# Do Oral Contraceptives Affect Women's Mental Health? A Study of Depression in Young Women*

Elisavet Iliadi†

The latest version of this paper is available at this link.

**Abstract**

This paper examines whether oral contraceptives affect young women's mental health. To address this question, I use population-wide Swedish registry data for women aged 14–25 between 2005 and 2017 and implement an event-study difference-in-differences design following Callaway and Sant'Anna (2021). The design compares initiators of oral contraceptives with not-yet-treated peers born in the same year and quarter who begin one or two years later, thereby strengthening the credibility of the counterfactual. The results show that oral contraceptive initiation is followed by a rise in antidepressant prescriptions, with effects concentrated among older adolescents and young adults. For women aged 17–19 and 20–25, I find increases of roughly 9 and 19 percent, respectively, relative to the year before initiation. In contrast, the youngest group (ages 14–16) exhibits pronounced pre-trends, consistent with selection into early initiation. Further analysis indicates that the pre-trends in the youngest group of initiators (aged 14-16) are largely driven by women with ADHD. For the older groups (ages 17–19 and 20–25), differences in contraceptive type do not explain the results, whereas women who initiate oral contraceptives to treat gynaecological conditions exhibit worse mental health outcomes than those who initiate for contraceptive purposes. Using rich Swedish administrative data and a modern difference-in-differences design with a credible counterfactual, this paper shows that the educational and labour-market gains from contraceptive access may come at a cost to women's mental health, particularly among early initiators with pre-existing vulnerabilities, and highlights the role of initiation motives in women's mental health.

**Keywords:** Mental Health, Antidepressant Use, Oral Contraceptives, Combined Oral Contraceptives, Progestogen-only Contraceptives, Adolescence, Young Adulthood, ADHD

**JEL Codes:** I00, I12, J13, J16

*I am grateful to my supervisors Erik Grönqvist and Erica Lindahl for the valuable comments and support. I would also like to thank Eva Mörk, Mikael Elinder, Yoko Okuyama, Oskar Nordström Skans, Lena Hensvik, Lucas Tilley, Trine Kjær, Daniel Spiro and Shobhit Kulshreshtha for the comments and suggestions. Finally, I would like to thank the participants of the conferences SHEA/HEFUU Ph.D.-Student Workshop (Uppsala), IRTG 2804 Spring School(Tübingen), Workshop in Causal Health Economics (Uppsala), 44th Nordic Health Economists' Study Group Meeting (Oslo) and SUDSWEC Conference (Stockholm). All errors are my own.

†Department of Economics, Uppsala University and WOMHER. Email: elisavet.iliadi@nek.uu.se

# 1 Introduction

Understanding how to improve women's economic outcomes remains a central concern for economists, policymakers, and society at large. The influential studies by Goldin and Katz (2000, 2002) on the introduction of hormonal oral contraceptives, commonly known as "the pill", in the 1960s in the United States provided evidence that hormonal contraception reshaped women's lives. Their findings showed that early access to the pill delayed marriage, increased college enrollment, and strengthened women's attachment to the labour market. These contributions launched what is now widely known as the "power of the pill" literature, inspiring numerous subsequent studies that demonstrated how the pill enhanced women's educational attainment and employment opportunities (Steingrimsdottir, 2006; Bailey, 2006; Bailey et al., 2012). Despite these advantages, recent research, including the present study, examines a critical but often overlooked dimension, namely whether oral contraceptives undeniably improve women's lives. Specifically, emerging evidence points to significant negative effects of oral contraceptive use on women's mental health, raising important questions about the broader economic and societal trade-offs associated with fertility control (Valder, 2022; Costa-Ramón et al., 2023).

Hormonal oral contraceptives[1] , used by about 150 million women worldwide (United Nations, 2022), rank among the most common forms of pregnancy prevention and are also routinely prescribed for a variety of gynaecological conditions[2]. In Sweden, women between 12 and 25 years old can easily obtain a prescription for any type of hormonal contraceptive through the youth clinics, where they can also get consultation by midwives and gynaecologists. Nevertheless, hormonal contraceptives are not risk-free and the literature reports that there may be several potential risks [3] and side effects [4] associated with contraceptive use, notably depression and mood changes (FSRH Guideline, 2022; FSRH Guideline, 2023). Therefore, the easy access to hormonal contraceptives makes Sweden a relevant setting to study their mental health consequences.

The present study investigates whether oral contraceptives play a role in the prevalence of depression among adolescents and young women. Depression is a widespread mental health disorder that disproportionately affects women (WHO, 2023) and is particularly prevalent among adolescents, with 14% experiencing depressive symptoms (WHO, 2024). In Sweden, approximately one in five people will experience depressive symptoms at some

[1]Contraception refers to the intentional prevention of pregnancy using artificial methods.

[2]The most common disorders treated with hormonal contraceptives are endometriosis, heavy or irregular menstrual bleeding, premenstrual syndrome, polycystic ovarian syndrome, acne, and hirsutism (Brant et al., 2017).

[3]Risks associated with the use of hormonal contraceptives are venous thromboembolism, ischemic stroke, myocardial infarction, breast cancer, cervical cancer, ovarian cysts, and ectopic pregnancy (FSRH Guideline, 2022; FSRH Guideline, 2023).

[4]Common side effects reported are changes in bleeding patterns, breakthrough bleeding, alterations in libido, headaches, acne, and weight gain (FSRH Guideline, 2022; FSRH Guideline, 2023).

point in their lives[5] (Folkhälsomyndigheten, 2024). Depression is a documented side effect of many medications, arising either through direct neurological pathways or secondary to other adverse reactions (Celano et al., 2011). Assessing whether hormonal contraceptives exacerbate such risks is therefore crucial, particularly for adolescents and young women.

In order to answer the question of whether oral contraceptives affect women's mental health, specifically the likelihood of receiving antidepressant prescriptions, this study employs an event-time strategy following the methodology introduced by Callaway and Sant'Anna (2021). A key contribution relative to prior economic and medical literature is the comparison between treated individuals and comparable peers who have not yet initiated contraceptive use. The treated individuals are compared only to not-yet-treated individuals born in the same year and quarter, which ensures that both are exposed to similar life events. Furthermore, comparisons are limited to peers who initiate oral contraceptive use when they are one or two years older, enhancing comparability with respect to age and calendar time. The data used are detailed Swedish registry data from 2005 to 2017 for women who initiated oral contraceptives between the ages of 14 and 25, which covers a wider age range than previous economic literature on the topic. The findings indicate a statistically significant increase in antidepressant prescriptions following contraceptive initiation, aligning with previous literature that links hormonal contraceptives to adverse mental health outcomes (Valder, 2022; Costa-Ramón et al., 2023). However, while these effects exist for the older age groups, for the younger age group, the effects cannot rule out alternative explanations, since antidepressant prescriptions were already on an upward trajectory before contraceptive initiation.

The results are also presented for three subgroups of women aged between 14-16, 17-19 and 20-25. This is done in order to ensure that the overrepresented groups of women are not driving the results in one direction and subsequently show the heterogeneity across groups. The largest increase in antidepressant prescriptions is observed among women who initiated oral contraceptive use between ages 14 and 16, in line with previous studies that indicate that the strongest association is among young teenagers (Skovlund et al., 2016; Zettermark et al., 2018; Johansson et al., 2023). However, the presence of a significant increasing trend before treatment in this subgroup implies that at least part of the observed increase may reflect underlying trends rather than a causal effect. This pattern likely reflects selection; women who begin oral contraceptive use at these ages may differ systematically from their peers. In contrast, women in late adolescence (ages 17–19) exhibit a notable but smaller 8.94% increase in antidepressant use 7 quarters after initiation. As pre-treatment coefficients in this group are small and statistically insignificant, the post-initiation rise can be interpreted as an effect of contraceptive use. Among women aged 20–25, the pre-treatment coefficients are near zero and statistically insignificant, indicating that an 18.92% increase in antidepressant prescriptions after the treatment

[5] In 2023, 1.2 million people were prescribed antidepressants in Sweden, including 8.8% of adolescents and young adults aged 10 to 24 (Socialstyrelsen, 2025).

initiation is attributable to oral contraceptive use, though the effect attenuates over time. Taken together, these findings suggest that oral contraceptive use may contribute to increased antidepressant use, particularly among older adolescents and young adults, but the evidence points to heterogeneity in both magnitude and persistence of the effect across age groups.

I further investigate whether women diagnosed with ADHD influence the pre-trends in the youngest treated group (ages 14-16). Women with ADHD represent a particularly relevant group, as they are more likely to engage in riskier sexual behavior during adolescence, which may affect the timing of contraceptive initiation (Flory et al., 2006; Hosain et al. 2012). In addition, ADHD is often comorbid with depression and anxiety, conditions that influence the antidepressant use (Gillberg, 1983; Larson et al., 2007). Despite its relevance, this dimension has received little attention in the literature, with only one medical study by Lundin et al. (2023) documenting stronger associations between oral contraceptive use and mental health outcomes among women with ADHD. Consistent with this evidence, I find a stronger relationship between oral contraceptive initiation and antidepressant prescriptions for women with ADHD in the post-treatment period. In the pre-treatment period, women with ADHD exhibit increasing trends that are larger than in the baseline case. On the other hand, women without an ADHD diagnosis have smaller estimates compared to the baseline analysis but follow a similar trajectory throughout the observed period. These findings suggest that the baseline pre-trends are largely driven by antidepressant use among women with ADHD.

I next examine whether the effects differ by contraceptive type and by the reasons for oral contraceptive initiation. This section focuses on women who initiate oral contraceptives in late adolescence (ages 17–19) and young adulthood (ages 20–25), where the timing of initiation can be considered as good as random. The youngest group (ages 14–16) is excluded, as treatment at these ages is more likely to reflect selection into treatment. Within this sample, the results show that the estimated effects for different contraceptive types are similar to the baseline, except among women aged 17–19 using progestogen-only pills, for whom no significant change in antidepressant prescriptions is observed. Despite this age-specific difference, the overall effects of the two contraceptive types are not statistically different in most cases, in contrast to findings in earlier studies (Skovlund et al., 2016; Zettermark et al., 2018; Lundin et al., 2022).

The second analysis explores whether the mental health effects of oral contraceptives differ according to the primary motivation for initiation. To my knowledge, the existing literature has not made this distinction, even though numerous studies document poorer mental health outcomes for several gynaecological diagnoses. Disentangling these motives is therefore essential for understanding the rising pattern of antidepressant prescriptions observed after oral contraceptive initiation since the relief of gynaecological symptoms may improve well-being, whereas the hormonal components of oral contraceptives may

have adverse effects. The findings suggest that women who initiate contraceptive use primarily for pregnancy prevention exhibit trajectories that closely mirror the baseline estimates. At the same time, women who use oral contraceptives to treat gynaecological conditions experience a more pronounced increase in antidepressant use across all subgroups. Although the estimated coefficients for the two groups are not statistically different, most likely due to the small share of women initiating oral contraceptives for non-contraceptive reasons, women who do so for medical purposes appear to experience poorer mental health outcomes.

In economics, a small but growing body of literature investigates the effects of oral contraceptives on women's mental health. Specifically, Valder (2022) and Costa-Ramón et al. (2023), who are, as far as I'm aware, the only two papers in the economics literature on this topic, both find a negative effect of contraceptives on women's mental health. Valder (2022) utilizes variations in pill access in the US between 1960 and 1977, identifying long-term negative mental health impacts in women at an age around 60. In the present study, I use the detailed Swedish registry data from 2005 to 2017, to determine whether oral contraceptive initiation in women aged 14-25 has an effect on antidepressant prescriptions with a two-year follow up window. Methodologically closest to my setting is Costa-Ramón et al. (2023), who use Danish registry data on adolescents aged 12–17 observed from five quarters before to four quarters after initiation. They employ the Sun and Abraham (2021) event-study estimator and compare not-yet-treated individuals with those treated in the last cohort. A key difference in my approach is that treated women are compared with not-yet-treated peers born in the same year and quarter who initiate oral-contraceptive use one or two years later. This design improves the credibility of the counterfactual because women treated shortly afterward are more likely to share similar lifestyle and behavioral trajectories, policy environments, access to health services, and social norms surrounding contraceptive use. As a result, the comparison strengthens the plausibility of parallel trends between treated and comparison groups. In addition, I use a broader sample of women aged 14–25, rather than only adolescents, and report subgroup estimates alongside the full-sample results to capture heterogeneity across life stages. The follow-up window is also extended to two years on either side of initiation, allowing a more accurate identification of first-time users in older cohorts and enabling a longer observation of post-initiation effects.

On the other hand, the medical literature presents conflicting findings[6] on the rela-

[6]These discrepancies may stem from variations in study design, including differences in how hormonal contraceptive methods are categorized. Some studies analyze each hormonal method separately—including oral contraceptives, implants, intrauterine devices, injections, patches, and vaginal rings—while others focus specifically on progestogen-only or combined contraceptives of all types. Additionally, comparison groups vary, with some studies comparing never-users, past-users, or users of other hormonal contraceptive methods. Differences in the choice of covariates may also influence results. Furthermore, depression is measured using various indicators, such as antidepressant use, depression scales, self-reported depressive symptoms, or clinical diagnoses. Finally, some studies focus on specific subpopulations, such as women with polycystic ovarian syndrome or those with no prior psychiatric history.

tionship between hormonal contraceptives and depression. Several studies report negative mental health impacts, indicating increased depression risk (Skovlund et al., 2016; Anderl et al., 2022; Johansson et al., 2023). Conversely, other research suggests positive effects, proposing reduced depressive symptoms (Toffol et al., 2012; Keyes et al., 2013; Gawronska et al., 2024), while additional studies find no significant relationship (Duke et al., 2007; Cheslack-Postava et al., 2015).

