

Appendix: MoBA items included in prenatal maternal stress exposure variable

Life Stress Domain:

Scale/Item	Time of Assessment	Variable Type	References
Adverse events – Have you lost someone close to you?	30 weeks	Dichotomous (yes/no)	Coddington, 1972; Dyrdal, 2018; Røsand, 2012
Adverse events – Child, partner, or relative was seriously ill	30 weeks	Dichotomous (yes/no)	Coddington, 1972; Dyrdal, 2018; Røsand, 2012
Adverse events – You were ill	30 weeks	Dichotomous (yes/no)	Coddington, 1972; Dyrdal, 2018; Røsand, 2012
Adverse events – Robbery, fire	30 weeks	Dichotomous (yes/no)	Coddington, 1972; Dyrdal, 2018; Røsand, 2012
Unplanned pregnancy	17 weeks	Dichotomous (yes/no)	N/A
Worried about health of baby	30 weeks	Dichotomous (yes/no)	N/A
Dissatisfied with antenatal care	30 weeks	Dichotomous (yes/no)	N/A
Experienced vaginal bleeding during pregnancy	30 weeks	Dichotomous (yes/no)	N/A
Test to see if baby was abnormal (amniocentesis or biopsy)	30 weeks	Dichotomous (yes/no)	N/A

Contextual Stress Domain

Scale/Item	Time of Assessment	Variable Type	References
Adverse events – problems at school or work	30 weeks	Dichotomous (yes/no)	Coddington, 1972; Dyrdal, 2018; Røsand, 2012
Adverse events – major financial problems	30 weeks	Dichotomous (yes/no)	Coddington, 1972; Dyrdal, 2018; Røsand, 2012
Financial difficulties – can your family manage without your income?	17 weeks	Dichotomous (yes/no)	N/A
Employment – lost job since start of pregnancy (fired, laid off)	30 weeks	Dichotomous (yes/no)	N/A
Employment – work stress scale	17 weeks	Dichotomous (median split)	Kristensen et al., 2008; Magnus et al., 2018
- I have physically heavy work ^R			-
- My work is very stressful ^R			-
- I learn a lot at work			-
- My work is very monotonous ^R			-
- My work demands a lot of me ^R			-
- I am able to decide how my work is to be carried out			-
- There is a good team spirit at my place of work			-
- I enjoy my work			-
Income – low income (< 300,000 NOK per year)	17 weeks	Dichotomous (yes/no)	Berglundh et al., 2021; Winkvist et al., 2015

Note. ^R Item reverse coded

Personal Stress Domain:

Scale/Item	Time of Assessment	Variable Type	References
Early parenthood (maternal age 18 and under)	17 weeks	Dichotomous (yes/no)	N/A
Feeling fearful	30 weeks	Dichotomous (yes/no)	Strand et al., 2003; Tambs and Moum, 1993
Nervousness or shakiness inside	30 weeks	Dichotomous (yes/no)	Strand et al., 2003; Tambs and Moum, 1993
Feeling hopeless about the future	30 weeks	Dichotomous (yes/no)	Strand et al., 2003; Tambs and Moum, 1993
Feeling blue	30 weeks	Dichotomous (yes/no)	Strand et al., 2003; Tambs and Moum, 1993
Worrying too much about things	30 weeks	Dichotomous (yes/no)	Strand et al., 2003; Tambs and Moum, 1993
Feeling everything is an effort	30 weeks	Dichotomous (yes/no)	Strand et al., 2003; Tambs and Moum, 1993
Feeling tense or keyed up	30 weeks	Dichotomous (yes/no)	Strand et al., 2003; Tambs and Moum, 1993
Suddenly scared for no reason	30 weeks	Dichotomous (yes/no)	Strand et al., 2003; Tambs and Moum, 1993
Maternal substance use	17 weeks	Dichotomous (yes/no)	N/A

Interpersonal Stress Domain:

Scale/Item	Time of Assessment	Variable Type	References
> 3 children under 18 in household	17 weeks	Dichotomous (yes/no)	N/A
I have a close relationship with my spouse/partner ^R	17 weeks	Dichotomous (yes/no)	Røysamb et al., 2014
My partner and I have problems in our relationship	17 weeks	Dichotomous (yes/no)	Røysamb et al., 2014
I am very happy with our relationship ^R	17 weeks	Dichotomous (yes/no)	Røysamb et al., 2014
My partner is generally understanding ^R	17 weeks	Dichotomous (yes/no)	Røysamb et al., 2014
I often consider ending our relationship	17 weeks	Dichotomous (yes/no)	Røysamb et al., 2014
I am satisfied with my relationship with my partner ^R	17 weeks	Dichotomous (yes/no)	Røysamb et al., 2014
We frequently disagree on important decisions	17 weeks	Dichotomous (yes/no)	Røysamb et al., 2014
I have been lucky in my choice of a partner ^R	17 weeks	Dichotomous (yes/no)	Røysamb et al., 2014
We agree on how our child should be raised ^R	17 weeks	Dichotomous (yes/no)	Røysamb et al., 2014
I believe my partner is satisfied with our relationship ^R	17 weeks	Dichotomous (yes/no)	Røysamb et al., 2014
Adverse Events – Arguments with family or friends	30 weeks	Dichotomous (yes/no)	Coddington, 1972; Dyrdal, 2018; Røsand, 2012
Adverse Events – Recent separation or divorce	30 weeks	Dichotomous (yes/no)	Coddington, 1972; Dyrdal, 2018; Røsand, 2012
Social Support scale	17 weeks	Dichotomous (median split)	Henriksen and Thuen, 2015
- Do you have anyone other than your husband/partner you can ask for advice in a difficult situation		Dichotomous (median split)	-
- How often do you meet or talk on the telephone with your family (other than your husband/partner and children) or close friends?			-
- Do you often feel lonely			-

Notes. ^RItem reverse coded

Table S1. Pearson correlations between Stress Domains and Child Internalizing and Externalizing Disorders

	Prenatal Contextual Stress	Prenatal Interpersonal Stress	Prenatal Life Stress	Prenatal Personal Stress	Depressive Symptoms, Age 8	Anxiety Symptoms, Age 8	Conduct Disorder Symptoms, Age 8	ADHD Symptoms, Age 8	ODD Symptoms, Age 8
Prenatal Contextual Stress	-	-	-	-	-	-	-	-	-
Prenatal Interpersonal Stress	0.17***	-	-	-	-	-	-	-	-
Prenatal Life Stress	0.15***	0.16**	-	-	-	-	-	-	-
Prenatal Personal Stress	0.25***	0.28***	0.27***	-	-	-	-	-	-
Depressive Symptoms, Age 8	.13***	.10***	.09***	.20***	-	-	-	-	-
Anxiety Symptoms, Age 8	.05***	.05***	.05***	.12***	.23***	-	-	-	-
Conduct Disorder Symptoms, Age 8	.07***	.07***	.03***	.08***	.35***	.03***	-	-	-
ADHD Symptoms, Age 8	.11***	.10***	.08***	.16***	.49***	.10***	.41***	-	-
ODD Symptoms, Age 8	.08***	.08***	.04***	.14***	.50***	.16***	.52***	.53***	-

Note. ADHD = attention-deficit hyperactivity disorder, ODD = oppositional defiant disorder. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table S2. Comparison between included and excluded mothers on study variables

Characteristic	Included (n = 15,963)		Excluded (n = 94,158)		p-value ^a
	n	Mean (SD) or %	n	Mean ± SD or %	
Maternal age	15,963	30.48 ± 4.37	86,180	29.63 (4.63)	< .0001
Parity					
0	8,080	50.62	37,732	40.07	< .0001
1+	7,753	48.57	46,408	49.29	
Missing	130	0.81	10,018	10.64	
Marital status					
Married	7,722	48.37	41,325	43.89	< .0001
Cohabiting	7,820	48.99	41,346	43.91	
Single	354	2.22	3,059	3.25	
Missing	67	0.42	8,428	8.95	
Maternal education					
> High school	11,960	74.92	50,163	53.28	< .0001
High school and below	3,306	20.71	31,475	33.43	
Missing	697	4.37	12,520	13.30	
Paternal education					
> High school	9,076	56.86	37,936	40.29	< .0001
High school and below	5,668	35.51	40,174	42.67	
Missing	1,219	7.64	16,048	17.04	
Smoking					
None	15,025	94.12	66,900	71.05	< .0001
Sometimes	250	1.57	2,567	2.72	
Daily	312	1.95	5,313	5.64	
Missing	376	2.36	19,378	20.58	
Alcohol use					
None	12,836	80.41	62,089	65.94	< .0001
1-3 drinks per month	1,257	7.87	9,389	9.97	
1+ drinks per week	50	0.31	464	0.49	
Missing	1,820	11.40	22,216	23.59	

