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Title	Maternal ADHD diagnoses before and after childbirth: a Danish population-based cohort study
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Publication date	2025-10-09
Original Citation	Madsen, K. B., Winther, M., Jensen, A. T., Marcussen, K., Munk-Olsen, T., Wesselhoeft, R. and Kittel-Schneider, S. (2025) 'Maternal ADHD diagnoses before and after childbirth: a Danish population-based cohort study', Journal of Attention Disorders, p.10870547251372730. https://doi.org/10.1177/10870547251372730
Type of publication	Article (peer-reviewed);journal-article
Link to publisher's version	10.1177/10870547251372730
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Download date	2026-11-10 15:27:25
Item downloaded from	https://hdl.handle.net/10468/18290



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Abstract

The rates of women of reproductive age diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD) have increased significantly. However, little is known about how pregnancy, childbirth and the postpartum period influence ADHD related problems, help-seeking behaviors or the timing of ADHD diagnosis. This study aimed to investigate incident ADHD diagnoses among women from five years before to five years after childbirth. The population-based cohort study utilized Danish nationwide registers to identify mothers of all childbirths between 2010 and 2018. ADHD diagnoses, defined as ICD-10 codes (F90 or F98.8) or redemption of ADHD medication prescriptions, were recorded during 1994-2023. Women who received an ADHD diagnosis prior to the five-year pre-birth period were excluded. We estimated calendar-year adjusted incidence of first-time maternal ADHD diagnoses using Poisson regression, and compared incidence across pre-pregnancy, pregnancy, postpartum up to two years, and two to five years postpartum, reporting adjusted incidence rate ratios (IRRs). Analyses included psychiatric comorbidities and non-ADHD psychotropic medication use prior to an ADHD diagnosis, for women diagnosed with ADHD postpartum. The study included 363,904 mothers with a total of 524,936 childbirths. ADHD incidence rates decreased significantly during pregnancy (IRR 0.28, 95% CI 0.22;0.37), remained lower than the pre-pregnancy period two years postpartum (IRR 0.82, 95% CI 0.74;0.92), and increased significantly above pre-pregnancy levels two to five years postpartum (IRR 1.24, 95% CI 1.13; 1.35). Among mothers diagnosed with ADHD postpartum, 53.9% had an in- or outpatient contact to psychiatric services or redeemed non-ADHD psychotropic medication prescriptions, in the period from childbirth until ADHD diagnosis. Incident ADHD diagnoses among women giving birth increased postpartum above pre-pregnancy levels, with peak rates observed between two to five years after childbirth. These findings highlight the postpartum period as a potential critical window of ADHD symptom worsening, underscoring the need for targeted mental health screenings and support for women during the years after childbirth.

Keywords: ADHD, pregnancy, childbirth, postpartum psychiatric disorders, incidence.

Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) diagnoses have increased significantly among women of reproductive age in recent years, possibly driven by heightened awareness, recognition of the disorder's persistence into adulthood, improved diagnostic practices, and evolving societal perceptions (Anderson et al., 2018; Kooij et al., 2019; Scoten et al., 2024; Zetterqvist et al., 2013). Many women with ADHD, however, experience delayed diagnosis (Skoglund et al., 2024), often due to difficulties with recognizing ADHD symptoms in girls and women, which are frequently masked by compensatory behaviors or misinterpreted as mood or anxiety disorders (Attoe & Climie, 2023; Madsen et al., 2018). The increased attention to females with ADHD and their common diagnostic delay emphasize the existing gap in understanding how life events unique to this population, such as childbirth and the perinatal period, affect symptomatology, help-seeking behaviors and the timing of ADHD diagnosis.