Several studies in the medical literature draw on large administrative registers comparable to this, yet they remain observational and do not establish whether oral contraceptives affect mental health. (Skovlund et al., 2016; Zettermark et al., 2018; Lundin et al., 2022). My study, however, uses an event-study design which observes trajectories pre- and post-initiation and contrasts initiators with not-yet-treated counterparts, enhancing the basis for causal inference. The causal impact of contraceptives has explicitly been addressed in the medical literature using randomized controlled trials (RCTs) (Lundin et al., 2017; Zethraeus et al., 2017; Gingnell et al., 2013; Bengtsdotter et al., 2018), however, these RCTs have a short intervention period and a small number of individuals compared to this study where I use an extended follow-up period after the pill initiation drawing on data from several age cohorts over multiple years covering the entire population of Sweden. Another notable limitation of this literature is the exclusion of women with prior depression or antidepressant use. While this helps to isolate new cases, it also conditions on the outcome and changes the composition of the treated, which weakens identification.

This paper makes several contributions to the literature on the effects of oral contraceptives and women's mental health. First, it provides new causal evidence by combining rich Swedish population-wide administrative data with an event-study design following Callaway and Sant'Anna (2021). The analysis compares women who initiate oral contraceptives with not-yet-treated peers born in the same year and quarter who initiate oral contraceptives one or two years later. This design improves the credibility of the counterfactual by ensuring that treated and comparison women share similar life-course trajectories and social environment, thereby strengthening the plausibility of parallel pre-trends. Second, the study extends the scope of existing evidence, which has mostly focused on specific age groups, by covering all women aged 14–25 and providing age-specific estimates to capture heterogeneity across life stages. Third, it explores key dimensions of heterogeneity in the estimated effects, focusing on the role of ADHD, and the motives for initiation. This approach helps uncover underlying mechanisms, showing that pre-trends among early initiators are largely driven by women with ADHD, while mental health effects are similar across contraceptive formulations but more pronounced among women who initiate for medical rather than contraceptive reasons. Taken together, these contributions bridge insights from the economics and medical literature and provide a comprehensive understanding of how hormonal contraceptive use affects women's mental health.

The remainder of the paper is organized as follows: Section 2 presents the literature

review, Section 3 describes the data, Section 4 outlines the empirical strategy, Section 5 presents the main results, Section 6 discusses the heterogeneity analysis, Section 7 details the robustness checks, and Section 8 concludes.

# 2 Literature Review

Since their introduction, oral contraceptives have generated a substantial economics literature that weighs emancipation through reproductive autonomy against emerging evidence of mental health costs. Specifically, a part of the economics literature examines how access to oral contraceptives has shaped women's career and educational trajectories. The introduction of the pill in the U.S. led to an increase in the age at first marriage, increased the participation of women in higher education and reduced the cost for women of investing in long-term careers (Goldin and Katz, 2000; Goldin and Katz, 2002). Similarly, Steingrimsdottir (2006) found that the pill influenced labour market choices, shifting women toward higher-paying, male-dominated jobs. Access to oral contraceptives increased women's labour force participation, reduced early childbearing and contributed to narrowing the gender wage gap (Bailey, 2006; Bailey et al., 2012). Another branch of the literature focuses on the pill's impact on teenage pregnancies, finding that access to oral contraceptives halved the pregnancy rates (Ragan, 2025). Additionally, research on Sweden's subsidization of the pill shows that it reduced abortion rates by 8% and lowered the likelihood of teenage childbearing by 20% (Grönqvist, 2009). Furthermore, Madestam and Simeonova (2012) found that the children born to women with access to the pill's subsidization in Sweden have higher educational attainment and are more prone to succeed on the labour market.

On the other hand, there is a newer strand of economics literature, complementing the existing medical literature, explores the health effects of oral contraceptives and specifically the effects on depression. Using U.S. survey data, Valder (2022) found that women in the U.S. with access to the pill report depression scores that are 27% higher on average, with even larger effects for those who had access during adolescence. Similarly, Costa-Ramón et al. (2023), using Danish registry data and an event study approach, found that teenage girls aged 12 to 17 experience worse mental health outcomes after initiating contraceptive use. When distinguishing between combined hormonal contraceptives and progestogen-only contraceptives, they found that the increased probability of being prescribed antidepressants was statistically significant only for those using combined hormonal contraceptives. Additionally, their findings suggest that girls whose physicians prescribe at higher rates tend to have worse mental health outcomes. Taken together, the literature portrays the effects of the pill as a trade-off—substantial gains in education, earnings, and fertility control alongside non-negligible mental health costs for some users, especially adolescents.

In the medical literature, the link between hormonal contraception and women's

mental health has been studied for many years and it remains inconclusive, largely because studies vary in data sources, outcome measures, and quality of empirical strategies. In a population akin to this paper, some papers utilize detailed population-registry data, yet their designs are more descriptive. Using nationwide Danish registers, Skovlund et al. (2016) followed every woman aged 15–34 from 2000 to 2013 and showed that initiating hormonal contraception increased the risk of a first depression diagnosis or antidepressant prescription, with the strongest relationship among adolescents. Using Swedish registers, Zettermark et al. (2018) tracked women aged 12–30 with no prior psychiatric morbidity. They linked first contraceptive prescriptions to subsequent psychotropic-drug use and found that the association was greatest for girls 12–14, weaker at 15–19, and absent in adults. Similarly, Lundin et al. (2022) observed Swedish women aged 15–25 between 2010 and 2017 and, after adjusting for parental mental health history, found no overall link for combined oral pills but did detect elevated risk among 15–19-year-olds using progestogen-only pills, with even higher estimates for the patch, ring, implant, and hormonal IUD. The aforementioned studies differ in outcome measures (first depression diagnosis, antidepressant prescriptions, both, or psychotropic-drug use), exclusion criteria (age, prior psychiatric diagnoses, childbirth history, prior psychotropic-drug use), and empirical methods. Even so, they indicate that associations with mental health vary by contraceptive formulation, with non-oral methods showing particularly strong associations with antidepressant or other psychotropic-drug prescriptions. They also reveal a clear age gradient, with adverse associations concentrated in adolescence and attenuating with age, motivating separate analyses by method and age group.

Because few countries maintain integrated population registers that link individuals across sectors through personal identifiers, most studies in this area rely on survey microdata or population-based cohorts (Duke et al., 2007; Toffol et al., 2012; Keyes et al., 2013; Cheslack-Postava et al., 2015; Gregory et al., 2018; Anderl et al., 2022; Johansson et al., 2023; Gawronska et al., 2024). These studies are heterogeneous along several dimensions. Outcomes differ, with many relying on self-reported questionnaires with different depression scales, symptoms and clinical diagnoses. Study populations encompass secondary-school populations, undergraduate cohorts, and adult women. Exclusion rules also differ, including concurrent sex-steroid use, gynaecological conditions related to hormonal contraception use, and prior pregnancy. Methodologies and covariate sets are not uniform, as well. Finally, exposure definitions range from all hormonal methods to oral contraceptives only, and within the latter to progestogen-only versus combined formulations. This heterogeneity complicates cross-study comparisons and causal interpretation, motivating an approach that harmonises outcomes and exposure definitions in linked administrative data.

Another strand of medical research uses randomised controlled trials (RCTs) to identify the causal effect of hormonal contraception on women's mental health, yet findings are mixed. RCTs typically have short intervention windows, small samples, and only test

for a specific drug formulation, limiting power, external validity, and the ability to assess longer-run effects or heterogeneity across methods. By extending the follow-up to two years, observing the whole Swedish population, and covering all oral contraceptive types, the present study helps address those gaps in the literature. Lundin et al. (2017) conducted an RCT in which one group received a combined oral contraceptive while another received a placebo. Their findings showed a slight increase in anxiety, mood swings, and irritability during the intermenstrual phase, but a decrease in depressive symptoms during the premenstrual phase. Similarly, Zethraeus et al. (2017) found that oral contraceptive users experienced a decline in general well-being scores compared to placebo users; however, the impact on depression scores was not statistically significant. Gingnell et al. (2013) provided stronger evidence of a causal link between combined oral contraceptive use and depression in users who had experienced emotional side effects in the past. Additionally, Bengtsdotter et al. (2018) found that women with a history of mental health issues were more susceptible to developing mood disorders when using a combined oral contraceptive. These studies highlight the complexity of the causal relationship between hormonal contraceptives and mental health, emphasizing the importance of considering individual susceptibility and different phases of the menstrual cycle.

# 3 Data

## 3.1 Youth Clinics and Access to Contraceptives

In Sweden, hormonal contraceptives are dispensed only by pharmacies and require a prescription. For adolescents and young adults aged 13 to 25, a prescription is usually acquired through the youth clinics (ungdomsmottagning). These clinics are open to all, and individuals may attend any clinic regardless of residence. Care is free of charge, with the exception of a fee for missed appointments, and access is straightforward. Appointments can be booked online or by phone, many clinics hold drop-in sessions, and an increasing number of them offer video and chat consultations.

Youth clinics are staffed by multidisciplinary teams that include midwives, physicians and gynaecologists, psychologists and psychotherapists, counsellors, dietitians, venereologists, and nurses. They offer a variety of information on the body, relationships, sexual orientation, and contraception, counselling on protection against sexually transmitted infections and unintended pregnancy, testing for sexually transmitted infections and pregnancy, prescription of hormonal contraceptives and provision of emergency contraception. Beyond sexual and reproductive health, youth clinics provide psychosocial support for mental health concerns such as sadness, depression, stress, disordered eating, and experiences of violence or abuse. When further treatment is needed, staff arranges referrals to specialised services for mental health because they are not authorized to prescribe medication for mental health disorders. Staff are bound by medical confidentiality, which

covers both the content of consultations and the fact that a visit occurred, subject to narrowly defined legal exceptions such as imminent risk of serious harm.

## 3.2 Hormonal Contraceptives and Mental Health Mechanisms

Hormonal contraceptives may influence mental health through several interconnected pathways. First, progesterone acts on the central nervous system, but it does not appear to offer protection against cognitive decline and affective disorders which can lead to worsened mood. The synthetic progesterone called progestogen, which is included in all contraceptive formulations, has similar effects on the brain (Zethraeus et al., 2017; Mu et al., 2022). Second, many formulations lower testosterone, a change associated with reduced well-being and mood symptoms such as depression, irritability, and moodiness (Zimmerman et al., 2014; Zethraeus et al., 2017). Third, users of androgenic oral contraceptives more frequently report adverse side effects such as mood changes, acne, increased appetite, and weight gain, which can indirectly impair mental health (Zethraeus et al., 2017). Fourth, neuroimaging evidence indicates lower global brain serotonin-4 receptor binding in users, providing a plausible molecular link to the risk of depression (Larsen et al., 2020). Finally, symptoms often worsen during the hormone-free interval, suggesting that withdrawal from contraceptive steroids during the pill pause can itself trigger adverse mental health effects (Noachtar et al., 2023).

## 3.3 Sample

### 3.3.1 Study Population

This analysis uses individual-level data from the Swedish Population Register on all individuals assigned female at birth who continuously resided in Sweden from the third quarter of 2005 to the last quarter of 2017. I focus on individuals whose first use of oral contraceptives occurred between ages 14 and 25 using the dispensing date of hormonal oral contraceptive medication from the National Prescribed Drug Register (Läkemedelsregistret). To improve identification of first-time users, I ensure that the individual had no prescription for any type of hormonal contraceptives for at least two years before their first oral contraceptive prescription. Although younger initiators and those observed later in the period are most likely true first-time users, confirming first use for older cohorts in the early years is harder because the lookback is limited to two years. However, research has shown that any effects of the pill should have returned to normal after one year (Gnoth et al., 2009; Mansour et al., 2011). Additionally, I follow all individuals for at least two years after they begin using oral contraceptives to ensure a well-balanced dataset with sufficient cohorts for analysis and an adequate window to capture short- to medium-run changes in mental health. As a result, my final sample consists of individuals who had their first oral contraceptive prescription between the third quarter of 2007 and the first quarter of 2015, while they were aged 14 to 25.

The age range of 14-25 years old is chosen because individuals who started contraceptive use before age 14 cannot be followed for the full study period. Those who initiate after age 25 may be preparing for pregnancy in the two years of the follow-up which is a factor that could independently affect mental health. Therefore, I exclude these groups from the analysis. Moreover, to ensure that all individuals remained in Sweden throughout the study period, I exclude those with gaps in the observation period.

All individuals in the sample have information on whether they use antidepressant medication, whether they have used any form of hormonal contraceptives from the National Prescribed Drug Register (Läkemedelsregistret), information on whether they visited the inpatient or outpatient care for endometriosis, heavy or irregular menstrual bleeding, premenstrual syndrome, polycystic ovarian syndrome, acne, and hirsutism from the National Patient Register (Patientregistret) and whether they have been hospitalized or referred to a specialized doctor for mental health disorder from the National Patient Register (Patientregistret).