Prenatal stress (mean scores)					
Life stress	15,222	.11 (.11)	66,874	.12 (.11)	< .001
Contextual stress	14,005	.17 (.17)	61,361	.21 (.19)	< .001
Personal stress	15,015	.16 (.19)	66,587	.18 (.20)	< .001
Interpersonal stress	14,828	.04 (.09)	67,481	.05 (.10)	< .001
Child mental health, age 5 (mean scores)					
Internalizing symptoms	15,732	1.21 (.25)	25,227	1.22 (.26)	.046
Externalizing symptoms	15,642	1.30 (.28)	24,845	1.32 (.29)	< .001

Note. ^aDifferences between included and excluded groups examined using *t*-tests for continuous variables, and χ^2 tests for categorical variables.

Table S3. Models of interactions between prenatal maternal stress and parenting behaviours at age 5 and symptoms of internalizing disorders at age 8 after additional adjustment (N = 15,963)

	Symptoms of Depression		Symptoms of Anxiety	
	b (SE)	β (95% CI)	b (SE)	β (95% CI)
Positive parenting model				
Prenatal maternal stress	37.575 (10.821)**	.547 (.244, .850)	11.366 (4.215)**	.326 (.091, .561)
Positive parenting	-.413 (.043)***	-.075 (-.091, -.060)	-.075 (.022)***	-.027 (-.042, -.011)
<i>Prenatal maternal stress x Positive parenting</i>	3.957 (2.339)	-.025 (-.054, .004)	-1.181 (.912)	-.015 (-.037, .008)
Inconsistent discipline model				
Prenatal maternal stress	7.041 (3.530)*	.102 (.001, .202)	3.422 (1.494)*	.098 (.015, .181)
Inconsistent discipline	.367 (.031)***	.094 (.079, .109)	.049 (.016)**	.025 (.009, .040)
<i>Prenatal maternal stress x Inconsistent discipline</i>	6.030 (1.820)**	.053 (.023, .083)	1.174 (.691)	.020 (-.003, .044)
Positive parental involvement model				
Prenatal maternal stress	37.032 (11.282)**	.538 (.223, .853)	10.826 (4.977)*	.309 (.033, .585)
Positive parental involvement	-.470 (.050)***	-.071 (-.087, -.056)	-.108 (.026)***	-.032 (-.048, -.017)
<i>Prenatal maternal stress x Positive parental involvement</i>	-3.931 (2.506)	-.021 (-.047, .005)	-1.089 (1.116)	-.011 (-.034, .011)

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. β = standardized regression coefficient, CI = confidence interval. Symptoms of depression and anxiety were included together in models. Models were adjusted for the following covariates: maternal education, paternal education, maternal alcohol use, maternal smoking, parity, sex, stressful life events from birth to age 5, and maternal depression at age 5.

Table S4. Models of interactions between prenatal maternal stress and parenting behaviours at age 5 and symptoms of internalizing disorders at age 8 after additional adjustment (males, $n = 8,083$)

