during maternity leave: results from a longitudinal cohort study

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Research article

Keywords: postpartum depressive symptoms; peripartum health; maternal mental health; psychosocial work stress; effort-reward imbalance; precarious working conditions; DREAM study

Posted Date: April 20th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-21892/v1>

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Version of Record: A version of this preprint was published on October 6th, 2020. See the published version at <https://doi.org/10.1186/s12889-020-09573-w>.

Abstract

Introduction: Most Western women work during their reproductive years, but past research has often neglected the influence of work-related factors on postpartum health. Especially postpartum depression (PPD) puts an enormous psychological burden on mothers. Therefore, this study aims to investigate the prospective impact of precarious working conditions and psychosocial work stress (such as work-privacy conflict and effort-reward imbalance at the job) during pregnancy on symptoms of maternal PPD.

Methods: In the prospective-longitudinal cohort study DREAM (**D**Resdner Studie zu **E**lternschaft, **A**rbeit und **M**entaler Gesundheit), $N = 587$ employed women were questioned about their work during pregnancy and mental health 8 weeks after delivery.

Results: Multiple regression analyses revealed that work-privacy conflict, low reward at work, and precarious working conditions significantly predicted symptoms of PPD, even when controlling for lifetime depression, anxiety, education, parity, and age.

Conclusion: Our results indicate that psychosocial work stress and precarious working conditions have important implications for maternal peripartum mental health and might act as prospective risk factors for PPD even during the period of maternal leave. Hence, preventative measures targeting work life need to be investigated in more detail.

Background

Postpartum depression (PPD) is a common complication in the postpartum period, affecting 17.7% of the female population globally (1). Previous research has identified risk factors for PPD such as antenatal depression, anxiety, stressful life events (2), and factors associated with PPD such as income inequality, and working ≥ 40 h a week (1). PPD represents a major public health problem (3) and can have serious adverse consequences for the mothers, making it more difficult to care for the offspring and handle household duties and work duties at the same time (4). Moreover, maternal PPD can have serious consequences for the physical (5) or the emotional and cognitive development of the infant (6, 7). Additionally, severe PPD can, when persistent, be associated with higher prevalence rates of depression in the child at 18 years (8). However, confounding factors such as household income and parental education need to be considered when investigating the longterm effects of PPD (9, 10). There has been evidence that maternal work participation in general has a positive influence on female health (11, 12). However, certain aspects of work seem to increase the risk for depression, such as effort-reward imbalance (13) and work-privacy conflict, especially in women outside from the peripartum period (14, 15). This leads to the question, how much of an impact job and work-related factors during the prepartum period may have regarding peripartum mental health, especially PPD. Previous studies on risk factors during pregnancy have often neglected these psychosocial work factors and their impact on peripartum mental health. In the light of a changing work environment and more women returning to work within the first two years after delivery, these work-related factors need to be investigated to ensure health and well-being of the whole family.

The relation between working conditions and postpartum depression

Precarious working conditions

Employment conditions and employment approaches have changed over the past decades, but the health correlates of *precarious employment* have not yet been sufficiently investigated (16), especially not in women. Since there is no

standard definition of *precarious employment*, Vives et al. (16) developed an instrument assessing precarious employment as a multidimensional construct with the following six dimensions: *temporariness* (contract duration), *disempowerment* (level of negotiation of employment conditions), *vulnerability* (defenselessness to authoritarian treatment), *wages* (low or insufficient; possible economic deprivation), *rights* (entitlement to workplace rights and social security benefits), and *exercise rights* (powerlessness, in practice, to exercise workplace rights) (17). This construct has already been found to be linked to poor mental health, especially in women (18), but not yet to peripartum mental health. Evidence suggests that the subscale *vulnerability* has the highest correlation with mental health (16). The association seems to follow a dose-response function, i.e., the higher the precarious employment, the higher the prevalence of poor mental health in men and women (19). In addition, the association of working conditions with mental health seems to be of a complex nature as it has been suggested that precarious working conditions might also impact on work-privacy-conflict (20), which makes it necessary to include both concepts in more in-depth investigations.