### 3.3.2 Data Sources

In this analysis, four registries were utilized for data collection and analysis. The first registry is the Population Registry, which contains demographic information on individuals born between 1982 and 2002 who were assigned female at birth, and resided in Sweden from 2005 to 2017. Secondly, I utilize the Läkemedelsregistret (National Prescribed Drug Register), which contains information on the prescribed drugs in Sweden from July 2005 to December 2017 using the 5th ATC level codes that indicate the chemical substance of the drug. Specifically, I have information on drugs used for the nervous system that begin with the ATC code N06A (Antidepressants) and I use them as a measure of depression and deteriorated mental health. Furthermore, I have information on medications used for the genitourinary system and sex hormones, which begin with the ATC code G02B (Contraceptives for Topical Use) and G03A (Hormonal Contraceptives for Systemic Use), excluding G03AD (Emergency Contraceptives). The Hormonal Contraceptives for Systemic Use (G03A) and the Contraceptives for Topical Use (G02B) are divided into two categories based on the administration method to oral contraceptives (G03AA07, G03AA09, G03AA10, G03AA11, G03AA12, G03AA14, G03AA16, G03AA18, G03AB08, G03AC01, G03AC02, G03AC09, G03AC10) and non-oral contraceptives (G02B, G03AA13, G03AC06, G03AC08). Then the first-time use is based on the first time an individual had dispensed a prescription for oral contraceptives and this quarter determines the event time before and after the initiation. Women who have been using any type of non-oral hormonal contraceptives are excluded from the sample, and further analysis is not conducted due to small number of users among adolescents and young adults. Thirdly, the Patientregistret Öppenvård (National Patient Register - Outpatient) is used, as it contains information such as the primary diagnosis using ICD-10 codes and the date of the appointment for all persons who received outpatient care services, i.e. treatment, consultation, or a

procedure without an overnight stay in the hospital, from 2005 to 2017. Finally, the Patientregistret Slutenvård (National Patient Register - Inpatient) contains information such as the principal admission diagnosis using ICD-10 codes, the number of hospital days and the dates of admission and discharge for all persons who were hospitalized from 2001 to 2017. The last two datasets provide information on gynaecological diagnoses and mental health disorders and ADHD.

### 3.3.3 Treatment and Outcome Variables

The outcome of interest is a binary indicator variable that takes the value of 1 if an individual has been prescribed antidepressants (identified by ATC code N06A) during a given quarter and 0 otherwise. I use the antidepressant use as the outcome of interest, since it is the most common way of measuring mental health in studies using registry data (Skovlund et al., 2016, Lundin et al., 2022) and it reflects the probability of receiving an antidepressant prescription over time.

The treatment variable in the baseline analysis is also a binary indicator. It takes the value of 1 starting from the first quarter in which an individual receives a prescription for oral hormonal contraceptives and remains 1 for all subsequent quarters. It is also set to 0 for all prior periods as individuals with contraceptive use in the two years before initiation are excluded. In the main analysis, I focus exclusively on oral hormonal contraceptives, identifying prescriptions using ATC code G03A (Hormonal Contraceptives for Systemic Use). However, I exclude hormonal contraceptives that do not fall in the category of oral contraceptives, namely G03AA13 (norelgestromin and ethinylestradiol, which refers to contraceptive patches), G03AC06 (medroxyprogesterone, referring to injectables), G03AC08 (etonogestrel, referring to implants), and G03AD (emergency contraceptives) (FASS.se Vårdpersonal, 2025), because these products contain the same hormones as the pills, but their administration and exposure profiles differ in ways that may influence mental health outcomes (Skovlund et al., 2016; Lundin et al., 2022).

## 3.4 Summary Statistics

Figure 1 plots the age distribution of first oral contraceptive initiation. The majority of the first-time users are during middle and late adolescence, peaking at age 16, and then the trend declines monotonically with age. The high concentration during adolescence is consistent with initiation of contraceptives soon after sexual debut and/or with common non-contraceptive reasons (i.e. alleviation of symptoms of gynaecological conditions). The steady decline after 17–18 is consistent with saturation of the population where most women who will ever start contraception have already done so, so new starts are infrequent. After about age 21, year-to-year differences are small, indicating low levels of first use in the mid-20s.

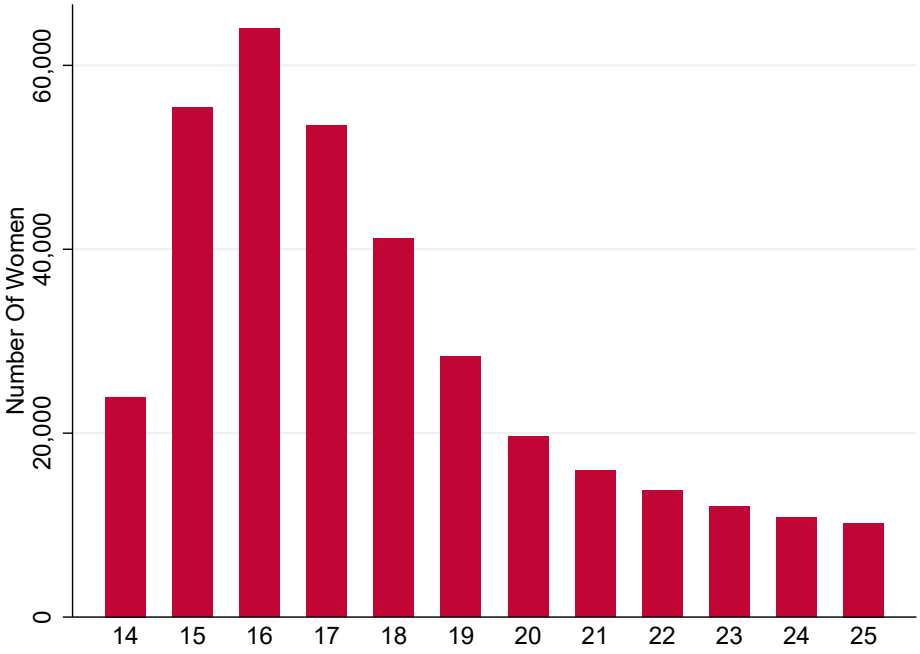


Figure 1: This figure displays the number of women initiating oral contraceptives by age. The data cover the period from July 2005 to December 2017.

To examine the pattern of antidepressant prescriptions over time, Figure 2 presents the probability of receiving an antidepressant prescription (ATC code N06A) from two years before to two years after the initiation of oral contraceptives (ATC code G03A). The event time is measured in quarters, with negative values representing the periods before initiation and positive values indicating the periods after. The probability of an antidepressant prescription rises steadily from about 2.5% in the earliest period to about 5.6% by the end of the window. The black dashed line depicts the extrapolated pre-treatment trend. After the initiation of oral contraceptives, the observed probability diverges upward from this projected path, suggesting an increase in antidepressant use around initiation. While this figure does not provide a formal causal estimate, the pattern is consistent with a potential effect of oral contraceptives on women's mental health.

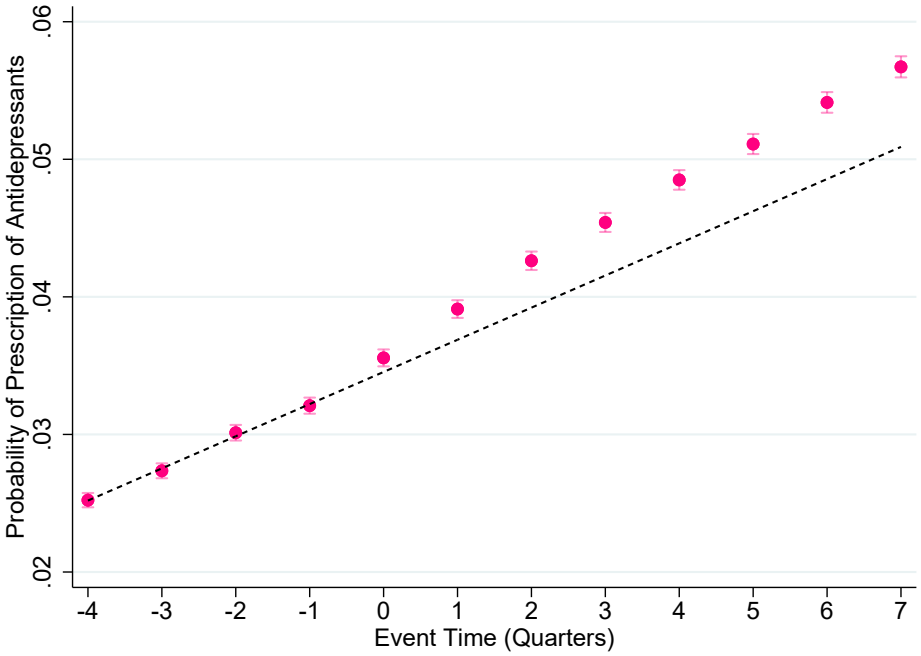


Figure 2: This figure illustrates the probability of having an antidepressant prescription at each event time. Event time 0 corresponds to the quarter in which an individual initiated oral contraceptive use for the first time. The analysis covers the period July 2005 to December 2017 and includes women aged 14–25 who began contraceptive use between the third quarter of 2007 and the first quarter of 2016. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.The dashed line represents the extrapolated pre-treatment trend.

# 4 Empirical Strategy

Estimating the mental health consequences of oral contraceptive use faces two classic identification challenges. Firstly, selection into treatment where women who initiate contraceptives may differ systematically from those who do not, and secondly, constructing a credible counterfactual for outcomes absent initiation. In staggered adoption settings, conventional two-way fixed effects event study models suffer from issues discussed extensively in the recent literature. The main problem arises from the "forbidden" comparisons where already treated groups can serve as controls for later treated groups which assigns negative weights to the treatment effect parameters of the weighted average estimator and contaminates lead and lag coefficients by mixing the effects of other lag and post-treatment periods (Borusyak and Jaravel, 2018; de Chaisemartin and D'Haultfoeuille, 2020; Goodman-Bacon, 2021; Sun and Abraham, 2021). To address these concerns, I use an event study difference-in-differences design that compares treated cohorts to appropriate not-yet-treated controls, implementing the estimator of Callaway and Sant'Anna (2021).

Following the Callaway and Sant'Anna (2021) framework, I tailor the design to my setting by defining cohorts by age-at-initiation within birth year and birth quarter, and by restricting controls to not-yet-treated peers who initiate one or two years later. More specifically, I construct separate datasets by age at initiation. Within each age-at-initiation dataset, the treated group consists of individuals who initiated contraceptives at that age, and the control group, which consists of peers who will initiate contraceptives when they

are one or two years older. This design aims to compare treated individuals to peers who initiate contraceptives at a similar age, since lifestyle factors and health trajectories are more likely to be similar. It is important to mention that treatment is an irreversible state and therefore, once individuals are treated, they remain treated throughout the whole time period. To further enhance comparability, comparisons are restricted to those born in the same year and quarter and not to other individuals in the control group who initiate contraceptives later, since patterns in contraceptive use may change over time. To illustrate the structure, initiators at age 14 are compared to peers from the same birth year and quarter who begin at ages 15 or 16. This means that at the time of comparison, all individuals are 14 years old, but only the treated have initiated contraceptive use. This structure is intended to strengthen the credibility of the counterfactual and help isolate the potential effect of oral contraceptive use on mental health outcomes.

Building on the Callaway and Sant'Anna (2021) setup and the cohort definitions above, identification relies on three assumptions. First, I assume that the timing of initiation is as good as random within the two-year follow-up window once I condition on birth year and birth quarter. In other words, among women who initiate within this window, the exact quarter of initiation is unrelated to how their untreated antidepressant use would have evolved. Appendix Figures A1–A4 show that the health of individuals is very similar across the treatment and control groups before initiation, both in terms of overall outpatient visits and inpatient episodes and in specific diagnostic codes for mental health disorders. Furthermore, I assume that there is no treatment anticipation which means that the outcome in the quarters before the first prescription is unaffected by the decision to initiate contraceptives, since any effect should arise through exposure to the pill rather than expectations. Although there is no formal testing to this assumption, Figure 2 provides further support for this assumption, as there is no change in the probability of prescription of antidepressants in the pre-treatment period. Finally, I assume that, in the absence of treatment, women who initiate contraceptives would follow a similar trajectory in the outcome to those who do not. Given the potential for covariate-specific trends, I assume that the parallel trends are conditional on covariates, namely birth year and birth quarter. In this context, this means that in the absence of treatment, women in the same birth year and birth quarter would have evolved the same in their antidepressant use.