Giving birth represents a profound physiological and psychological transition. Cognitive impairment and decreased executive functioning, key symptoms of ADHD, are more common during pregnancy than in non-pregnant states (Davies et al., 2018). Hormonal fluctuations during pregnancy and the postpartum period may contribute to neurobiological alterations that exacerbate ADHD symptoms, including changes in brain structure and function (Hoekzema et al., 2017; Rehbein et al., 2021). These changes, combined with the heightened demands of pregnancy and early parenthood, may amplify distractibility and cognitive fatigue, posing additional challenges for women with ADHD. Eddy and colleagues found that inattentive symptoms were significant predictors of professional life impairment, daily life impairment, and relationship impairment, while impulsivity uniquely predicted variability in professional life and relationship impairment in pregnant women with ADHD (Eddy et al., 2019). The postpartum period may further exacerbate these challenges. New or worsened cognitive impairments, disruptions to previously effective daily strategies, and the demands of caring for a newborn may increase ADHD symptoms and functional impairments, possibly prompting help-seeking behaviors. Evidence suggests that parents with ADHD and their partners experience greater parenting distress in the first year of their

child's life than parents without ADHD (Joseph et al., 2022). Also, postpartum depression, a common condition for mothers with ADHD (Andersson et al., 2023), may also act as a trigger for ADHD diagnosis, as its overlapping symptoms, such as emotional dysregulation and executive dysfunction, may prompt clinical attention to previously unrecognized ADHD.

This study investigates whether the transition into parenthood, including pregnancy, childbirth, potential postpartum psychiatric comorbidity, and the demands of caring for a young child, drives maternal help-seeking, as reflected by the timing of first-time ADHD diagnoses. We hypothesise that this transition will amplify previously unrecognised ADHD symptoms and thereby prompt women to seek evaluation and care. Consequently, we expect a rise in incident first-time maternal ADHD diagnoses during the postpartum years exceeding pre-pregnancy levels.

Methods

Study design and population

This descriptive population-based cohort study utilized data from Danish nationwide registers. All childbirths occurring from 2010 to 2018 were identified through the Danish Medical Birth Registry (Bliddal et al., 2018). After excluding 8,991 childbirths due to missing or unlikely gestational ages (<154 or >315 days) and 3,326 childbirths by mothers with a preexisting record of ADHD diagnosis before the five-year pre-birth period, the final cohort included 363,904 mothers to 524,936 liveborn children.

Incidence of ADHD before and after childbirth

First-time records of ADHD were considered each month, starting at five years before until five years after childbirth, with one month defined as 30.44 days. To ensure only incident diagnoses were included, we excluded women with an ADHD diagnosis recorded between 1994-2005 or before the five-year pre-birth period leaving enough time to exclude women who had received a diagnosis in childhood or adolescence. The five-year pre-childbirth window provides sufficient time to establish a

stable baseline for ADHD incidence, while extending follow-up to five years postpartum accounts for the possibility of delayed diagnoses between initial symptom recognition and formal diagnostic recording. An incident diagnosis of ADHD was defined as an ICD-10 F90 or F98.8 diagnosis identified in the Danish National Patient Register (Lynge et al., 2011) or a first time use of ADHD medication using the following Anatomical Therapeutic Chemical (ATC) classification codes for stimulant treatment: N06BA04 “Methylphenidate”, N06BA01 “Amphetamine”, N06BA02 “Dexamfetamine”, N06BA12 “Lisdexamfetamine”, and other treatment: N06BA07 “Modafinil”, and N06BA09 “Atomoxetine” in the Danish National Prescription Register (Kildemoes et al., 2011). In Denmark, citizens have the right to consult privately practicing specialists free of charge if waiting times at public hospital services exceed one month. However, private psychiatrists are not required to report diagnoses to national registries. Therefore, we used redeemed ADHD medication prescriptions as a proxy for ADHD diagnoses, since only psychiatrists are authorized to prescribe these medications following a comprehensive clinical assessment confirming ADHD. Recorded ADHD diagnoses in the Danish registers are deemed valid and reliable (Mohr-Jensen et al., 2016). Among postpartum ADHD diagnosed mothers, we estimated the proportion with in- and outpatient admissions with the ICD-10 diagnostic codes F10-19 “Mental and behavioural disorders due to psychoactive substance use”, F30-39 “Mood disorders”, and F40-48 “Neurotic, stress-related and somatoform disorders” and non-ADHD psychotropic medication prescription fills; antidepressants (ATC N06A), anxiolytics (ATC N05B), and drugs used in alcohol dependence (ATC N07BB) in the period from childbirth until ADHD diagnosis.