Work-privacy conflict

The historical gender role of mothers only doing housework and taking care of the children without pursuing a career is no longer representing the majority of mothers (21), leading to mothers having two roles – as caretaker at home and as professional at the workplace. Hence, it is important to consider the reciprocal relationship of these two roles including potentially arising conflicts between them. Work-privacy conflict (WPC), and synonymous terms such as work-family conflict and work-life conflict, are understood as experiences from work that negatively impact experiences in the private/family domain (22). A growing body of research has investigated possible negative consequences of this spill-over, such as higher prevalence of burnout, depression, anxiety, and absenteeism from work as well as lower life satisfaction, lack of energy, sleep disorders, fatigue, and poorer self-reported health (23–25). WPC as psychosocial work stress can even be considered as an indicator of general psychological stress (26). Interestingly, a recent investigation found that the rise of depressive symptoms among training physicians could partly be explained by WPC, however this was only the case in female physicians (15). In addition, women with depression often reported to have a very high WPC (14) and a 2-year prospective study in Sweden could show the increased risk of poor self-rated health influenced by WPC was more pronounced in women compared to men (27). In general, mothers and women seem to be at greater risk for WPC (21), especially when holding a university degree or having a high socio-economic status (14). Given the diverse aspects of the work environment, it seems likely that other aspects of psychosocial working conditions, such as emotional and quantitative demands at the workplace, are related to WPC (14). Since pregnant women are facing enormous changes within their personal life, it seems necessary to investigate the impact of WPC on pregnant women and on PPD (28).

Effort-reward imbalance

Another concept to explain the impact of work factors on mental health is the effort-reward imbalance (ERI) model. It states why high-cost and low-gain conditions at work are considered particularly stressful for the individual and therefore are associated with negative impacts on health (29). The model claims that a lack of reciprocity between 'costs' and 'gains' from work may result in a state of emotional distress which can lead to negative consequences (30). Researchers have used the ERI ratio as a measure of effort-reward imbalance, where the *effort* score is divided by the *reward* score. Results from previous studies show that an increased ERI ratio is associated with physical, potentially negative, health biomarkers such as increased hypertension and lower heart-rate variability (31–33). Further findings also highlight the association with mental health problems such as depression (34), emotional exhaustion (35), and burnout (36, 37). A recent meta-analysis with eight cohort studies, including 84.963 employees from Europe, Canada, and the US, concludes that effort-reward imbalance is associated with an increased risk for depressive disorders. The authors explain that through three possible mechanisms: feelings of humiliation and deteriorating self-esteem caused

by mismatch of effort and reward, perception of entrapment and learned helplessness, and a dysregulated hypothalamic-pituitary-adrenal stress (HPA) axis caused by the mismatch (13). Although more research is needed to confirm these theories, Siegrist et al. (33) emphasized the idea of biomarkers, such as a dysregulated HPA-axis and altered functions of immune and inflammatory markers, acting as mediators of work stress and stress-related disorders such as depression.

Within the context of the peripartum period, studies are scarce. Up to date, only very few studies examined the ERI ratio within a peripartum population. Lee et al. (38) investigated whether maternal work-related stress during pregnancy influenced birth outcomes such as birthweight and gestational age. It was found that as ERI *reward* scores increased, gestational age also significantly increased. Moreover, an inverse relationship between the ERI ratio and gestational age has been observed. In this study, the ERI ratio was not significantly associated with birthweight. In contrast, Meyer, O'Campo, Warren, & Muntaner (39) could demonstrate such an association by examining a sample of 61 women multiple times over the course of their pregnancy. A declining ERI ratio was associated with higher birthweight. The effect on birthweight was robust to the inclusion of other occupational factors and stressors in the regression such as WPC. In addition, an earlier study found that an increasing ERI ratio was associated with higher systolic blood pressure in the peripartum period (40). Given this evidence, it was suggested to combine the ERI measure with other work stress indicators, such as WPC to investigate depressive symptomatology (41). Up to date, no profound investigation on PPD and work-related factors including multiple standardized tests to explore psychosocial work stress and precarious working conditions in expectant mothers has been conducted.

Aims and objectives

To close this gap, this study will examine working conditions during pregnancy and PPD symptoms at 8 weeks postpartum. The aim is to investigate the impact of precarious working conditions and psychosocial stress factors at work (WPC, and effort-reward imbalance) on symptoms of PPD to detect possible prospective risk factors for PPD in expectant mothers.

Methods

Study setting and participants

This investigation is part of the longitudinal cohort Dresden Study on Parenting, Work, and Mental Health (DREAM; DResdner Studie zu Elternschaft, Arbeit und Mentaler Gesundheit), which prospectively examines the relationship between parental work participation, role distribution, stress factors, and their effects on perinatal outcomes and long-term family mental and somatic health (42). Expectant mothers and their partners were recruited during pregnancy predominately at information evenings in hospitals and birth preparation courses in and around Dresden, Germany. The DREAM study consists of currently four measurement points, during which questionnaires covering a comprehensive field of physical and mental health outcomes are completed by participants. The measurement points encompass T1, during pregnancy, and three postpartum assessment waves: T2 at 8 weeks after the anticipated birth, T3 at 14 months, and T4 at 2 years after the actual birth (prolongation into middle childhood planned; for a detailed description of the study see Kress et al. 2019;42). For the purpose of the present study, data from expectant mothers on working conditions during pregnancy and PPD symptoms at 8 weeks postpartum were analyzed.