The age-at-initiation group time average treatment effect is estimated with the doubly robust procedure of Callaway and Sant'Anna (2021) using not-yet-treated units as controls, as shown below.

$$\widehat{ATT}^{ny}_{dr}(g,t) =$$
$$n^{-1}\sum_{i=1}^{n}\left(\frac{G_{i,g}}{n^{-1}\sum_{i=1}^{n}G_{i,g}} - \frac{\frac{\hat{p}_{i,g,t}(X_i)(1-D_{i,t})(1-G_{i,g})}{1-\hat{p}_{i,g,t}(X_i)}}{n^{-1}\sum_{i=1}^{n}\left(\frac{\hat{p}_{i,g,t}(X_i)(1-D_{i,t})(1-G_{i,g})}{1-\hat{p}_{i,g,t}(X_i)}\right)}\right)\left(Y_{i,t} - Y_{i,g-1} - m^{ny}_{i,g,t}(X_i)\right) \tag{1}$$

where

$$\widehat{m}^{ny}_{i,g,t}(X_i) = n^{-1}\sum_{i=1}^{n}\left[Y^{ny}_{i,t}(X = X_i) - Y^{ny}_{i,g-1}(X = X_i)\right] \tag{2}$$

and

$$\hat{p}_{i,g,t}(X_i) = P\left(G_{i,g} = 1 \mid X_i, G_{i,g} + (1-D_{i,t})(1 - G_{i,g}) = 1\right) \tag{3}$$

Where $Y_{i,t}$ is the binary outcome equal to 1 if individual $i$ has filled an antidepressant prescription in quarter $t$ and 0 otherwise. $D_{i,t}$ is the treatment indicator that equals 1 if the individual $i$ has initiated oral contraceptives at time $t$ and onward. $G_{i,g}$ is a binary variable that takes the value 1 if the individual $i$ has initiated contraceptives for the first time in quarter $g$.$n$ is the number of individuals at each age-at-initiation dataset. $\hat{p}_{i,g,t}(X_i)$ denotes the generalized propensity score, which shows the probability that individual $i$ is treated at quarter $g$, conditional on pre-treatment covariates $X$ which are birth year and birth quarter, and on either belonging to those initiated contraceptives at time $g$, or belonging in the not-yet-treated group at time $t$. $m^{ny}_{i,g,t}(X_i)$ is the outcome regression function for the not-yet-treated group, that is, the conditional mean difference in the probability of prescription of antidepressants between time $t$ and $g-1$ for all those who are not-yet-treated in time $t$ for specific pre-treatment covariates $X_i$ which are birth year and birth quarter. Time is measured in quarters. Finally, the choice to estimate the group-time average treatment effect using the Doubly Robust estimator instead of IPW (Inverse Probability Weighting) or OR (Outcome Regression) estimators is that it is more robust to misspecification, as it combines both IPW and OR methods.

Due to randomization, no treatment anticipation, and the conditional parallel trend assumption, I estimate the group-time average treatment effects for each age-at-initiation cohort separately. The $\widehat{ATT^{n}_{dr}}(g,t)$ are normalized to time period $g-1$, since it is the last time period that an individual is not treated. Then, I aggregate the group-time average treatment effects to create the event time coefficient for $e$ quarters after the treatment initiation, while following everyone for eight quarters since the treatment started for every age-at-initiation cohort $k$ :

$$\theta_k(e;7) = \sum_{g\in G}\mathbf{1}\{g+7\leq T\}\widehat{ATT}(g,g+e)P(G=g \mid G+7\leq T) \tag{4}$$

The indicator $\mathbf{1}\{g+7\leq T\}$ is an indicator function equal to 1 if I observe the individual

for 7 quarters after the pill initiation. $P(G = g \mid G + 7 \leq T)$ is the probability of the individuals to belong in the group of women who first started treatment at time $g$. The $\widehat{ATT}(g, g + e)$ is the estimated grouptime average treatment effects for women who first started treatment at time $g$ and I observe them at time $g + e$. The aggregation for event time coefficients is for every $g$ that belongs in subset $\mathcal{G}$ which includes the time periods that individuals can be treated i.e. third quarter of 2007 to first quarter of 2015. Finally, $T$ is the last quarter of the sample, with the observation window spanning from July 2005 to December 2017.

The results presented in the following chapters are population-weighted averages across age-at-initiation cohorts using the equation below, where $AETC(e; k_1, k_2)$ is the Aggregated Event Time Coefficient for every event time $e$ for the age-at-initiation cohorts from $k_1$ to $k_2$ and $n_k$ is the number of women at each age-at-initiation dataset.

$$AETC(e; k_1, k_2) = \left( \sum_{k=k_1}^{k_2} n_k \right)^{-1} \left( \sum_{k=k_1}^{k_2} \theta_k(e; 7) n_k \right) \tag{5}$$

# 5 Effects of Oral Contraceptive Initiation on Mental Health

## 5.1 Main Results

In this section, I present the results for the relationship between oral contraceptives and antidepressant prescriptions. Figure 3 shows the probability of having a prescription of antidepressants by event time for women whose oral contraceptive initiation occurred between ages 14 and 25. Each event-time estimate is the population-weighted mean of the cohort-specific coefficients, where each age cohort's effect is comparing treated women with not-yet-treated who initiate contraceptives within two years. The event time coefficients are relative to the quarter preceding the initiation of contraceptives. The results indicate an increase in the probability of receiving a prescription for antidepressants following the initiation of contraceptives. After a period of eight quarters, or two years, the probability has increased by 0.72 percentage points relative to the year before initiation, amounting to a 22.65 percent increase. However, the quarters before the initiation show that there is an increasing pre-trend in the probability of being prescribed antidepressants in the population. Given the presence of the pre-trend, it is not possible to rule out that the observed increase in antidepressant prescriptions reflects factors other than oral contraceptive use, since women were already increasing their use before initiation. Therefore, the results should not be interpreted as causal.

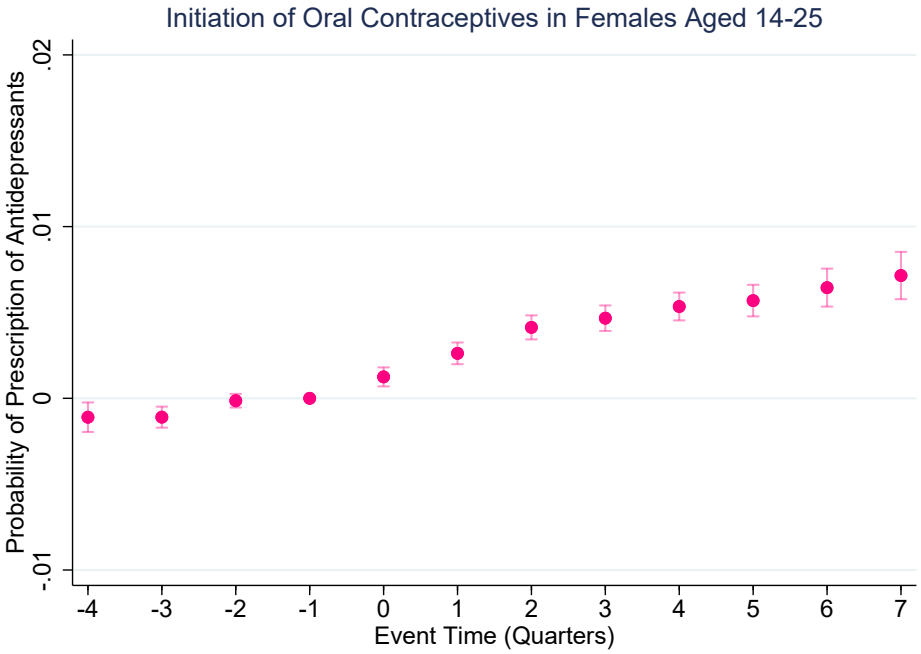


Figure 3: This figure displays aggregated event-time coefficients for women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016, measured relative to one quarter before initiation. The baseline probability of having an antidepressant prescription in the quarter before initiation is 0.032. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

Showing results only for the full 14–25 age range may be uninformative because it conceals important variation across age groups. As shown in Figure 1, first-time initiation of oral contraceptives is concentrated at ages 15 to 18 and there are relatively few initiators above age 20, and this might lead to an overrepresentation of the larger age groups, thereby shifting the average toward the ages with the highest concentration of initiators. Hence, the results are split into three subgroups. The selection of subgroups follows life stages where 14–16 reflects middle adolescence with women in junior high school, 17–19 reflects women in late adolescence who are in high school and are transitioning to adulthood, and 20–25 reflects young adulthood with women entering into the labour market and/or joining a university.

Figure 4 shows a statistically significant post-initiation increase in antidepressant prescriptions for women who begin at ages 14–16. A pronounced, near-linear pre-trend, however, rules out a causal interpretation. The evidence points to selection into the timing of treatment, as early contraceptive users display steeper pre-initiation increases in antidepressant use compared to their not-yet-treated peers who will initiate contraceptives within the next two years. For the group of females in late adolescence (17-19), an 8.94 percent increase in the probability of being prescribed antidepressants during the first year after oral contraceptives initiation. However, this effect remains stable after the first year. The pre-trends in that group are statistically insignificant for all the estimated coefficients, and therefore the increase in the probability of antidepressant prescription can

be attributed to the initiation of oral contraceptives. Finally, the group with females in young adulthood (20-25) shows an increase of 18.9 percent in the probability of prescription of antidepressants which also stabilizes over time. Due to pre-trends in this group being statistically insignificant, the results can be interpreted as causal. Since the estimated coefficients are weighted averages of cohort-specific estimates, I present the event time coefficients for each age-at-initiation cohort separately in Appendix Figure A5.

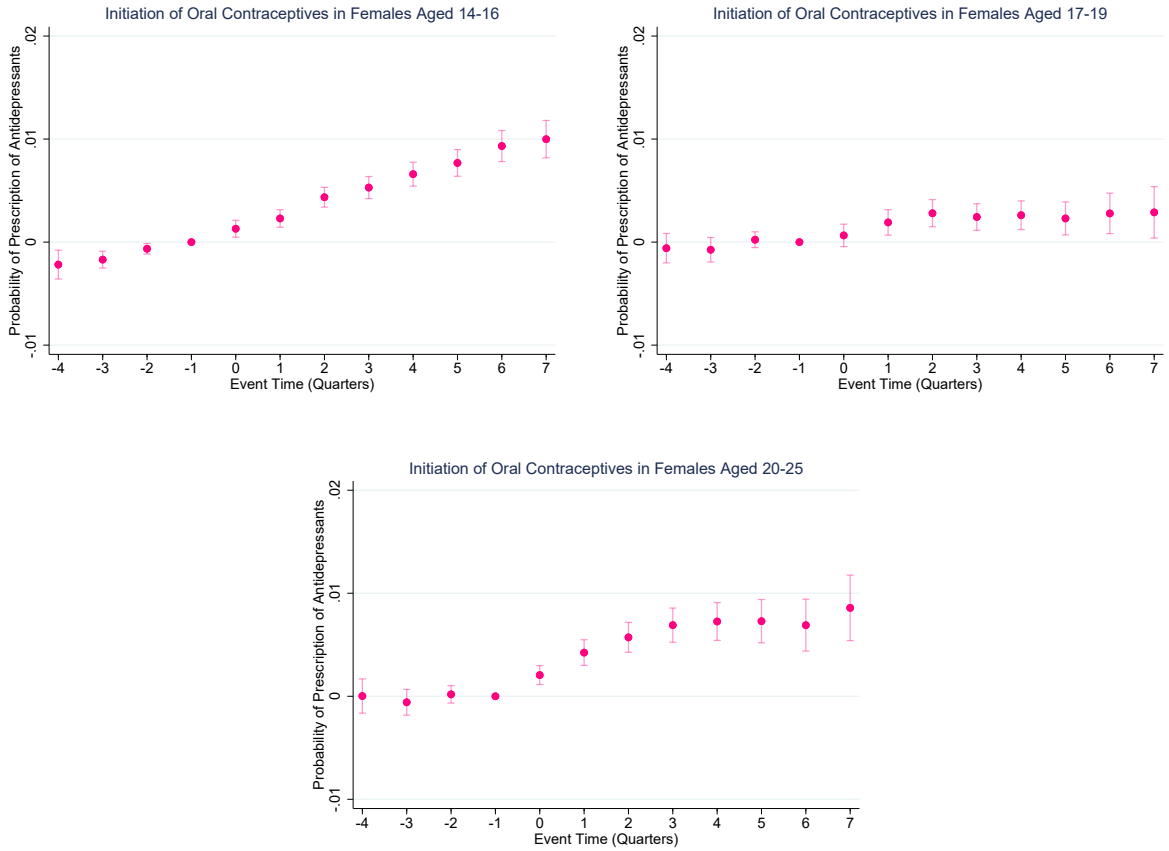


Figure 4: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016, with coefficients measured relative to one quarter before initiation. The panels show separate estimates for women aged 14–16 (top left), 17–19 (top right), and 20–25 (bottom). The mean probability of having an antidepressant prescription in the quarter before initiation is 0.026, 0.030, and 0.046, respectively. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

In Appendix Figure A6, I present results excluding individuals who received a depression diagnosis [7] in outpatient or inpatient care two years before contraceptive initiation. This exclusion addresses the concern that overall effect may be driven by a small group with severe pre-existing conditions rather than reflecting patterns in the broader population. Across all age groups, the pre-treatment trajectories resemble the baseline, while the post-treatment estimates are moderately larger. This pattern may arise due to the very low baseline level of antidepressant use among women without prior depression diagnoses

[7] I exclude people from the sample who either had a diagnosis of a Depressive Episode with ICD-10 code F32 or a Recurrent Depressive Disorder with ICD-10 code F33.

(2.7 percent at t–1), which mechanically inflates the relative size of the post-treatment effects.

The Appendix Figures A7 and A8 also include an analysis of the probability of outpatient and inpatient care visits among individuals with depressive diagnoses. In Sweden, most of people that have been diagnosed with depression can receive treatment by their general practitioner in their local healthcare centre, however, the doctor can issue a referral for a visit in the specialized care depending on the severity of the situation (1177.se, Söka vård för psykiska besvär, 2022; 1177.se, Depression, 2025). This analysis examines whether oral contraceptives use affects the probability of seeking specialized care for severe depression. The results indicate no causal relationship between oral contraceptive use and outpatient visits or inpatient episodes for depression.