Statistical analyses

Women were followed from five years pre-childbirth until an ADHD diagnosis, five years after childbirth, or December 2023, whichever occurred first. The incidence was based on the first-ever ADHD diagnosis within the period from five years before through five years after birth; meaning that incident cases could not have had earlier records of ADHD treatment. To estimate the incidence of first-time maternal ADHD diagnosis across different time periods surrounding childbirth adjusting for calendar

year of diagnosis, we fitted Poisson regression models with robust standard errors. The dependent variable was the count of ADHD diagnoses in each quarter from five years before to five years after childbirth. The offset term was the natural logarithm of person-years observed in each quarter, allowing us to model incidence rates with 95% CI. We defined four exposure periods relative to childbirth: pre-pregnancy (5 years to 9 months before childbirth), pregnancy (9 months before to childbirth), postpartum 0–2 years, and postpartum 2–5 years to compare incidence rates in these periods. The Poisson model included the period variable as a categorical predictor and adjusted for calendar year to account for secular trends in ADHD diagnosis. Adjusted incidence rate ratios (IRRs) and 95% confidence intervals (CIs) were estimated using the irr option in Stata. Marginal incidence rates (per 1000 person-years) for each period were estimated using the margins command. Also, we determined the proportion diagnosed with other psychiatric disorders or filling prescriptions for non-ADHD psychotropics among mothers who received an ADHD diagnosis in the five-year postpartum period. We restricted this comorbidity analysis to the interval between childbirth and the mother's first ADHD diagnosis postpartum, because this window provides a uniform, diagnosis-anchored frame, whereas an equivalent pre-pregnancy interval would be arbitrary and capture temporally distant disorders that are not directly comparable to the time period between childbirth and initial ADHD diagnosis. Finally, we conducted a sensitivity analysis including a random sample of one childbirth per mother to take into account the possible counting of the same mother multiple times across different childbirths. Analyses were conducted using Stata (version 18 StataCorp, College Station, TX, USA).

Results

Between 2010 and 2018, our study included 363,904 mothers who gave birth to 524,936 children. During the 10-year period surrounding childbirth (five years before and five years after), 7,940 childbirths were associated with a maternal ADHD diagnosis, corresponding to 7,077 unique mothers. Of these, 2,974 mothers received their diagnosis within the five years before childbirth, and 4,103 within the five years after childbirth. Maternal mean age at first childbirth was significantly lower for mothers

who received an ADHD diagnosis in the period from five years pre-birth to five years postpartum (mean age 26.9 years [SD 5.3]) compared to mothers who did not (mean age 29.3 years [SD 4.8]) (ttest, p<0.001).

Calendar year–adjusted incidence rates with 95% CI of first-time maternal ADHD diagnosis are presented quarterly across the study period in Figure 1 and for the first quarter each year in Table 1. The adjusted incidence rate five years before childbirth was 1.59 per 1000 person-years (95% CI 1.35-1.83) and increased to 2.18 (95%CI 1.82-2.57) five years after childbirth, which can be interpreted as one new ADHD diagnosis for every 630 and 460 women, respectively. As presented in Table 2, compared with the pre-pregnancy period (defined as 5 years to 9 months before childbirth), the incidence was significantly lower during pregnancy (IRR = 0.28; 95% CI: 0.22;0.37). In the first two years postpartum, the adjusted incidence was slightly but significantly lower compared to the pre-pregnancy period (IRR = 0.82; 95% CI: 0.74;0.92). A significant increase was observed in the period from two to five years postpartum, peaking at four to five years postpartum, where the adjusted incidence was significantly higher than in the pre-pregnancy period (IRR = 1.24; 95% CI: 1.13;1.35). Of the 4,597 childbirths where mothers received an ADHD diagnosis within five years postpartum, 2476 (53.9%) involved mothers who were diagnosed with depression, anxiety or substance use disorder or redeemed prescriptions for antidepressants, anxiolytics or alcohol dependence medication before their initial ADHD diagnosis (Table 3). The same pattern was observed in the sensitivity analysis restricting to one random childbirth per mother (Figure 2, Table 4, Table 5, and Table 6).