Study population and retention rate

By April 17th 2019, $n = 1,067$ expectant mothers had returned the first questionnaire (T1). Of the $n = 967$ mothers, who had already received the second questionnaire (T2), $n = 814$ (84.2%) women had returned the completed questionnaire on time. Study data are collected and managed using Research Electronic Data Capture (REDCap), hosted at the

“Koordinierungszentrum für Klinische Studien” at the Faculty of Medicine of the Technische Universität Dresden, Germany (43, 44).

Women were included in the analysis if they either worked work full-time, part-time, had minor employment, were in apprenticeship, or were already on maternal leave or employment ban from a previous job. Female participants on employment ban or maternal leave were asked to answer the questions according to their last 6 months of employment before the current pregnancy. Women in self-employment were excluded from the analysis due to the theoretical concepts of the used measures for work stress.

All participants, regardless of their employment situation, were asked about their lifetime history of major depression (45) and $n = 85$ (10.9%) participants responded positively to the symptoms for a probable lifetime diagnosis. In addition, data for $n = 35$ (4.3%) participants for a probable lifetime diagnosis of depression were missing. To only assess incident depression, these participants were excluded from all analyses. Because of missing data and exclusion of outliers, n varied slightly between the different analyses.

Measures

Adverse psychosocial work conditions as predictors for PPD

Psychosocial work characteristics were assessed by the German version of the ERI (30), the WPC (46, 47) derived from the Copenhagen Psychosocial Questionnaire (COPSOQ; 42), and the EPRES (17).

The EPRES assesses precarious working conditions and was specifically designed for epidemiological studies among waged workers (16). In past investigations, it has shown good acceptability, internal consistency, reliability (Cronbach's alpha coefficients ≥ 0.70), and construct validity (16). The subscale *disempowerment* was excluded in this study due to large heterogeneity of employment approaches within the sample. The overall EPRES score, ranging from 0 (not precarious) to 4 (most precarious), is the arithmetic mean of the subscale scores.

The COPSOQ was designed to assess a range of psychosocial factors in the work environment (48). For the purpose of this study, the subscale WPC (47) with 7 items from the German version of the COPSOQ was used, which has been associated with overall demands at work, specifically with cognitive and emotional demands and has been previously shown to be associated with depression in a study done by Garthus-Niegel et al. (14). The scale has very good internal consistency (Cronbach's alpha = 0.92; (49)). An example item is “Do you feel that your work drains so much of your energy that it has a negative effect on your private life?”. Response categories ranged from “to a small extent” (1) to “to a large extent” (5), and the answers from the response categories were transformed to fit the range 0-100 (48). High levels on the subscale indicate a higher WPC, meaning that work interferes with a person's private life.

The ERI elaborates the psychosocial working conditions and a possible imbalance between effort put into the job and reward achieved from it. The standardized self-report measure consists of three subscales: *effort*, *reward*, and *overcommitment*. For the purpose of this study, the short-version of the ERI was used (30). It includes three items concerning *effort* and seven items concerning *reward*. Example items are: “I have constant time pressure due to a heavy workload” (*effort*), and “Considering all my efforts and achievements, I receive the respect and prestige I deserve at work” (*reward*). The ERI has satisfactory validity (30) and has been applied in Germany with good psychometric properties (overall Cronbach's alpha ≥ 0.77) of the short version in industrial workers (50). Response categories ranged from “full disagreement” to “full agreement with the respective statement”. Sum scores were calculated for the two subscales, where higher scores reflect higher effort and higher reward. The ERI ratio, the core indicator of the ERI model, was then calculated by dividing the *effort* by the *reward* subscale sum scores, weighted by the number of items (51). Higher values of the ratio express a higher level of imbalance between (high) effort and (low) reward.

Outcome measure for symptoms of postpartum depression

PPD was measured by the German version of the Edinburgh Postnatal Depression Scale (EPDS; 47). The EPDS is the most common scale to screen for symptoms of PPD across the perinatal period (53) and has been validated in numerous studies (53). The EPDS is a 10-item self-report scale, scored on a four point scale (0–3; 49). It ranges from 0–30. Higher scores indicate stronger symptoms of PPD. For the sample description, the prevalence of PPD will be reported using the most common cut off scores of ≥ 10 to indicate minor depression and ≥ 13 to indicate major depression (52, 55).