In Appendix Figure A9, I present results from an alternative specification in which treated women are compared to peers who initiated oral contraceptives at the same age but one year later, rather than to peers who initiated one or two years later as in the baseline analysis. This analysis allows me to isolate whether the estimated effects are driven by differences in age at initiation due to women being at different points in their schooling, relationships, or health trajectories. However, due to the comparison of one-year older peers, I can follow individuals for one year after initiation, instead of two years. I also present the results where women are compared to peers who initiated oral contraceptives at the same age but only two years later in Appendix Figure A10 for further robustness. Across all specifications, the results are closely aligned with the baseline, suggesting that no particular comparison group is driving the estimates.

Appendix Figure A11 presents the results for a different different not-yet-treated group. More specifically, the individuals who started contraceptives at a specific age are compared to the individuals who started contraceptives at the same age but at a later time. The change this brings to equation (1) is that the covariate $X_i$ is the age of first use of oral contraceptives instead of birth year and birth quarter. This implies that the treated individuals in the post-treatment period are compared to their younger peers. The benefits of this robustness check are that I further reduce any confounding factors from differences in the life-stages of individuals and I investigate whether the baseline results are driven by cohort structure. For the middle-adolescence group (ages 14–16), the results are modestly larger but not statistically different from the baseline, following a similar overall trajectory. For the other age groups, the estimates remain closely aligned with the baseline.

As an additional robustness check, I compare the results to those for individuals who have never used contraceptives, presented in Appendix Figure A12. This approach is adopted to ensure a fair comparison between individuals who have received treatment and those who have not, with the latter group being defined as individuals who have not filled a prescription for any type of contraceptives from July 2005 to December 2017.

The treated individuals of a specific group are compared to people that have never used any hormonal contraceptives and are born in the same year and the same quarter. This means that the never-treated individuals can be the comparison group for multiple treated individuals. A caveat of this analysis is that individuals not observed after age 25 may initiate contraceptives later in life that I cannot follow. Another limitation to this analysis is that some individuals may use long-acting reversible contraception (LARC) that lasts 3 to 8 years which I cannot capture. Finally, never-treated individuals can be a very specific group and this might bias the analysis. For these reasons, the results should be interpreted with caution. The findings presented in Appendix Figure A8 are robust and consistent across all subgroups, except for the middle-adolescence group (ages 14–16), where the estimates are somewhat larger but remain statistically indistinguishable from the baseline and follow the same overall trajectory.

Finally, Appendix Figure A13 restricts the analysis to women born in Sweden. The results are virtually unchanged compared to the full sample, suggesting that the main findings are not driven by foreign-born women, who may differ in contraceptive use, health care access, or prescription patterns. This reinforces the robustness of the baseline estimates.

## 5.2 ADHD and Selection into Treatment

Given the pronounced pre-trends observed among the youngest initiators, it is important to assess whether these patterns are driven by specific subpopulations. One potential source of heterogeneity may come from individuals diagnosed with Attention-deficit/hyperactivity disorder (ADHD)[8] . ADHD is strongly comorbid with other mood and anxiety disorders (Gillberg, 1983; Larson et al., 2007; Elia et al., 2008; Katzman et al., 2017), making affected individuals more likely to receive antidepressant treatment. In addition, ADHD has been linked to riskier sexual behavior during adolescence and young adulthood (Flory et al., 2006; Hosain et al. 2012; Sarver et al., 2014; Skoglund et al. 2019; Young et al., 2023) which may in turn increase medical incentives to prescribe contraceptives, particularly during middle adolescence. This section investigates whether differences between women with and without an ADHD diagnosis contribute to the observed pre-trend dynamics and whether the mental health effects of oral contraceptive initiation vary across these groups.

To identify women with an ADHD diagnosis, I include all individuals who visited outpatient care between 2001 and 2017 and received a diagnosis of ADHD (ICD-10 code F90). ADHD is a neurodevelopmental disorder with onset in childhood, and even if these individuals had not been diagnosed before initiating contraceptives, they were nonetheless affected by it. Moreover, clinical evidence shows that around 50-70 percent continue to

[8]ADHD is a neurodevelopmental disorder with onset in childhood (DSM-5; American Psychiatric Association, 2013). According to the World Health Organization (2019), it affects children's learning and daily functioning, and is characterized by symptoms of inattention, hyperactivity, and impulsivity, which may occur in combination.

experience symptoms into adulthood (Lara et al., 2008; Sibley et al., 2016; Cortese et al., 2025). This implies that even if I observe someone who was diagnosed with ADHD in childhood, symptoms are likely to persist for the majority of this population in young adulthood.

Figure 5 presents the proportion of women with an ADHD diagnosis across age groups defined by the timing of oral contraceptive initiation. The prevalence is highest among those initiating at age 14, where nearly 9 percent have a diagnosis. The proportion then declines sharply with age, falling to about 6 percent at age 15, 4 percent at age 16, and stabilizing around 2 percent from age 18 onwards. The figure highlights that the prevalence of ADHD diagnoses is higher among women who initiate oral contraceptives at younger ages. Motivated by this pattern, and given that pre-trends are primarily observed among adolescents, the analysis focuses on the 14–16 age group.

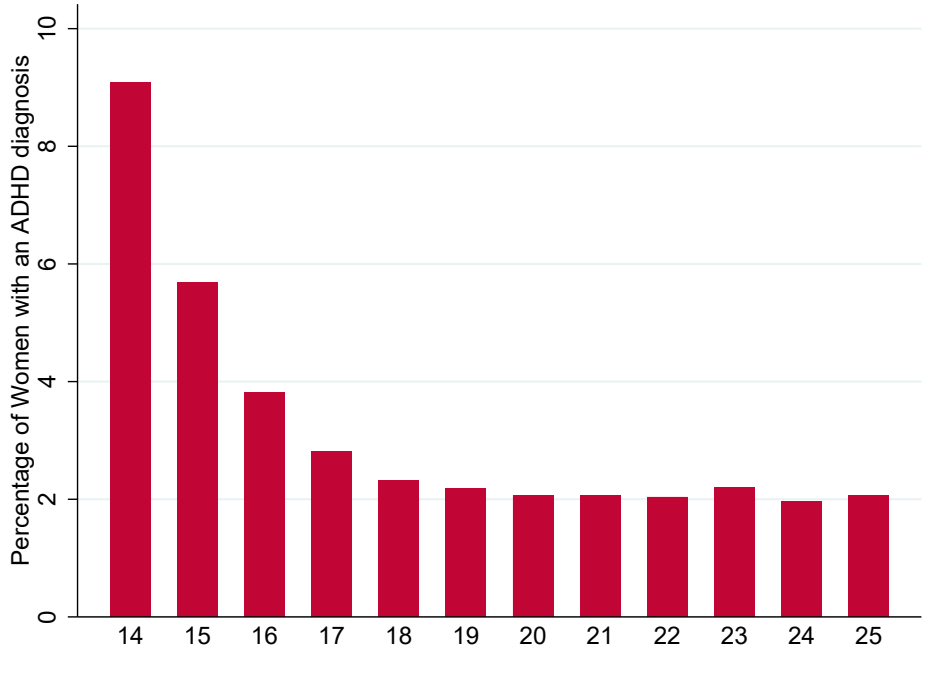


Figure 5: This figure presents the percentage of women with an ADHD diagnosis, categorized by age at initiation of oral contraceptives. The dataset covers the period July 2005 to December 2017 and includes women aged 14–25 who began contraceptive use between the third quarter of 2007 and the first quarter of 2016.

Figure 6 displays the estimated effects for women in middle adolescence (ages 14–16). The effects are substantially larger for women with ADHD, and the differences relative to their non-ADHD peers are statistically significant throughout the post-treatment period. The pre-treatment trajectory for women diagnosed with ADHD is larger than the baseline case, displaying an almost linear increase in the probability of antidepressant prescriptions. Although the pre-treatment effects are not statistically significant, this likely reflects the small sample size of women with ADHD rather than the absence of a trend. In contrast, among women without ADHD in the middle-adolescence group, the estimates are smaller than in the baseline, indicating less pronounced pre-trends (Appendix Figure A14 illustrates these results using a narrower scale, as in Figure 3). This pattern suggests

that the baseline pre-trend is predominantly driven by women diagnosed with ADHD.

The findings resemble the results of Lundin et al. (2023), who also document stronger associations between oral contraceptives and mental health outcomes among women with ADHD. Nonetheless, the relationship between oral contraceptive use and the probability of prescription of antidepressants should be interpreted with caution for women diagnosed with ADHD, as ADHD symptomatology and psychiatric comorbidity are known to increase the likelihood of missed doses, discontinuation, and switching between contraceptive types due to intolerance (Klint Carlander et al., 2022; Wallin et al., 2024).

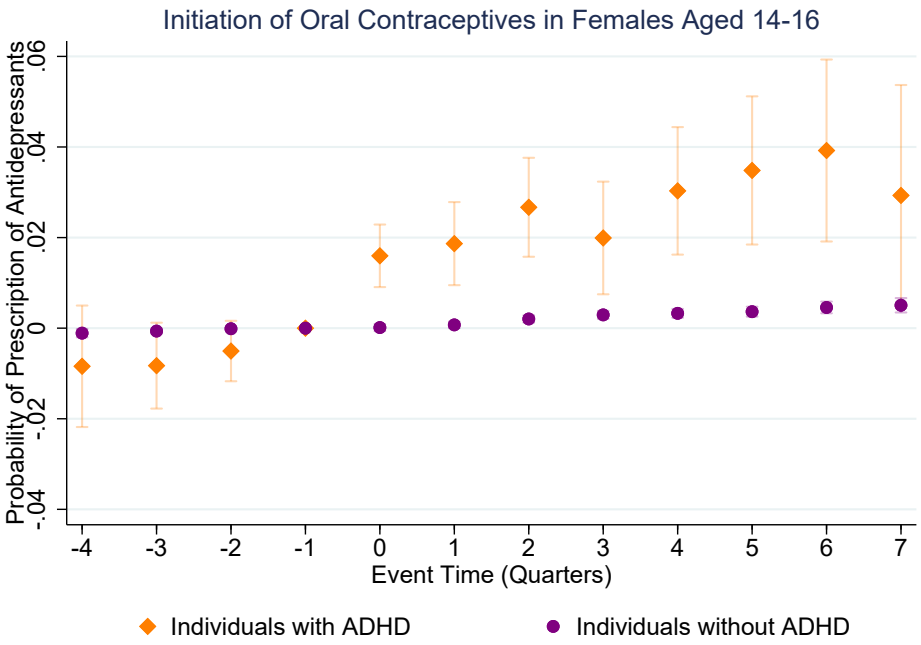


Figure 6: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women aged 14–16 who initiated oral contraceptives between July 2007 and March 2016, measured relative to one quarter before initiation. Results are shown separately for women with a diagnosis of ADHD (orange diamonds) and women without ADHD (purple circles). The mean probability of having an antidepressant prescription in the quarter before initiation is 0.263 for women with ADHD and 0.013 for those without ADHD. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

Appendix Figure A15 presents the results for women with and without ADHD who initiate oral contraceptives in late adolescence (ages 17–19) and young adulthood (ages 20–25). The estimates for women with ADHD are highly imprecise, likely due to the small proportion of women with ADHD initiating oral contraceptives at these ages, as shown in Figure 5, making it difficult to draw firm conclusions. In contrast, the results for women without an ADHD diagnosis closely resemble the baseline pattern.

# 6 Heterogeneity Analysis

In the heterogeneity analysis, the focus is on women who initiate oral contraceptives in late adolescence (ages 17–19) and young adulthood (ages 20–25), where the timing of initiation can be considered as good as random. The younger group (ages 14–16) is excluded, since treatment at these ages is more likely to reflect selection into contraceptive use rather than random timing. In particular, the pre-treatment trends for this group are largely driven by women diagnosed with ADHD, who make up a notable share of early initiators and display distinct mental health trajectories even before initiation. Restricting the analysis to the older groups therefore allows the estimates to capture effects for women whose treatment timing is plausibly random.

## 6.1 Type of Oral Contraceptives

The following analysis makes a distinction between the two different types of oral hormonal contraceptives. The two types are combined contraceptives, which contain both estrogen and progestogen, and progestogen-only contraceptives. The impact of the different types of contraceptive medications on women's mental health and antidepressant utilisation has been a subject of investigation, though findings remain inconclusive. Studies have demonstrated an elevated risk of depression diagnosis or antidepressant prescription for women who use progestogen-only contraceptives (Wiréhn et al., 2010; Lindberg et al., 2012; Skovlund et al., 2016). Conversely, other studies have shown no effect of progestogen-only contraceptives on the probability of an antidepressant prescription (Worly et al., 2018; Costa-Ramón et al., 2023). The evidence regarding combined oral contraceptives is similarly inconsistent. Studies have shown that combined contraceptives have no association with depression (Natale et al., 2006; Zethraeus et al., 2017; Lundin et al., 2022), while other studies have found an association between combined contraceptives and depression (for specific chemical substances Lindberg et al., 2012; Skovlund et al., 2016; Khafagy et al., 2021).

The decision for the most appropriate type of oral contraceptive for every woman is informed by the preferences of the woman in question and any medical conditions she may have, given that not all contraceptives are deemed safe for all individuals (1177.se, Preventivmedel – skydd mot graviditet, 2022). According to the 2024 US Medical Eligibility Criteria for Contraceptive Use of the CDC, guidelines state that doctors should avoid prescribing specific types of oral contraceptives to women with specific conditions. More specifically, combined contraceptives should not be prescribed to women who are breastfeeding and are in the postpartum period, to women with cardiovascular conditions such as thrombophilia and previous venous thromboembolism, to women with liver or renal disease, to smokers, to women with diabetes, and to women with migraines with aura. In contrast, progestogen-only contraceptives have been found to carry a higher risk than benefit for women with a history of ectopic pregnancy and women who experience

heavy or irregular bleeding.