Discussion

This study demonstrated that ADHD diagnosis incidence decreased during pregnancy but increased significantly in the postpartum period, reaching pre-pregnancy levels between 1-2 years postpartum and continuing to rise, peaking at about 4 years postpartum. Additionally, a majority of mothers were diagnosed with depression, anxiety, or substance use disorder or redeemed prescriptions for non-ADHD psychotropics in the period from childbirth until receiving their ADHD diagnosis postpartum.

The significant decline in ADHD incidence during pregnancy may reflect multiple factors, including symptom reduction or masking due to hormonal changes (Eng et al., 2024), lower likelihood of help-seeking during this period, or hesitancy among healthcare providers to diagnose ADHD or initiate treatment during pregnancy (Hinshaw et al., 2022). This may lead to unmet needs that resurface postpartum where ADHD incidence increased above pre-birth levels. Also, the challenges associated with parenting, combined with the cumulative cognitive and emotional demands of the postpartum period, may highlight previously unrecognized ADHD symptoms. The caregiving task itself, usually including deprived sleep and emotional outbursts or demands of the infant or preschooler, might amplify ADHD core symptoms, and impairment may initially present as depression or anxiety, which, in our data, often preceded the ADHD diagnosis (Joseph et al., 2022).

We observed a peak in ADHD incidence four to five years after childbirth, which could be due to the documented delay between women's first recognition of ADHD-related difficulties and their action upon them (Agnew-Blais, 2024; Skoglund et al., 2024). Women with ADHD, and their relatives, may initially attribute inattentiveness, disorganization and emotional lability to regular postpartum exhaustion or parenting stress. It is possible that formal evaluation is not requested until these problems have persisted for years.

Strikingly more than half of mothers diagnosed with ADHD postpartum had other psychopathology (defined as in- or outpatient contacts for depression, anxiety, or substance use disorders, or redeemed prescriptions for non-ADHD psychotropic medications) before receiving their ADHD diagnosis. These comorbidities often mask ADHD symptoms and complicate the assessment of ADHD, which may cause physicians to overlook the diagnosis of ADHD (Young et al., 2020) contributing to diagnostic delays or even misdiagnosis (Quinn & Madhoo, 2014). Conversely, postpartum depression symptoms, such as concentration difficulties (inattention) and psychomotor agitation (hyperactivity/impulsivity), may exaggerate ADHD symptoms, increasing the risk of temporarily pushing those with elevated but still normative levels of ADHD symptoms into the clinical range.

We found a significantly lower maternal mean age at first childbirth for mothers with ADHD compared to mothers without in line with previous research (Amikam et al., 2024; Skoglund et al., 2019). A recent study found a 4-times higher rate of unplanned pregnancies in young women with ADHD compared to non-ADHD controls (Owens & Hinshaw, 2020). Such unintended, and often early pregnancies, are consistently associated with adverse obstetric and perinatal outcomes (Skoglund et al., 2019) that are also linked to postpartum psychiatric disorders (Meltzer-Brody et al., 2017).