Covariates

According to the literature age, parity, anxiety, and professional education were selected as potential confounders (56). Anxiety was measured with the anxiety subscale of the validated German version of the Symptom-Checklist Revised (SCL-90-R;57)). The scale ranges from 0–40 and higher scores indicate higher levels of anxiety (57).

Statistical analyses

Descriptive and correlational analyses were carried out to acquire information on the prevalence and link between symptoms of PPD, psychosocial work stress, and precarious working conditions within the sample. Thereafter, linear regression models were calculated to analyze the prospective influence of the same psychosocial work stress factors and precarious working conditions on symptoms of PPD (used as a continuous measure). Due to the prospective design, possible risk factors as defined by Kraemer et al. (58) could be identified. Therefore, all predictors were separately tested for their prospective impact on PPD (see Table 2–3) before using all predictors within one regression model (see Table 4–5). Forced entry was used. All the predictors and covariates showed sufficient internal consistency with Cronbach's alpha scores $> .70$ with the exception of the scale *rights* from the EPRES questionnaire (Cronbach's alpha = .30). All analyses were conducted using IBM SPSS Statistics (59).

Results

Sample characteristics

The final sample consisted of $n = 587$ expectant mothers at T1. The characteristics of the sample are summarized in Table 1.

Table 1
Sample characteristics at T1 (during pregnancy) and depressive symptoms at T2

Sample characteristics	<i>n</i> ^a (%)	Mean ± <i>SD</i> (Range)
Age		30.10 ± 3.88 (20–43)
Week of pregnancy		30.49 ± 5.94 (12–40)
Country of birth		
Germany	571 (97.6)	
Other	14 (2.4)	
Education		
Lower secondary education	5 (0.9)	
Secondary school certificate	121 (20.6)	
Advanced technical college entrance qualification	50 (8.5)	
Subject-related or higher education entrance qualification (A-level)	411 (70.0)	
Professional education		
No university degree	244 (41.6)	
University degree	342 (58.4)	
Children		
		0.25 ± .525 (0–3)
None	461 (79.1)	
One child	104 (17.8)	
Two	14 (2.4)	
Three	4 (0.7)	
Partnership status		
Married/registered same sex partnership	245 (41.8)	
Unmarried	319 (54.4)	
Divorced	20 (3.4)	
Widowed	1 (0.2)	
Unknown	1 (0.2)	
Employment status^b		
Full-time employment	286 (48.7)	
Part-time employment	89 (15.2)	
Marginal employment	17 (2.9)	

Note. ^a *n* slightly varies due to missing data of some participants. ^b Multiple answers allowed. ^c Subscale of Symptom-Checklist Revised (SCL-90-R). ^d EPDS = Edinburgh Postnatal Depression Scale.

Sample characteristics	<i>n</i> ^a (%)	Mean ± <i>SD</i> (Range)
Still in apprenticeship	4 (0.7)	
Employment ban	176 (30.0)	
Parental leave	21 (3.6)	
Monthly income of main job (after taxes)		
Less than 450 €	14 (2.4)	
451–850€	8 (1.4)	
851–1,500 €	176 (30.3)	
1,501–2,500 €	325 (56.0)	
Anxiety ^c (Range 0–40)		2.30 ± 2.67 (0–22)
EPDS ^d at T2 (Range 0–20)		5.53 ± 3.65 (0–20)
EPDS ≤ 9	503 (86.3)	
EPDS 10–12	51 (8.7)	
EPDS ≥ 13	29 (5.0)	
<i>Note.</i> ^a <i>n</i> slightly varies due to missing data of some participants. ^b Multiple answers allowed. ^c Subscale of Symptom-Checklist Revised (SCL-90-R). ^d EPDS = Edinburgh Postnatal Depression Scale.		

Mean age of the participants was 30.10 years ($SD = 3.88$; Range = 20–43). The majority of participants was born in Germany (97.6%), expected their first child (79.1%), and was in the third trimester of pregnancy (76.4%). Almost all women reported to be in a permanent relationship (99.1%) and to be living with their partner permanently (96.7%). Regarding current employment at T1, 48.7% of the sample reported to be working full-time and 15.3% to be working part-time. As most women completed the questionnaire during their third trimester of pregnancy, 30.0% of women were on employment ban. Regarding monthly income, 56.0% of women reported to have an income of 1,501–2,500 € after taxes. With 58.4% of the sample holding a university degree, the sample consisted of women with a higher education compared to the average female population in Dresden (60). At 8 weeks after the anticipated birth (T2), the infants were between 5–24 weeks old ($M = 8.58$, $SD = 2.42$). The average EPDS score was 5.53 ($SD = 3.65$) and 83 women (13.7%) had scores of at least 10, indicating minor depression (52, 55). This prevalence is similar to recent findings in Germany regarding PPD (61).