Regarding individual choice, women select contraceptive methods based on the effectiveness in preventing pregnancy, interactions with other drugs, and/or the side effects of each type. Extensive literature has examined the side effects of hormonal contraceptives, highlighting differences based on their chemical composition. The risk of venous thromboembolism (VTE) (Lidegaard et al., 2012), cerebral thromboembolic attacks (Lidegaard et al., 2002), thrombotic stroke or myocardial infarction (Lidegaard et al., 2012), and changes in blood pressure (Ribeiro et al., 2018) are high for users of combined oral contraceptives while there is no risk for progestogen-only contraceptive users. On the other hand, progestogen-only contraceptive users have more frequent and less predictable spotting and bleeding than combined contraceptive users (Belsey, 1988).

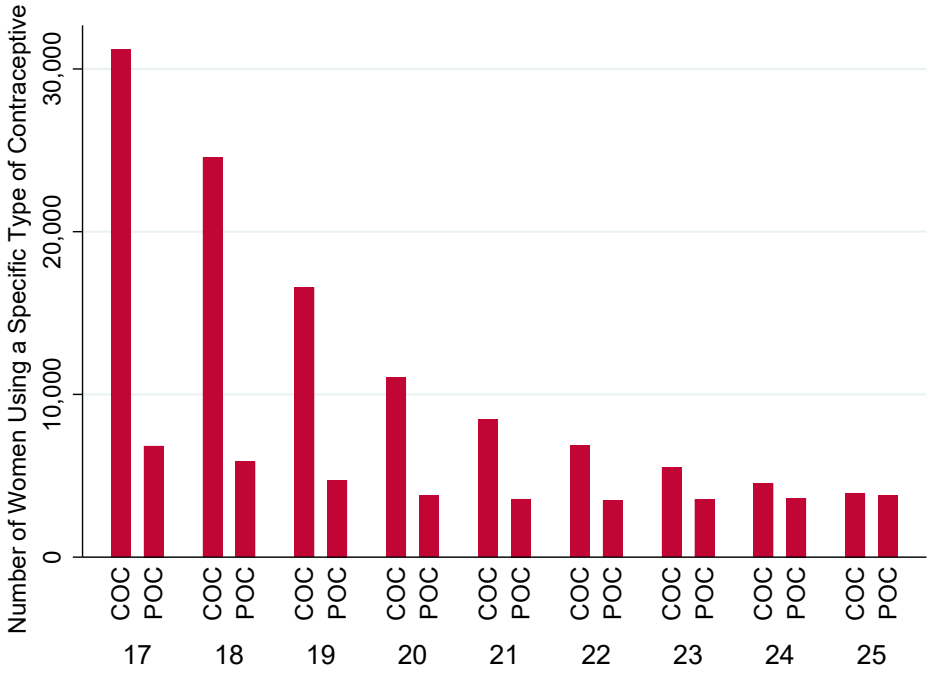


Figure 7: This figure presents the number of women who exclusively used combined oral contraceptives (COC) and those who exclusively used progestogen-only oral contraceptives (POC), categorized by age at initiation. The dataset covers the period July 2005 to December 2017 and includes women aged 17–25 who began contraceptive use between the third quarter of 2007 and the first quarter of 2016.

In this study, I classify women using oral contraceptives into two distinct groups, those who have exclusively taken combined oral contraceptives and those who have exclusively used progestogen-only pills. Women who transitioned between the two contraceptive types constituting 26% of the sample were excluded from the analysis. In Figure 7, I show the number of women who use each type of contraceptive based on the age that they initiated oral contraceptives for the first time. The majority of oral contraceptive users are combined oral contraceptive users with 112,622 women (54,8% of the sample), while progestogen-only contraceptive users account only for 39,273 individuals (19,2% of the sample). An interesting pattern is that combined contraceptives are more prevalent among adolescent first-time initiations, while the two types are roughly equal from age 23

onward.

Figure 8 presents the estimated effects by type of oral contraceptive. The results for combined oral contraceptive users are broadly comparable across age groups and resemble the baseline pattern. For progestogen-only contraceptive users, no effect is observed on antidepressant prescriptions in the post-treatment period among the late adolescence group (ages 17–19). This likely reflects the relatively low prevalence of progestogen-only use at these ages, as shown in Figure 7. Among women initiating contraceptives between ages 20 and 25, where progestogen-only pills are more common, the results are almost identical across the two contraceptive types. Overall, the estimated coefficients for both groups are not statistically different in all cases, suggesting that the chemical formulation of oral contraceptives does not materially affect the probability of antidepressant prescriptions.

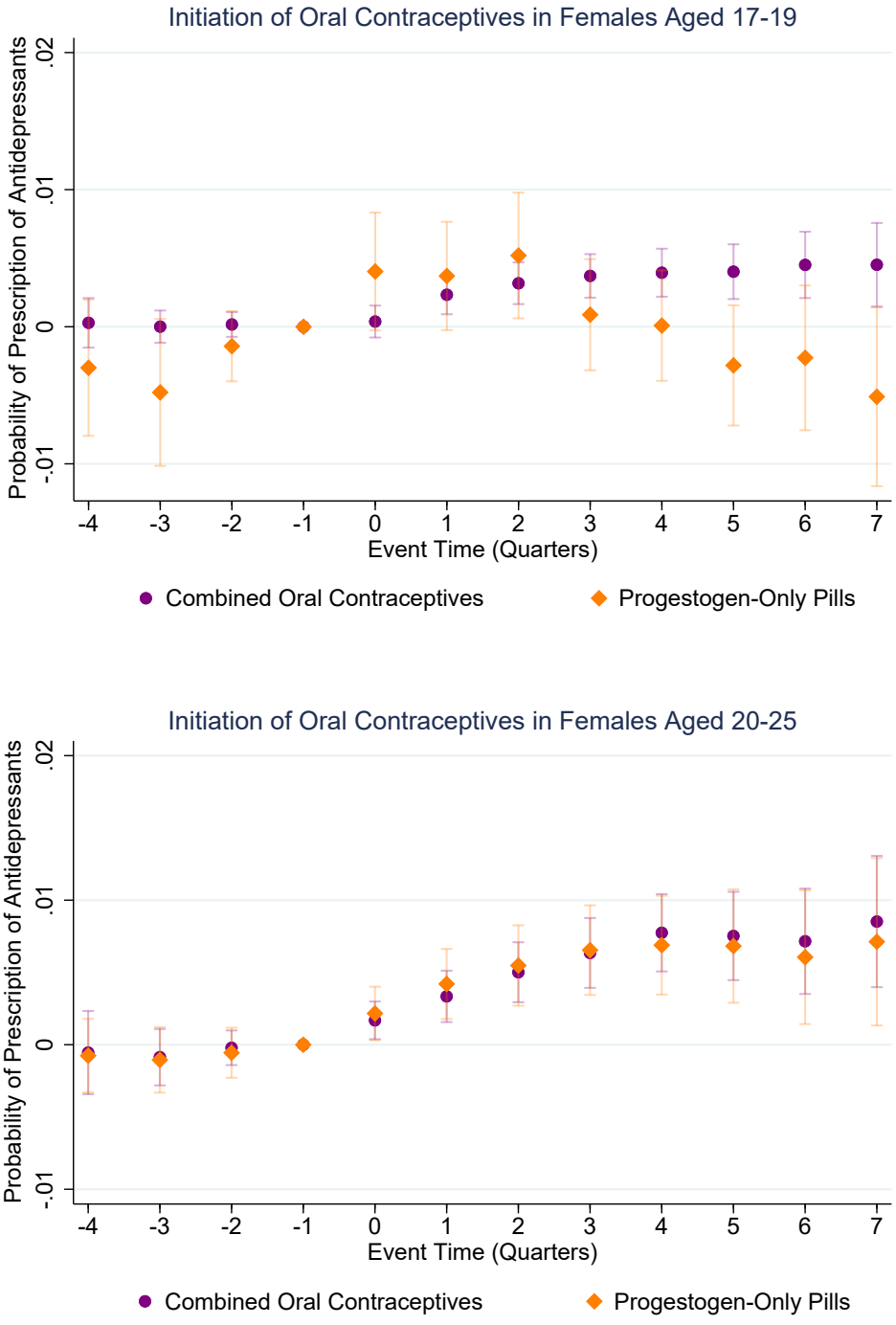


Figure 8: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women who initiated oral contraceptives between ages 17–25 from July 2007 to March 2016, measured relative to one quarter before initiation. Results are shown separately for combined oral contraceptives (purple circles) and progestogen-only pills (orange diamonds). The top panel displays estimates for women aged 17–19, and the bottom panel for women aged 20–25. The mean probability of having an antidepressant prescription in the quarter before initiation is 0.026 for combined and 0.043 for progestogen-only users among women aged 17–19, and 0.043 for combined and 0.049 for progestogen-only users among women aged 20–25. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

Appendix Figure A16 presents the results for women who initiated different types of oral contraceptives between ages 14 and 16, distinguishing between those with and without an ADHD diagnosis. Among women with ADHD, users of progestogen-only

contraceptives display clear pre-trends and no post-treatment effects, whereas users of combined oral contraceptives show statistically insignificant pre-trends and a small positive effect after initiation. Among women without ADHD, pre-trends are statistically insignificant for both groups, but progestogen-only users exhibit no post-treatment effects, while combined oral contraceptive users experience a positive effect that is somewhat smaller than the baseline. Across both ADHD groups, no statistically significant differences emerge between contraceptive types, suggesting that the formulation of oral contraceptives does not differentially influence mental-health outcomes.

## 6.2 Purpose of Contraceptive Initiation

Hormonal contraceptives have been used widely for reasons unrelated to pregnancy. In the present analysis, the objective is to examine the potential differential impact of contraceptives on the motivation for initiation. The goal is to determine whether women with underlying medical conditions, who have a higher risk of depression, influence the observed trajectories. More specifically, this analysis is done to see if the women with gynaecological diagnosis are the ones with worse mental health. In order to achieve that, the sample is divided into two distinct groups, those who initiated oral contraceptives for the purpose of pregnancy prevention, and those who initiated them to alleviate the symptoms of their medical conditions. To do this, I separate women who received at least one of the above-mentioned diagnoses in the same quarter as their initial prescription for oral contraceptives.

The gynaecological diagnoses that are most commonly treated with hormonal contraceptives help in the alleviation of pain, discomfort and other symptoms of common gynaecological medical conditions. Endometriosis is one such condition, and studies have shown that oral contraceptives reduce the symptoms of dysmenorrhea, pelvic pain, and dyspareunia (Jensen et al., 2018) while they decreases the risk of incurrence after surgery (Grandi et al., 2019). Menstrual disorders such as heavy or prolonged menstrual bleeding and dysmenorrhea are also treated with oral contraceptives (Creatsas et al., 1990; Davis et al., 2005; Fraser et al., 2011; Lethaby et al., 2019). Moreover, oral contraceptives improve the symptoms of women suffering from Premenstrual Dysphoric Disorder and Premenstrual Syndrome (Freeman et al., 2012; Rapkin et al., 2019). Furthermore, a common treatment for women suffering from Polycystic ovarian syndrome (PCOS) is oral contraceptives (Vrbíková et al., 2005; Nader et al., 2007), since it improves menstrual cycle frequency, reduces acne and alleviates hirsutism (Al Khalifah et al., 2016), which are frequent symptoms among women with PCOS (Legro et al., 2013). Finally, acne and hirsutism are also conditions that can be effectively treated with oral contraceptives (Słopień et al., 2018; Moubasher et al., 2020).

It has been shown in the literature that women with these diagnoses might be at a higher risk of depression, raising concerns about selection because such conditions can

also motivate the oral contraceptive initiation. Existing literature indicates that women with endometriosis and PCOS face an elevated risk of depression (Lorençatto et al., 2006; Hollinrake et al., 2007; Kerchner et al., 2009). Likewise, heavy menstrual bleeding and dysmenorrhea have been linked to higher rates of depression diagnoses (Balık et al., 2014; Weyand et al., 2022). Additionally, research has found an increased prevalence of depression among women suffering from premenstrual disorder and premenstrual dysphoric disorder (Forrester-Knauss et al., 2011; de Carvalho et al., 2018). Lastly, women with acne and hirsutism also exhibit a higher risk of depression (Uhlenhake et al., 2010; Ekbäck et al., 2013; Yang et al., 2014).