Our findings emphasize the need for heightened clinical awareness of ADHD in women during the perinatal period. Although limited research has examined the consequences of delayed ADHD diagnosis in women, existing evidence highlights its profound and far-reaching effects. Late diagnosis is associated with diminished self-esteem, significant mental health challenges, disruptions in personal identity, and reduced life opportunities (Attoe & Climie, 2023; Skoglund et al., 2024; Young et al., 2020). These impacts often lead to increased psychosocial burdens and adverse outcomes, including strained relationships and impaired caregiving capacity (Morgan, 2024). To address this, perinatal care providers should be trained to recognize the overlapping symptoms of ADHD, depression, and anxiety, and always consider ADHD as differential diagnosis in women presenting with executive dysfunction or emotional dysregulation. Integrating mental health screenings into routine perinatal care could facilitate earlier identification and treatment, reducing the long-term burden of undiagnosed ADHD for both mother and child.

Strengths and Limitations

The use of a nationwide cohort with comprehensive data on ADHD diagnoses, medication prescriptions, and psychiatric comorbidities is a major strength of this study, allowing us to capture population-wide trends and minimize selection bias. Additionally, the longitudinal design enabled us to examine diagnostic patterns over a 10-year window, providing a nuanced understanding of ADHD incidence relative to childbirth.

However, limitations should be acknowledged. First, ADHD diagnoses were based on clinical records and medication prescriptions, which may underestimate true incidence, particularly for women with mild symptoms, and the absence of data on subjective experiences or self-reported symptoms limits our ability to fully understand the psychosocial factors driving help-seeking behaviors. Second, we deliberately capped follow-up at five years postpartum to minimise referral bias from mothers who seek evaluation only after their child is assessed (Chatwin et al., 2025). This restriction, however, prevents us from determining whether the rising diagnostic trend after childbirth plateaus, continues, or declines into child school age. Third, we interpreted a first-time ADHD diagnosis in the registers as a proxy for maternal help-seeking; however, because registry data lack information on the motivations and pathways that lead women to initiate evaluation, this proxy cannot fully capture the complexity of help-seeking behavior.

Future research should move beyond describing the postpartum rise in diagnoses to clarifying the mechanisms that drive it. One plausible pathway is that the heightened executive and emotional demands of early parenthood exacerbate previously unrecognised ADHD symptoms, prompting women to seek help and, ultimately, receive a diagnosis, but this hypothesis remains untested. Likewise, although the striking rates of postpartum depression and anxiety in newly diagnosed mothers raise the possibility that mood symptoms are, in part, downstream consequences of undetected ADHD, the temporal and causal links are still unknown.

Conclusion

This study highlights distinct patterns in ADHD diagnosis incidence among women before and after childbirth. While ADHD diagnoses decreased significantly during pregnancy, incidence rates returned to pre-pregnancy levels by two years postpartum and peaked at four to five years postpartum. The cumulative incidence of ADHD diagnoses was notably higher in the postpartum period, suggesting that

early parenthood is particularly challenging to women with ADHD, which possibly triggers help-seeking eventually leading to diagnostic recognition.

A significant proportion of mothers diagnosed with ADHD postpartum had prior contacts to hospital care for depression, anxiety, or substance use disorders or redeemed non-ADHD psychotropic medications before receiving their ADHD diagnosis. This highlights both the overlap of psychiatric symptoms and the possibility that unrecognized ADHD may contribute to the development of these comorbidities, potentially delaying accurate ADHD diagnosis. These findings emphasize the postpartum period as a critical window for ADHD detection, highlighting the importance of integrating mental health screenings into routine perinatal care to facilitate timely diagnosis and intervention. Early identification of ADHD in mothers could improve outcomes not only for the women themselves but also for their children, reducing the intergenerational burden of untreated ADHD.