	Symptoms of Attention-Deficit Hyperactivity Disorder		Symptoms of Conduct Disorder		Symptoms of Oppositional Defiant Disorder	
	b (SE)	β (95% CI)	b (SE)	β (95% CI)	b (SE)	β (95% CI)
Positive parenting model						
Prenatal maternal stress	43.065 (35.134)	.212 (-.127, .551)	20.560 (8.555)**	.446 (.096, .796)	28.619 (14.260)*	.326 (.008, .644)
Positive parenting	-1.392 (.192)***	-.082 (-.104, -.059)	-.418 (.044)***	-.108 (-.130, -.085)	-.751 (.081)***	-.102 (-.123, -.080)
<i>Prenatal maternal stress x Positive parenting</i>	-.303 (7.729)	-.001 (-.033, .032)	-3.242 (1.753)	-.031 (-.064, .002)	-2.679 (3.140)	-.013 (-.044, .017)
Inconsistent discipline model						
Prenatal maternal stress	22.484 (12.433)	.111 (-.009, .231)	-1.726 (2.561)	-.037 (-.146, .071)	.558 (5.124)	.006 (-.108, .121)
Inconsistent discipline	1.601 (.136)***	.131 (.110, .153)	.355 (.030)***	.128 (.108, .149)	.895 (.059)***	.170 (.149, .192)
<i>Prenatal maternal stress x Inconsistent discipline</i>	8.706 (5.856)	.026 (-.008, .061)	3.553 (1.344)**	.047 (.013, .082)	7.366 (2.596)**	.052 (.017, .086)
Positive parental involvement model						
Prenatal maternal stress	68.085 (46.379)	.335 (-.110, .780)	15.635 (10.723)	.339 (-.118, .796)	13.272 (17.277)	.151 (-.234, .536)
Positive parental involvement	-2.634 (.237)***	-.129 (-.152, -.106)	-.622 (.053)***	-.134 (-.157, -.112)	-1.112 (.099)***	-.125 (-.147, -.103)
<i>Prenatal maternal stress x Positive parental involvement</i>	-6.023 (10.285)	-.011 (-.047, .025)	-2.265 (2.357)	-.018 (-.055, .019)	.768 (3.904)	.003 (-.029, .035)

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. β = standardized regression coefficient, CI = confidence interval. Symptoms of depression and anxiety were included together in models. Models were adjusted for the following covariates: maternal education, paternal education, maternal alcohol use, maternal smoking, parity, stressful life events from birth to age 5, and maternal depression at age 5.

Table S5. Models of interactions between prenatal maternal stress and parenting behaviours at age 5 and symptoms of internalizing disorders at age 8 after additional adjustment (females, $n = 7,754$)

	Symptoms of Attention-Deficit Hyperactivity Disorder		Symptoms of Conduct Disorder		Symptoms of Oppositional Defiant Disorder	
	b (SE)	β (95% CI)	b (SE)	β (95% CI)	b (SE)	β (95% CI)
Positive parenting model						
Prenatal maternal stress	44.164 (37.634)	.253 (-.168, .674)	14.372 (8.999)	.462 (-.105, 1.028)	19.982 (15.451)	.235 (-.123, .593)
Positive parenting	-1.303 (.157) ^{***}	-.092 (-.114, -.070)	-.248 (.029) ^{***}	-.099 (-.121, -.077)	-.786 (.077) ^{***}	-.115 (-.137, -.093)
<i>Prenatal maternal stress x Positive parenting</i>	-.882 (8.222)	-.004 (-.038, .029)	-2.436 (1.850)	-.034 (-.084, .017)	-.853 (3.370)	-.004 (-.038, .029)
Inconsistent discipline model						
Prenatal maternal stress	23.697 (13.674)	.132 (-.018, .283)	-2.273 (2.886)	-.071 (-.248, .106)	6.656 (5.924)	.077 (-.057, .210)
Inconsistent discipline	1.302 (.116) ^{***}	.129 (.107, .152)	.189 (.020) ^{***}	.105 (.083, .126)	.861 (.056) ^{***}	.176 (.154, .199)
<i>Prenatal maternal stress x Inconsistent discipline</i>	6.893 (6.631)	.023 (-.020, .066)	2.533 (1.656)	.048 (-.013, .110)	3.786 (2.886)	.027 (-.013, .066)
Positive parental involvement model						
Prenatal maternal stress	152.146 (44.718) ^{**}	.860 (.365, 1.354)	14.729 (12.442)	.469 (-.312, 1.251)	32.211 (18.795)	.375 (-.057, .806)
Positive parental involvement	-2.105 (.182) ^{***}	-.125 (-.146, -.103)	-.335 (.033) ^{***}	-.112 (-.133, -.091)	-1.079 (.091) ^{***}	-.132 (-.153, -.110)
<i>Prenatal maternal stress x Positive parental involvement</i>	-25.270 (9.822) [*]	-.052 (-.091, -.012)	-2.627 (2.650)	-.030 (-.091, .030)	-3.693 (4.172)	-.016 (-.050, .019)

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. β = standardized regression coefficient, CI = confidence interval. Symptoms of depression and anxiety were included together in models. Models were adjusted for the following covariates: maternal education, paternal education, maternal alcohol use, maternal smoking, parity, stressful life events from birth to age 5, and maternal depression at age 5.