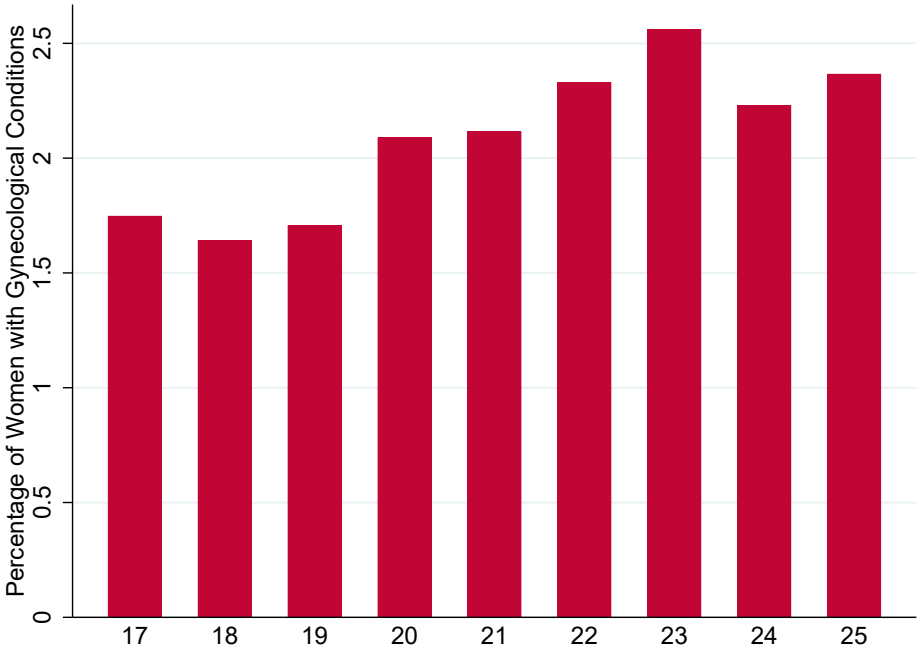


Figure 9: This figure presents the percentage of women who received a prescription for oral contraceptives for a non-contraceptive reason, categorized by age at initiation. The dataset covers the period July 2005 to December 2017 and includes women aged 17–25 who began contraceptive use between the third quarter of 2007 and the first quarter of 2016.

I identify women who use oral contraceptives for non-contraceptive reasons based on the presence of a diagnosis of endometriosis, polycystic ovary syndrome (PCOS), acne, hirsutism, or menstrual disorders recorded in the same month as their first prescription. Using this definition, Figure 9 presents the share of women with such gynaecological diagnoses by age at initiation. The figure shows that the prevalence of these diagnoses increases with age, from around 1.5 percent among women initiating at age 17 to just above 2.5 percent among those initiating after age 23. This pattern suggests that medical, rather than contraceptive, motives for initiation become more common at older ages.

Figure 10 presents the results by reason for oral contraceptive initiation. The estimates for women who start using oral contraceptives for pregnancy prevention closely resemble the baseline results, which is expected given that they represent about 98 percent of the sample. In contrast, women diagnosed with gynaecological disorders, who are likely to use oral contraceptives to alleviate symptoms rather than to prevent pregnancy, exhibit

trajectories that follow a similar pattern but with noticeably larger estimated effects. This pattern suggests that women initiating oral contraceptives for medical reasons exhibit poorer mental health outcomes compared to those who initiate them for pregnancy prevention. Although the estimates are not statistically significant, the direction and magnitude of the effects point to meaningful differences between the two groups, which are likely obscured by the small sample size, as women who initiate oral contraceptives for non-contraceptive reasons represent only about 2% of the sample.

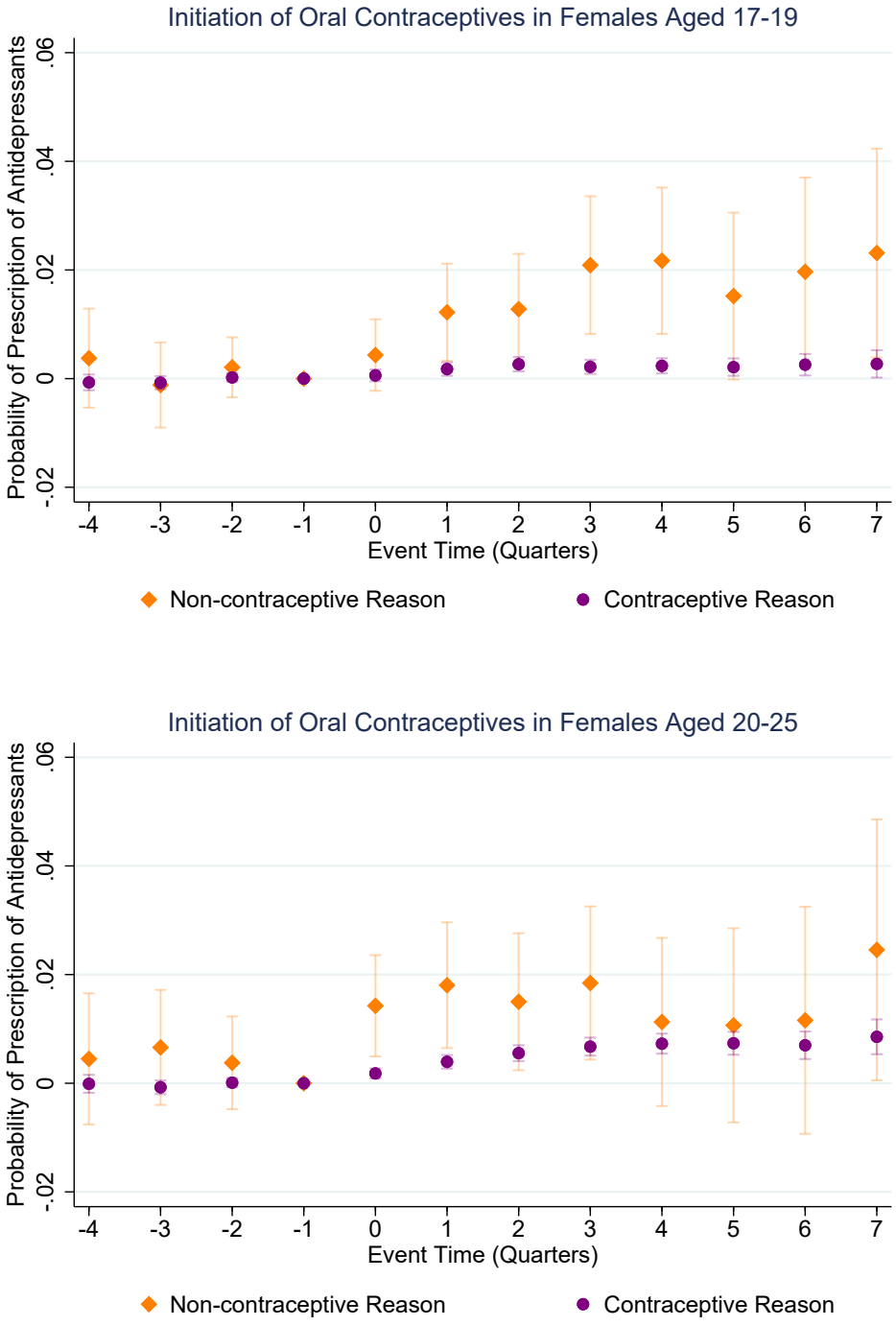


Figure 10: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women who initiated oral contraceptives between ages 17–25 from July 2007 to March 2016, measured relative to one quarter before initiation. Results are shown separately by initiation motive: contraceptive reasons (purple circles) and non-contraceptive reasons (orange diamonds). The top panel displays estimates for women aged 17–19, and the bottom panel for women aged 20–25. The mean probability of having an antidepressant prescription in the quarter before initiation is 0.029 for contraceptive and 0.051 for non-contraceptive users among women aged 17–19, and 0.045 for contraceptive and 0.089 for non-contraceptive users among women aged 20–25. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

Appendix Figure A17 presents the results for women who initiated oral contraceptives between ages 14 and 16, distinguishing between those with and without an ADHD diagnosis and across different initiation motives. Among women with ADHD who use

oral contraceptives to treat gynaecological conditions, the estimates are highly imprecise due to the very small number of individuals in this group. Women with ADHD who initiate oral contraceptives for pregnancy prevention show positive post-treatment effects that exceed the baseline estimates, although the presence of a clear pre-trend limits causal interpretation. Among women without ADHD, those who use oral contraceptives to manage gynaecological conditions display no statistically significant pre-trends but experience a notably larger increase in antidepressant prescriptions following initiation. In contrast, women without ADHD who initiate contraceptives for pregnancy prevention show a small, marginally significant pre-trend and post-initiation effects that are smaller than the baseline. The difference in estimates by initiation motive becomes statistically significant three quarters after initiation, indicating that women who use oral contraceptives to treat gynaecological conditions experience poorer mental health outcomes than those who use them for pregnancy prevention for women without ADHD.

# 7 Conclusion

This paper examines the mental health consequences of oral contraceptive initiation among adolescents and young adult women in Sweden. Using comprehensive population registers linked across medication prescriptions, healthcare usage, and population characteristics, and applying the event study estimator proposed by Callaway and Sant'Anna (2021), I document systematic increases in antidepressant prescriptions following oral contraceptive initiation. Women who initiate oral contraceptives between age groups 17-19 and 20-25 show clear post-initiation increases in antidepressant use with no signs of pre-treatment trends, indicating that initiation is likely associated with a rise in antidepressant uptake in late adolescence and early adulthood. In contrast, women in middle adolescence (ages 14–16) display the steepest increases in antidepressant use, but pronounced pre-trends complicate a causal interpretation for this group. Further analysis shows that ADHD plays an important role in explaining these patterns for the youngest treated group. Women with ADHD show both higher overall antidepressant use and stronger upward trends around the time of initiation, while their non-ADHD peers exhibit smaller and more stable trajectories. The evidence suggests that the pre-treatment trends observed in the baseline are primarily driven by women with ADHD.

Extending the analysis, I investigate whether the estimated effects vary across contraceptive formulations and according to the primary motive for initiation. The results reveal no systematic variation across contraceptive types. Combined and progestogen-only pills are both associated with increases in antidepressant prescriptions, with estimated trajectories that closely follow the baseline pattern. The only exception is observed among women initiating progestogen-only pills at ages 17–19, where post-initiation effects are not statistically significant. On the other hand, the reason for contraceptive initiation suggests that women using oral contraceptives for medical reasons have poorer mental health

outcomes than those initiating for contraceptive purposes. Women initiating oral contraceptives for medical reasons experience a somewhat steeper increase in antidepressant prescriptions, which may reflect greater vulnerability related to pre-existing gynaecological conditions. In contrast, women who initiate contraceptive use for pregnancy prevention exhibit patterns that closely mirror the baseline. Although the difference by initiation motive is not statistically significant, this is likely due to wider confidence intervals stemming from the smaller sample size rather than the absence of a true effect.

The findings have several implications for the literature in economics that investigates the effects of oral contraceptives. While most of the economics research emphasizes the beneficial effects of oral contraceptives on education, fertility, and labour-market outcomes, my results underscore that these benefits may come at a cost to mental health, especially in the years immediately following initiation, in line with the work of Costa-Ramón et al. (2023). Moreover, the analysis identifies an especially vulnerable group, namely women with ADHD, for whom the association between contraceptive use and antidepressant prescriptions is stronger, and pre-trends suggest heightened underlying mental health risks even before initiation. The results further indicate that the motivation for contraceptive use also matters, since women who initiate oral contraceptives for medical reasons display poorer mental health outcomes than those who initiate for pregnancy prevention, suggesting that pre-existing health conditions may exacerbate mental health vulnerability. These findings underscore the importance of integrating health considerations and individual heterogeneity within the broader discussion of contraceptive access and policy.

From a methodological perspective, this study advances the literature by applying recent econometric tools to a new setting. By comparing treated to their not-yet-treated peers of the same birth year and birth quarter, I strengthen the credibility of the counterfactual and avoid misleading estimates driven by inappropriate control groups. Moreover, the use of population administrative data allows for large-scale coverage across ages and pill types, extending beyond the narrow age ranges or smaller samples of earlier work. These features make the results both robust and relevant to ongoing policy debates on women's health, reproductive autonomy, and the regulation of the supply of hormonal contraceptives.

Nevertheless, several limitations remain. First, antidepressant prescriptions, while a common proxy for depression, may not capture the whole range of mental health outcomes and may reflect health-seeking behaviour as much as deteriorated mental health. Second, although the design addresses some sources of bias, selection into timing of initiation cannot be fully ruled out, particularly among the younger users without ADHD. Finally, the analysis focuses on medium-run effects and the long-run mental health consequences of oral contraceptive use, whether persistent or not, remain an open question for future research.

Overall, this study provides new evidence that oral contraceptives, while central to

women's reproductive autonomy and economic opportunities, may also increase vulnerability to depression. The results further indicate that mental health risks are not evenly distributed and women with ADHD and women who initiate contraceptives to treat gynaecological conditions appear particularly affected, underscoring the need for more targeted support for those with pre-existing vulnerabilities. Policymakers and practitioners should therefore weigh the mental health implications alongside the documented social and economic benefits of contraceptive access. Future work combining rich register data with complementary survey and clinical measures will be critical to deepening our understanding of this trade-off and to guiding health and education policies that support young women in making informed choices about contraception.

# References

1177 (2022). Preventivmedel – skydd mot graviditet. https://www.1177.se/Uppsala-lan/liv–halsa/sexuell-halsa/skydd-mot-graviditet/preventivmedel–skydd-mot-graviditet/

1177 (2022). Söka vård för psykiska besvär. https://www.1177.se/Uppsala-lan/liv–halsa/psykisk-halsa/att-soka-stod-och-hjalp/soka-psykiatrisk-vard/

1177 (2025). Depression. https://www.1177.se/Uppsala-lan/sjukdomar–besvar/psykiska-sjukdomar-och-besvar/depression/depression/section-145995

Al Khalifah RA, Florez ID, Dennis B, Thabane L, Bassilious E. Metformin or Oral Contraceptives for Adolescents With Polycystic Ovarian Syndrome: A Meta-analysis. Pediatrics. 2016 May;137(5):e20154089. doi: 10.1542/peds.2015-4089. PMID: 27244814.