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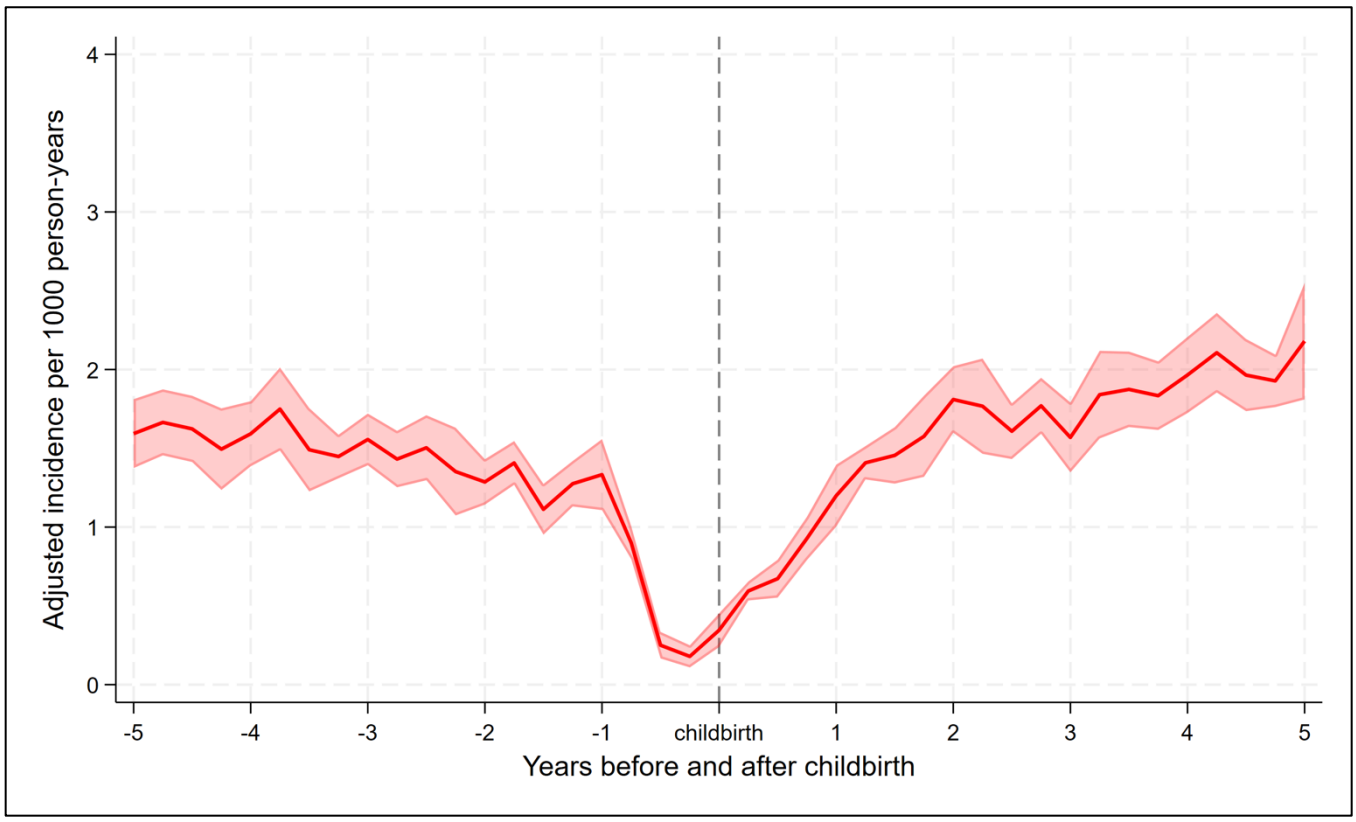


Figure 1. Calendar year adjusted ADHD incidence rates 5 years before to 5 years after childbirth per 1000 person-years – all childbirths during 2010-2018.

Table 1. Calendar year adjusted ADHD incidence rates in the first quarter from 5 years before to 5 years after childbirth per 1000 person-years – all childbirths during 2010-2018.