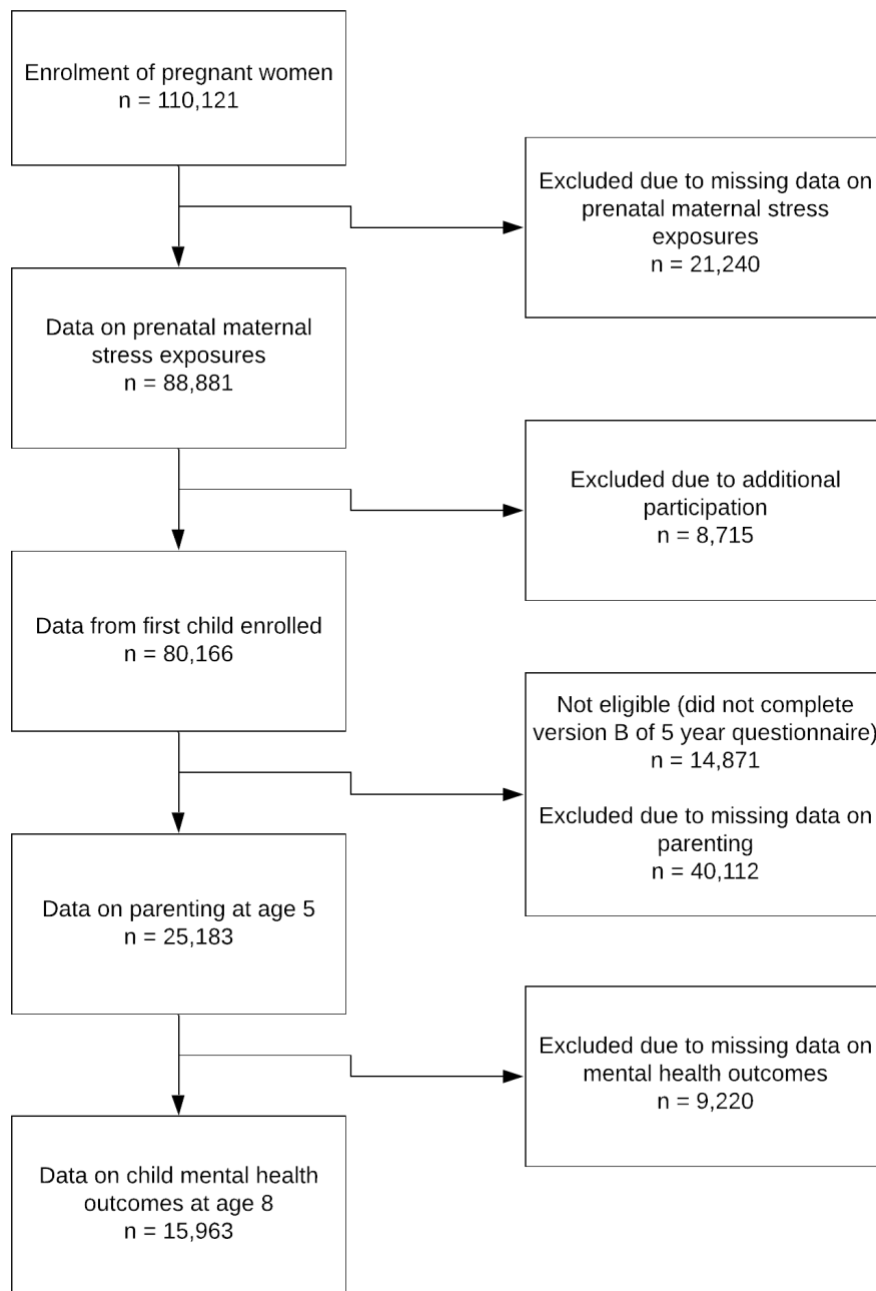


Figure S1. Flow chart of inclusion and exclusion criteria for participants included in complete MoBa cohort to sample included in current analysis