Dropout analyses

Dropout analyses were conducted for sociodemographic characteristics, predictors, and confounders (tables on request). A significant difference between completers vs. non-completers were only found for the EPRES scores and for the relationship status of completers vs. non-completers. Completers were more often in a permanent relationship (99.2% vs 97.4%; $\chi^2(1, n = 828) = 3.88, p = .049$) and had slightly less precarious working conditions ($MW = 1.03$ vs $MW = 0.94$; $t(748) = -2.44, p = .001$).

Precarious working conditions and psychosocial work stress

Precarious working conditions

Precarious working conditions measured with the overall EPRES score ($M = 1.02$, $SD = 0.46$) were significantly positively correlated with PPD ($r(528) = .209$, $p < .001$) and significantly positively associated ($\beta = .157$, $p < .05$) with symptoms of PPD (Model 1, Table 2) when controlling for anxiety, age, parity, and professional education at T1. When calculating a regression model with the EPRES subscales (Model 2, Table 2), only the scale *wages* showed a significant positive association with symptoms of PPD ($\beta = .158$, $p < .05$), whereas the other scales showed no significant association. When doing two explorative multiple linear regressions, this time only including participants with a university degree vs participants without a university degree, this effect could especially be shown in participants with a university degree ($\beta = .191$, $p < .05$), whereas the association could not be found in participants without a university degree (data not shown).

Table 2
Effects of precarious working conditions on PPD, controlled for age, professional education, and anxiety

	Model 1				Model 2			
	<i>SE B</i>	β	<i>p</i>	R^2	<i>SE B</i>	β	<i>P</i>	R^2
Constant	3.285		.008	.148	3.088		0.15	.161
Education	-0.125	-0.018	.660		0.117	0.017	.695	
Anxiety ^a	0.423	0.317	.000		0.395	0.296	.000	
Age	0.003	0.003	.939		0.001	0.001	.984	
Parity	-0.493	-0.059	.170		-0.684	-0.082	.063	
EPRES ^b	1.144	0.157	.000					
EPRES ^b temporariness					0.018	0.006	.887	
EPRES ^b vulnerability					0.330	0.069	.141	
EPRES ^b wages					0.565	0.158	.001	
EPRES ^b rights					0.011	0.003	.950	
EPRES ^b exercise rights					0.238	0.058	.200	

Note. *SE B* = standard error for unstandardized beta. β = standardized beta coefficient. R^2 = coefficient of determination. ^a Subscale of Symptom-Checklist Revised (SCL-90-R). ^b Employment Precariousness Scale (EPRES). Significant associations ($p < .05$) are presented in bold.

Psychosocial work stress

There was a positive association between ERI as well as WPC and PPD. Pearson correlation between ERI, WPC, and PPD ranged from $r(564) = .178$; $p < .001$) between ERI and PPD, to $r(576) = .198$; $p < .001$), between WPC and PPD. First, regression analyses were carried out individually for the ERI ratio (Model 1), the ERI subscales *effort* and *reward* (Model 2), and WPC (Model 3, Table 3) controlled for age, professional education, and anxiety. The ERI ratio ($M = 1.09$, $SD = 0.37$) and the WPC scores ($M = 30.17$, $SD = 19.26$) were both significantly positively associated with the EPDS scores ($\beta = .112$; $\beta = .125$, $p < .05$). Within the ERI, only the subscale *reward* ($M = 19.21$, $SD = 3.60$) was significantly negatively associated with symptoms of PPD ($\beta = -.143$, $p < .05$).

Table 3

Effects of psychosocial work stress on PPD, controlled for age, professional education, anxiety, and parity

	Model 1				Model 2				Model 3			
	<i>SE B</i>	β	<i>p</i>	<i>R</i> ²	<i>SE B</i>	β	<i>p</i>	<i>R</i> ²	<i>SE B</i>	β	<i>p</i>	<i>R</i> ²
Constant	3.214		.005	.123	6.576		.000	.132	3.789		.001	.125
Education	-0.251	-0.037	.369		-0.204	-0.030	.465		-0.255	-0.037	.361	
Anxiety ^a	0.396	0.293	.000		0.393	0.291	.000		0.394	0.286	.000	
Age	0.012	0.014	.739		-0.010	0.011	.792		0.006	0.006	.880	
Parity	-0.566	-0.068	.108		-0.591	-0.070	.092		-0.427	-0.050	.224	
ERI ^b ratio	1.018	0.112	.007									
ERI ^b reward					-0.134	-0.143	.001					
ERI ^b effort					0.046	0.026	.523					
WPC ^c									0.026	0.145	.000	

Note. *SE B* = standard error for unstandardized beta. β = standardized beta coefficient. *R*² = coefficient of determination. ^a Subscale of Symptom-Checklist Revised (SCL-90-R). ^b Effort-reward imbalance (ERI). ^c work-privacy conflict (WPC). Significant associations (*p* < .05) are presented in bold.