Time in relation to childbirth	All childbirths (N=524,936)	
	Cases (n)	Adjusted incidence rate per 1000 person-years (95%CI)
- 5 years (Q1)	172	1.59 (1.35-1.83)
- 4 years (Q1)	192	1.59 (1.37-1.82)
- 3 years (Q1)	202	1.56 (1.34-1.77)
- 2 years (Q1)	175	1.29 (1.10-1.48)
- 1 years (Q1)	187	1.33 (1.14-1.52)
Childbirth (Q1)	48	0.35 (0.25-0.44)
+ 1 years (Q1)	162	1.19 (1.01-1.38)
+ 2 years (Q1)	244	1.81 (1.58-2.04)
+ 3 years (Q1)	223	1.57 (1.36-1.77)
+ 4 years (Q1)	321	1.97 (1.75-2.18)
+ 5 years	141	2.18 (1.82-2.57)

Table 2. Test for period difference with Poisson regression adjusted for calendar year of diagnosis

	All childbirths (N=524,936)		
	IRR	95% CI	P
Pre-pregnancy	ref	ref	-
Pregnancy	0.28	0.22-0.37	>0.001
Postpartum 0-2 years	0.82	0.74-0.92	>0.001
Postpartum 2-5 years	1.24	1.13-1.35	>0.001

- IRR – Incidence Rate Ratio
- 95 CI – 95% Confidence Interval

Table 3. In- and outpatient psychiatric contact and/or filling of psychotropic medication from birth until 5 years postpartum prior to ADHD diagnosis

	ADHD diagnosis postpartum (N=4,597)	
	Childbirths, n	%
Contact and/or medication	2476	53.9
Contact all	842	18.3
- *Substance use disorder*	57	1.2
- *Mood disorder*	448	9.8
- *Anxiety disorder*	529	11.5
Medication all	2293	49.9

- *Drugs for alcohol dependence*	46	1.0
- *Antidepressants*	2181	47.4
- *Anxiolytics*	411	8.9