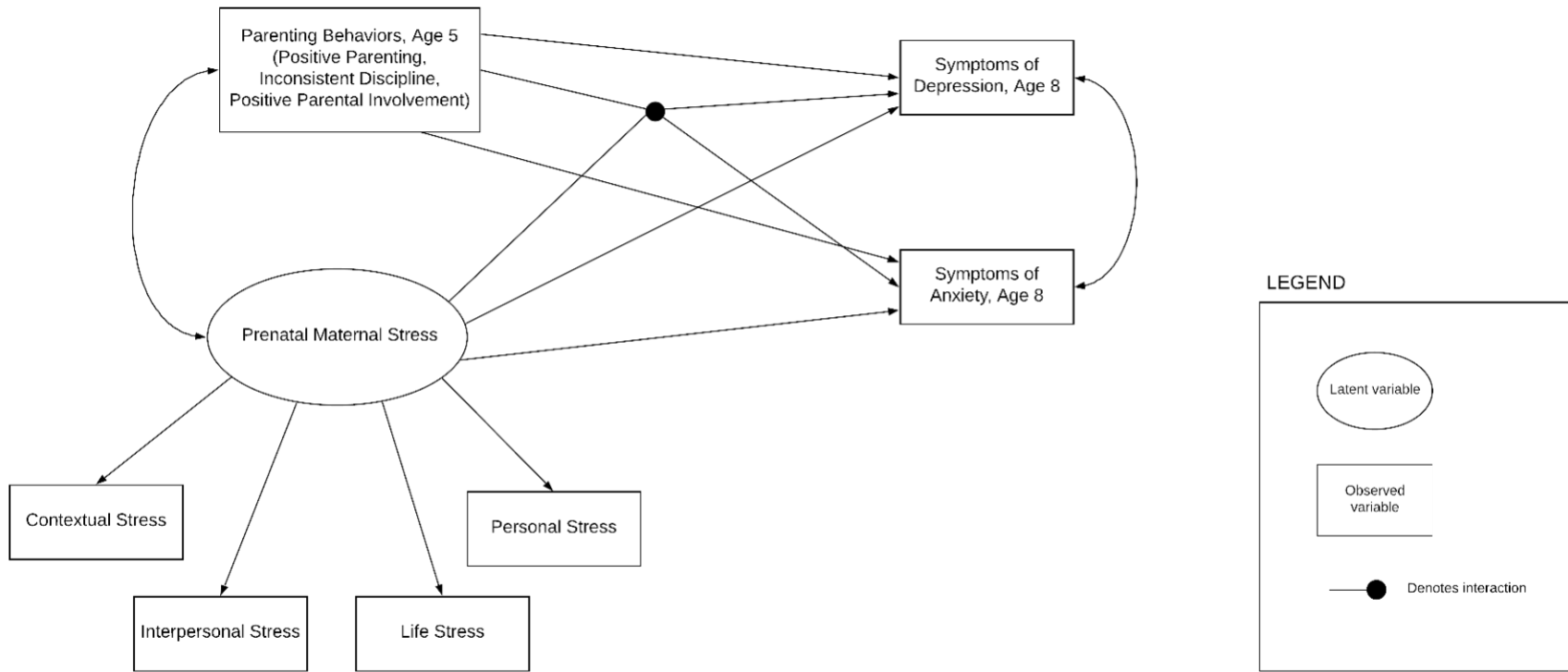


Figure S2. Conceptual path diagram of latent structural equations approach examining main effects and interaction effect between prenatal maternal stress and parenting behaviours on child internalizing symptoms (covariates not included, analyses stratified by sex)