Precarious working conditions and psychosocial work stress

All three predictors correlated with each other, according to Cohens conventions, within the range of a medium effect size: $r(518) = .288$; $p < .001$) between EPRES and WPC, $r(518) = .320$; $p < .001$) between EPRES and ERI, and $r(518) = .400$; $p < .001$) between WPC and ERI. When including those three predictors in a multiple regression analysis with PPD as outcome controlled for age, professional education, anxiety, and parity, the EPRES ($\beta = .131$, $p < .05$) and WPC scores ($\beta = .094$, $p < .05$) remained significantly positively associated with PPD (Table 4).

Table 4

Effects of psychosocial work stress and precarious working conditions on PPD, controlled for age, professional education, anxiety, and parity; $R^2 = .153$

	<i>B</i>	<i>SE B</i>	β	95% CI	<i>p</i>
Constant	1.817	1.281		[-0.699; 4.334]	.157
Education	-0.246	0.294	-0.036	[-0.823; 0.331]	.402
Anxiety ^a	0.378	0.057	0.281	[0.266; 0.490]	.000
Age	0.042	0.040	0.047	[-0.037; 0.121]	.299
Parity	-0.819	0.367	-0.026	[-1.540; -0.098]	.061
EPRES ^b	0.983	0.343	0.131	[.309; 1.657]	.004
WPC ^c	0.017	0.008	0.094	[0.001; 0.032]	.041
ERI Ratio ^d	0.227	0.430	0.025	[-0.618; 1.072]	.598
<p><i>Note.</i> <i>B</i> = unstandardized regression coefficient, <i>SE B</i> = standard error for unstandardized beta. β = standardized beta coefficient. R^2 = coefficient of determination. ^a Subscale of Symptom-Checklist Revised (SCL-90-R). ^b Employment Precariousness Scale (EPRES). ^c work-privacy conflict (WPC). ^d Effort-reward imbalance (ERI). Significant associations ($p < .05$) are presented in bold.</p>					
<p>Since the <i>effort</i> subscale of ERI was not significantly associated with symptoms of PPD, the analysis was replicated with solely the <i>reward</i> subscale. In this analysis, all three predictors were variable risk factors for PPD (Table 5).</p>					

Table 5

Effects of psychosocial work stress and precarious working conditions on PPD, controlled for age, professional education, and anxiety; $R^2 = .159$

	<i>B</i>	<i>SE B</i>	β	95% CI	<i>p</i>
Constant	4.319	1.758		[0.865; 7.774]	.014
Education	-0.238	0.292	-0.035	[-0.811; 0.335]	.415
Anxiety	0.374	0.056	0.278	[0.263; 0.485]	.000
Age	0.032	0.040	0.036	[-0.047; 0.111]	.431
Parity	-0.820	0.365	-0.097	[-1.538; -0.102]	.025
EPRES	0.724	0.365	0.097	[0.006; 1.441]	.048
WPC	0.017	0.008	0.094	[0.002; 0.032]	.030
ERI Reward	-0.088	0.044	-0.092	[-0.175; -0.001]	.047
<p><i>Note.</i> <i>B</i> = unstandardized regression coefficient, <i>SE B</i> = standard error for unstandardized beta. β = standardized beta coefficient. R^2 = coefficient of determination. ^a Subscale of Symptom-Checklist Revised (SCL-90-R). ^b Employment Precariousness Scale (EPRES). ^c work-privacy conflict (WPC). ^d Effort-reward imbalance (ERI). Significant associations ($p < .05$) are presented in bold.</p>					

Discussion

The aim of this study was to investigate the prospective influence of work-related factors on symptoms of PPD, i.e., whether precarious working conditions, WPC, and ERI ratio increase the risk for PPD. In this prospective cohort study precarious working conditions, WPC, and ERI ratio were each significantly positively associated with symptoms of PPD within regression models, when controlling for age, professional education, parity, and anxiety during pregnancy. Within a regression including all three predictors, i.e., precarious working conditions, WPC, and the ERI *reward* scale), all predictors remained significantly associated with PPD. Therefore, precarious working conditions and WPC might act as prospective risk factors for PPD, whereas *reward at work* might act as a protective factor.