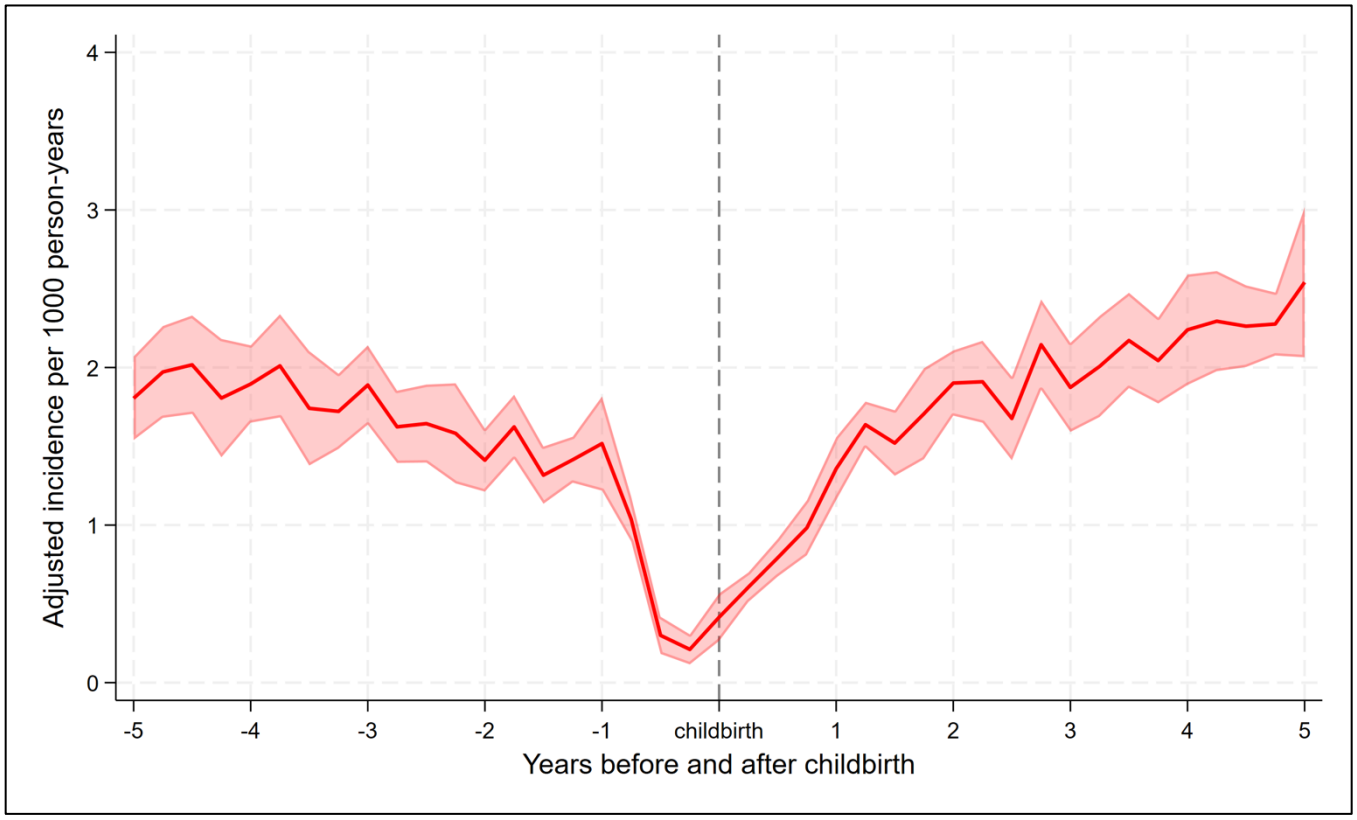


Figure 2. Sensitivity analysis: Calendar year adjusted ADHD incidence rates 5 years before to 5 years after childbirth per 1000 person-years – one randomly selected childbirth per mother.

Table 4. Calendar year adjusted ADHD incidence rates in the first quarter from 5 years before to 5 years after childbirth per 1000 person-years – one random childbirth during 2010-2018.

Time in relation to childbirth	All childbirths (N=524,936)	
	Cases (n)	Adjusted incidence rate per 1000 person-years (95%CI)
- 5 years (Q1)	142	1.79 (1.50-2.08)
- 4 years (Q1)	167	1.91 (1.63-2.21)
- 3 years (Q1)	273	1.85 (1.58-2.13)
- 2 years (Q1)	135	1.38 (1.15-1.61)
- 1 years (Q1)	161	1.59 (1.35-1.84)
Childbirth (Q1)	43	0.43 (0.30-0.57)

+ 1 years (Q1)	175	1.93 (1.65-2.22)
+ 2 years (Q1)	161	1.75 (1.48-2.03)
+ 3 years (Q1)	246	2.36 (2.07-2.65)
+ 4 years (Q1)	94	2.29 (1.83-2.76)
+ 5 years	141	2.18 (1.82-2.57)

Table 5. Sensitivity analysis: Test for period difference with Poisson regression adjusted for calendar year of diagnosis

	One random childbirth per mother (N=363,904)		
	IRR	95% CI	P
Pre-pregnancy	ref	ref	-
Pregnancy	0.29	0.23-0.38	>0.001
Postpartum 0-2 years	0.76	0.68-0.86	>0.001
Postpartum 2-5 years	1.21	1.10-1.33	>0.001

- IRR – Incidence Rate Ratio
- 95 CI – 95% Confidence Interval

Table 6. Sensitivity analysis - In- and outpatient psychiatric contact and/or filling of psychotropic medication from birth until 5 years postpartum prior to ADHD diagnosis

	ADHD diagnosis postpartum (N=3,384)	
	Childbirths, n	%
Contact and/or medication	1837	54.3
Contact all	645	19.1
- *Substance use disorder*	43	1.3
- *Mood disorder*	343	10.1
- *Anxiety disorder*	403	11.9
Medication all	1697	50.2
- *Drugs for alcohol dependence*	33	1.0
- *Antidepressants*	1619	47.8
- *Anxiolytics*	300	8.9