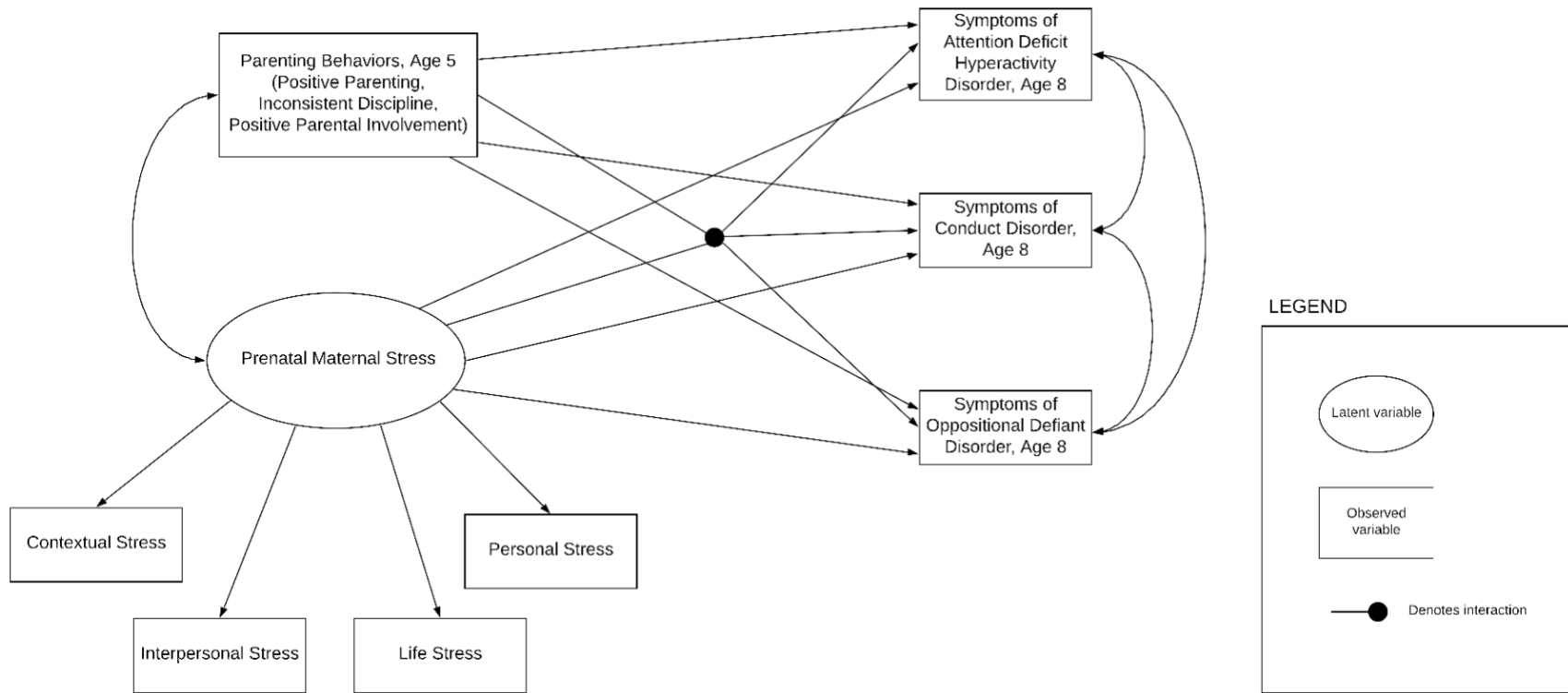


Figure S3. Conceptual path diagram of latent structural equations approach examining main effects and interaction effect between prenatal maternal stress and parenting behaviours on child externalizing symptoms (covariates not included, analyses stratified by sex)

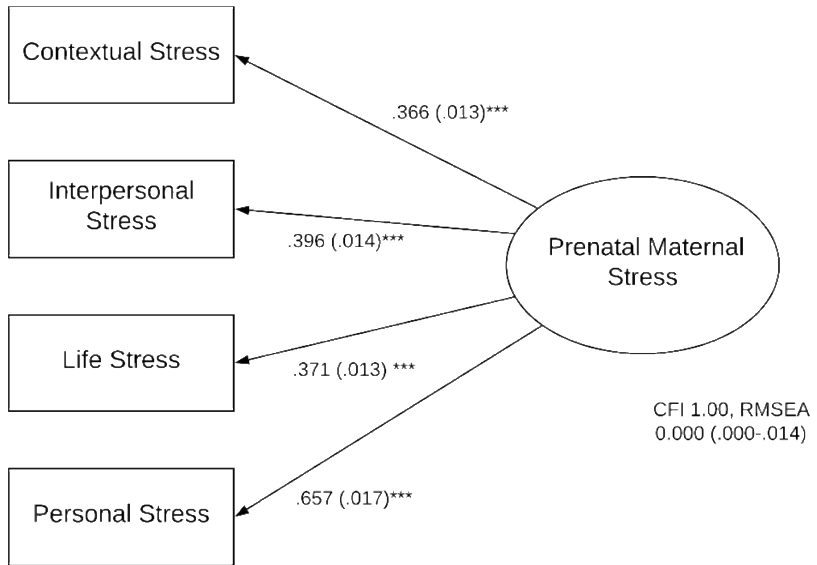


Figure S4. Path diagram of prenatal maternal stress latent variable and indicator variables with associated factor loadings. *** $p < .001$.

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