Precarious working conditions

Precarious working conditions such as defenselessness to authoritarian treatment (subscale *vulnerability*), low or insufficient wages, less social security benefits, less workplace rights, and powerlessness to exercise those rights might act as prospective risk factors of PPD. The effects seem to spill over into the postpartum period of maternity leave. In this study, the subscale *wages* showed the strongest association with symptoms of PPD within participants with higher education. The association of *wages* with symptoms of PPD was surprising as a recent meta-analysis found no association between education or income as a risk factor for PPD (62). A higher association with *vulnerability* was expected since its previously found strong relationship with mental health (16).

Work-privacy conflict and effort-reward imbalance

A perceived interference from work into private life might and also a perceived imbalance between effort put into and reward achieved from work act as a prospective risk factor for symptoms of PPD. The effects seem to spill over into the postpartum period. In another study comparing the measures of WPC and ERI, the association between effort-reward imbalance and PPD was not stronger than the association between WPC and PPD. Among hospital employees in Switzerland, both concepts were found to be significantly associated with burnout, but WPC was found to be a stronger predictor for burnout than the ERI among health professionals (63). Interestingly, when looking at groups of hospital staff with different levels of professional education, the ERI ratio has been found to be more relevant for burnout in tertiary-educated staff than WPC. This indicates that in higher educated, professional groups such as therapists, physicians, and medical-technical staff, WPC seems less important than an effort-reward imbalance for mental health (63). This could be due to a different perspective on the job such as higher personal commitment and will to work after hours. In contrast, higher educated professionals generally show a higher ERI ratio (51) and therefore might be particularly susceptible to burnout or other negative health outcomes. Hence, future analysis should classify between different kinds of professional groups within the peripartum population to investigate different influences of WPC and ERI on PPD. Moreover, among employees in a hospital setting, Hämmig (36) could show that exposure to stress and the outcomes burnout and intention to leave the profession were partly or largely mediated by WPC and ERI in physicians. Whereas WPC predicted burnout symptoms, the ERI ratio most strongly predicted thoughts of leaving the profession, indicating that WPC and ERI measure different aspects of psychosocial work stress and therefore might predict different outcomes (36). More research is needed to draw better conclusions.

While the ERI ratio did not remain a significant predictor of PPD in a regression with WPC and precarious working conditions (see Table 4), the ERI subscale *reward* did prove to be a significant predictor of PPD. The *reward* subscale had a stronger association with the outcome in the peripartum period. This has also been found in another study, where *reward*, rather than *effort*, was found to be positively associated with gestational age (38). Recent findings indicate that ERI scores can fluctuate during the prepartum period (39, 40). The factor scores for *effort* and *reward* seem to decline during the course of pregnancy, which means that women put less effort into work but also receive

less reward from it. Siegrist & Li (33) also conclude that aspects of low reward at work seem to be particularly important for biomarkers and therefore physical correlates of health. *Reward* at work therefore might be especially important for expectant mothers and should thus be investigated to a greater extent. It further needs to be noted that a steady ERI ratio was not shown for all participants in those previous studies (39, 40). Therefore, it seems important to consider individual or systematic differences in the trajectory of the ERI.

Strengths and limitations

This study is the first one to include multiple theoretical approaches of work stress within a representative sample of women in the peripartum period. In addition, no studies were found that applied the WPC and the EPRES to the peripartum period. The investigation is part of a large prospective-longitudinal cohort study covering many fields of interest regarding employment, mental health, and associated factors (42). Therefore, it will be possible to incorporate more theoretical concepts and factors in future analyses. Examples include paternal mental health as well as hair cortisol levels of fathers, mothers, and their offspring as biological indicators of stress within the DREAM-study. It is the aim to further investigate the impact of work-related factors on the well-being of all family members.

However, some possible limitations need to be noted. The applications of findings in this study to the general population might be limited because the sample is highly educated in comparison to the general female population of Dresden. However, previous research has shown that self-selection according to sociodemographic variables such as education had little impact on prevalence estimates (64). Concerning the predictors, the ERI ratio itself might be modified by the peripartum period with changing perspectives on work (40). Changes of the ERI score could not be observed due the lack of assessment before the pregnancy. Within the EPRES, the scale *rights*, concerning workplace rights, showed a low internal consistency unlike described by the authors (16, 17). This could be due to the used answer categories: “yes”, “no”, “don’t know”: Most of the participants in this study were in an employment situation with the workplace right “paid maternity leave”, but most did not know whether they would receive a dismissal wage. When recoding the answer “don’t know” into “missing”, the internal consistency of this scale rose to Cronbach’s alpha = .67. Moreover, the dropout analyses showed a slightly higher EPRES score for completers vs non-completers. Women with more precarious working conditions might have been particularly motivated to take part in the study to promote change within the workplace for pregnant women.

Implications

Since outcomes and consequences of PPD on the ones affected, their families, and especially their children are considered to be severe, a longitudinal approach including risk and protective factors is necessary to provide the best basis for effective treatment approaches. Therefore, work-related factors need to be considered when screening for PPD or during treatment of PPD. Future analyses should include more confounding variables, such as social support and paternal mental health.

WPC should be lowered, especially considering the upcoming changing private situation of women during the perinatal period. The finding that WPC remained significantly associated with PPD when controlling for other psychosocial stress factors at work highlights the importance of introducing strict work guidelines to prevent employers working from home after working hours. Previous research suggests that various family-specific support systems, such as family friendly organizational policies and climate can reduce WPC (65). A growing body of research has investigated family-supportive supervisors, i.e., supervisors at work who promote the management of work and non-work responsibilities and acknowledge their employees private life (66, 67). The concept might be an effective approach for improving employee work, family, and health outcomes (66). Additionally, mindfulness and self-monitoring trainings (68) as well as cognitive-behavioural interventions such as coaching sessions (69) have recently been investigated to successfully reduce WPC.

Further, reward at work seems to be a protective factor against symptoms of PPD for expecting mothers. Women could experience less appreciation and reward at work in their peripartum period due to changing physical capacity and shifting priorities away from the job. Valuing the efforts spent at work during late pregnancy might protect mothers from PPD symptoms and additionally prepare them for a better re-entry into employment after maternity leave.

Some factors of precarious employment, especially defenselessness to authoritarian treatment and low or insufficient wages, seem to increase the risk for PPD. Therefore, special workplace policies are necessary. Julià, Vives, Tarafa, & Benach (19) suggested a surveillance system to monitor different precarious employment dimensions and identify populations at risk to reduce mental health impact. Moreover, the high association of *wages* with PPD compared to the other factors in this study raises the discussion of equal payment for women in relation to men. It is especially interesting that lower wages in more educated women are associated with an increased risk for PPD.

Conclusion

The aim of the present prospective-longitudinal cohort study was to measure potential work-related risk factors for PPD. Precarious working conditions, especially defencelessness against authoritarian behaviour, low or insufficient wages, and WPC might act as potential risk factors for PPD. Reward at work might act as a potential protective factor against PPD and should be promoted. Interventions to reduce precarious working conditions, WPC, and ERI might help to reduce the risk for PPD in the postpartum period.

List Of Abbreviations

PPD, postpartum depression;

EPRES, The Employment Precariousness Scale

DREAM, Dresden Study on Parenting, Work, and Mental Health (“DResdner Studie zu Elternschaft, Arbeit und Mentaler Gesundheit”);

T1, measurement point during pregnancy;

T2, measurement point 8 weeks after the anticipated birth;

SCL-90-R; Symptom-Checklist Revised;

EPDS, Edinburgh Postnatal Depression Scale;

Declarations

Ethical considerations: Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine of the Technische Universität Dresden (No: EK 278062015) prior to conducting the DREAM study. Potential participants were given written information about the purpose and the procedure of the study during recruitment. Pseudonymization and confidentiality were assured, and participants were informed that they could withdraw from the study at any time. All participants signed a declaration of consent.

Consent for publication: Not applicable.

Availability of data and materials: Not applicable.

Competing interests: None.

Acknowledgements: We want to thank all (expectant) mothers for supporting our project. Furthermore, we want to thank all cooperating clinics and midwives for providing access to potential participants as well as all colleagues and (doctoral) students performing the recruitment.

Funding: The DREAM study is funded by the German Research Foundation (“Deutsche Forschungsgemeinschaft”; DFG) [grant number GA 2287/4-1]; and by the German Society of Psychosomatic Obstetrics and Gynecology (“Deutsche Gesellschaft für Psychosomatische Frauenheilkunde und Geburtshilfe”; DGPF e.V.). The sponsors were not involved in study design; in collection, analysis and interpretation of data; in writing of the report; and in the decision to submit the article for publication.

Authors’ contributions:

MK performed the statistical analyses, drafted the initial manuscript, and reviewed and revised the manuscript. RS, VK, and MKo supported the conduction of the study, especially through data collection and contributed with the interpretation of the data. VK and MKo prepared the data for statistical analyses. KW provided resources for the acquisition of data in the DREAM study and contributed with her clinical expertise and in the interpretation of the data. JM contributed with her expertise in the research field and in the interpretation of the data. SGN acquired the funding, was responsible for conception and design of the DREAM study as well as the coordination and supervision of the (ongoing) data collection, and she contributed with her expertise in the research field and in the interpretation of the data. All authors critically reviewed the manuscript, approved the final version as submitted, and agree to be accountable for all aspects of the work.

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