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Anderl C, de Wit AE, Giltay EJ, Oldehinkel AJ, Chen FS. Association between adolescent oral contraceptive use and future major depressive disorder: a prospective cohort study. J Child Psychol Psychiatry. 2022 Mar;63(3):333-341. doi: 10.1111/jcpp.13476. Epub 2021 Jul 12. PMID: 34254301; PMCID: PMC9291927.

Bailey, Martha J., More Power to the Pill: The Impact of Contraceptive Freedom on Women's Life Cycle Labor Supply, The Quarterly Journal of Economics, Volume 121, Issue 1, February 2006, Pages 289–320, https://doi.org/10.1093/qje/121.1.289

Bailey, Martha J., Brad Hershbein, and Amalia R. Miller. 2012. "The Opt-In Revolution? Contraception and the Gender Gap in Wages." American Economic Journal: Applied Economics 4 (3): 225–54.

Balık G, Ustüner I, Kağıtcı M, Sahin FK. Is there a relationship between mood disorders and dysmenorrhea? J Pediatr Adolesc Gynecol. 2014 Dec;27(6):371-4. doi: 10.1016/j.jpag.2014.01.108. Epub 2014 Sep 23. PMID: 25256879.

Belsey EM. Vaginal bleeding patterns among women using one natural and eight hormonal methods of contraception. Contraception. 1988 Aug;38(2):181-206. doi: 10.1016/0010-7824(88)90038-8. PMID: 2971505.

Brant, A.R., Ye, P.P., Teng, S.J. et al. Non-Contraceptive Benefits of Hormonal Contraception: Established Benefits and New Findings. Curr Obstet Gynecol Rep 6, 109–117 (2017). https://doi.org/10.1007/s13669-017-0205-3

Celano CM, Freudenreich O, Fernandez-Robles C, Stern TA, Caro MA, Huffman JC. Depressogenic effects of medications: a review. Dialogues Clin Neurosci. 2011;13(1):109-25. doi: 10.31887/DCNS.2011.13.1/ccelano. PMID: 21485751; PMCID: PMC3181967.

Cheslack-Postava K, Keyes KM, Lowe SR, Koenen KC. Oral contraceptive use and psychiatric disorders in a nationally representative sample of women. Arch Womens Ment Health. 2015 Feb;18(1):103-11. doi: 10.1007/s00737-014-0453-4. Epub 2014 Aug 13. PMID: 25113319; PMCID: PMC4308571.

Cortese S, Bellgrove MA, Brikell I, Franke B, Goodman DW, Hartman CA, Larsson H, Levin FR, Ostinelli EG, Parlatini V, Ramos-Quiroga JA, Sibley MH, Tomlinson A, Wilens TE, Wong ICK, Hovén N, Didier J, Correll CU, Rohde LA, Faraone SV. Attention-deficit/hyperactivity disorder (ADHD) in adults: evidence base, uncertainties and controversies. World Psychiatry. 2025 Oct;24(3):347-371. doi: 10.1002/wps.21374. PMID: 40948064; PMCID: PMC12434367.

Costa-Ramón, Ana and Daysal, N. Meltem and Rodriguez-Gonzalez, Ana, The Oral Contraceptive Pill and Adolescents' Mental Health. IZA Discussion Paper No. 16288, Available at SSRN: https://ssrn.com/abstract=4503044 or http://dx.doi.org/10.2139/ssrn.4503044

Creatsas G, Deligeoroglou E, Zachari A, Loutradis D, Papadimitriou T, Miras K, Aravantinos D. Prostaglandins: PGF2 alpha, PGE2, 6-keto-PGF1 alpha and TXB2 serum levels in dysmenorrheic adolescents before, during and after treatment with oral contraceptives. Eur J Obstet Gynecol Reprod Biol. 1990 Sep;36(3):292-8. doi: 10.1016/0028-2243(90)90213-k. PMID: 2116333.

Curtis KM, Nguyen AT, Tepper NK, et al. U.S. Selected Practice Recommendations for Contraceptive Use, 2024. MMWR Recomm Rep 2024;73(No. RR-3):1–77. DOI: http://dx.doi.org/10.15585/mmwr.rr7303a1.

Davis, Anne Rachel MD; Westhoff, Carolyn MD; O'Connell, Katharine MD; Gallagher, Nancy RN. Oral Contraceptives for Dysmenorrhea in Adolescent Girls: A Randomized Trial. Obstetrics & Gynecology 106(1):p 97-104, July 2005. | DOI: 10.1097/01.AOG.0000165826.03915.65

de Carvalho AB, Cardoso TA, Mondin TC, da Silva RA, Souza LDM, Magalhães PVDS, Jansen K. Prevalence and factors associated with Premenstrual Dysphoric Disorder: A community sample of young adult women. Psychiatry Res. 2018 Oct;268:42-45. doi: 10.1016/j.psychres.2018.06.005. Epub 2018 Jun 26. PMID: 29986177.

Duke JM, Sibbritt DW, Young AF. Is there an association between the use of oral contraception and depressive symptoms in young Australian women? Contraception. 2007 Jan;75(1):27-31. doi: 10.1016/j.contraception.2006.08.002. Epub 2006 Sep 18. PMID: 17161120.

Ekbäck MP, Lindberg M, Benzein E, Årestedt K. Health-related quality of life, depression and anxiety correlate with the degree of hirsutism. Dermatology. 2013;227(3):278-84. doi: 10.1159/000355356. Epub 2013 Oct 4. PMID: 24107472.

Elia J, Ambrosini P, Berrettini W. ADHD characteristics: I. Concurrent co-morbidity patterns in children & adolescents. Child Adolesc Psychiatry Ment Health. 2008 Jul 3;2(1):15. doi: 10.1186/1753-2000-2-15. PMID: 18598351; PMCID: PMC2500004.

Envall, N., Wallström, T., Gemzell Danielsson, K., & Kopp Kallner, H. (2022). Use of contraception and attitudes towards contraceptive use in Swedish women: an internet-based nationwide survey. The European Journal of Contraception & Reproductive Health Care, 27(5), 409–417. https://doi.org/10.1080/13625187.2022.2094911

FASS Vårdpersonal (2025), ATC-register, https://www.fass.se/LIF/startpage

Flory K, Molina BS, Pelham WE Jr, Gnagy E, Smith B. Childhood ADHD predicts risky sexual behavior in young adulthood. J Clin Child Adolesc Psychol. 2006 Dec;35(4):571-7. doi: 10.1207/s15374424jccp3504_8. PMID: 17007602.

Folkhälsomyndigheten (2024). Statistics on mental health in Sweden. Retrieved from https://dinpsykiskahalsa.se/artiklar/other-languages/engelska/statistics-on-mental-health-in-sweden/

Forrester-Knauss C, Zemp Stutz E, Weiss C, Tschudin S. The interrelation between premenstrual syndrome and major depression: results from a population-based sample. BMC Public Health. 2011 Oct 12;11:795. doi: 10.1186/1471-2458-11-795. PMID: 21992230; PMCID: PMC3209462.

Fraser IS, Parke S, Mellinger U, Machlitt A, Serrani M, Jensen J. Effective treatment of heavy and/or prolonged menstrual bleeding without organic cause: pooled analysis of two multinational, randomised, double-blind, placebo-controlled trials of oestradiol valerate and dienogest. Eur J Contracept Reprod Health Care. 2011 Aug;16(4):258-69. doi: 10.3109/13625187.2011.591456. PMID: 21774563; PMCID: PMC3154543.

Freeman EW, Halbreich U, Grubb GS, Rapkin AJ, Skouby SO, Smith L, Mirkin S, Constantine GD. An overview of four studies of a continuous oral contraceptive (levonorgestrel 90 mcg/ethinyl estradiol 20 mcg) on premenstrual dysphoric disorder and premenstrual syndrome. Contraception. 2012 May;85(5):437-45. doi: 10.1016/j.contraception.2011.09.010. Epub 2011 Dec 5. PMID: 22152588.

FSRH Guideline (January 2019, amended October 2023) Combined Hormonal Contraception BMJ Sexual & Reproductive Health 2019;45:1-93.

FSRH Guideline (August 2022) Progestogen-only PillsBMJ Sexual & Reproductive Health 2022;48:1-75.

Gawronska J, Meads C, Smith L, Cao C, Wang N, Walker S. Association of oral contraceptive pill use and depression among US women. J Affect Disord. 2024 Jan 1;344:132-140. doi: 10.1016/j.jad.2023.10.041. Epub 2023 Oct 11. PMID: 37832730.

Gillberg C. Perceptual, motor and attentional deficits in Swedish primary school children. Some child psychiatric aspects. J Child Psychol Psychiatry. 1983 Jul;24(3):377-403. doi: 10.1111/j.1469-7610.1983.tb00116.x. PMID: 6874784.

Gingnell M, Engman J, Frick A, Moby L, Wikström J, Fredrikson M, Sundström-Poromaa I. Oral contraceptive use changes brain activity and mood in women with previous negative affect on the pill–a double-blinded, placebo-controlled randomized trial of a levonorgestrel-containing combined oral contraceptive. Psychoneuroendocrinology. 2013 Jul;38(7):1133-44. doi: 10.1016/j.psyneuen.2012.11.006. Epub 2012 Dec 6. PMID: 23219471.

Gnoth, C., Frank-Herrmann, P., Schmoll, A., Godehardt, E., & Freundl, G. (2002). Cycle characteristics after discontinuation of oral contraceptives. Gynecological Endocrinology, 16(4), 307–317. https://doi.org/10.1080/gye.16.4.307.317

Goldin, Claudia, and Lawrence F. Katz. 2000. "Career and Marriage in the Age of the Pill." American Economic Review 90 (2): 461–465.DOI: 10.1257/aer.90.2.461

Goldin, C., & Katz, L. F. (2002). The Power of the Pill: Oral Contraceptives and Women's Career and Marriage Decisions. Journal of Political Economy, 110(4), 730–770. https://doi.org/10.1086/340778

Grandi, G., Barra, F., Ferrero, S., Sileo, F. G., Bertucci, E., Napolitano, A., & Facchinetti, F. (2019). Hormonal contraception in women with endometriosis: a systematic review. The European Journal of Contraception & Reproductive Health Care, 24(1), 61–70. https://doi.org/10.1080/13625187.2018.1550576

Gregory ST, Hall K, Quast T, Gatto A, Bleck J, Storch EA, DeBate R. Hormonal Contraception, depression, and Academic Performance among females attending college in the United States. Psychiatry Res. 2018 Dec;270:111-116. doi: 10.1016/j.psychres.2018.09.029. Epub 2018 Sep 15. PMID: 30245373.

Grönqvist, Hans, 2009. "Putting teenagers on the pill: the consequences of subsidized contraception," Working Paper Series 2009:8, IFAU - Institute for Evaluation of Labour Market and Education Policy

Hellström, A., Gemzell Danielsson, K., & Kopp Kallner, H. (2019). Trends in use and attitudes towards contraception in Sweden: results of a nationwide survey. The European Journal of Contraception & Reproductive Health Care, 24(2), 154–160. https://doi.org/10.1080/13625187.2019.1581163

Hollinrake E, Abreu A, Maifeld M, Van Voorhis BJ, Dokras A. Increased risk of depressive disorders in women with polycystic ovary syndrome. Fertil Steril. 2007 Jun;87(6):1369-76. doi: 10.1016/j.fertnstert.2006.11.039. Epub 2007 Mar 29. PMID: 17397839.

Hosain GM, Berenson AB, Tennen H, Bauer LO, Wu ZH. Attention deficit hyperactivity symptoms and risky sexual behavior in young adult women. J Womens Health (Larchmt). 2012 Apr;21(4):463-8. doi: 10.1089/jwh.2011.2825. Epub 2012 Feb 3. PMID: 22303821; PMCID: PMC3321673.

Jensen JT, Schlaff W, Gordon K. Use of combined hormonal contraceptives for the treatment of endometriosis-related pain: a systematic review of the evidence. Fertil Steril. 2018 Jul 1;110(1):137-152.e1. doi: 10.1016/j.fertnstert.2018.03.012. Epub 2018 Jun 21. PMID: 29937152.

Johansson T, Vinther Larsen S, Bui M, Ek WE, Karlsson T, Johansson Å. Population-based cohort study of oral contraceptive use and risk of depression. Epidemiology and Psychiatric Sciences. 2023;32:e39. doi:10.1017/S2045796023000525

Katzman MA, Bilkey TS, Chokka PR, Fallu A, Klassen LJ. Adult ADHD and comorbid disorders: clinical implications of a dimensional approach. BMC Psychiatry. 2017 Aug 22;17(1):302. doi: 10.1186/s12888-017-1463-3. PMID: 28830387; PMCID: PMC5567978.

Kerchner A, Lester W, Stuart SP, Dokras A. Risk of depression and other mental health disorders in women with polycystic ovary syndrome: a longitudinal study. Fertil Steril. 2009 Jan;91(1):207-12. doi: 10.1016/j.fertnstert.2007.11.022. Epub 2008 Feb 4. PMID: 18249398.

Keyes KM, Cheslack-Postava K, Westhoff C, Heim CM, Haloossim M, Walsh K, Koenen K. Association of hormonal contraceptive use with reduced levels of depressive symptoms: a national study of sexually active women in the United States. Am J Epidemiol. 2013 Nov 1;178(9):1378-88. doi: 10.1093/aje/kwt188. Epub 2013 Sep 15. PMID: 24043440; PMCID: PMC3888252.

Khafagy GM, Shalaby HL, Saad NE, Hasan MD. Effect of the Monthly Injectable Combined Contraceptives versus Oral Contraceptive Pills on Mood. Korean J Fam Med. 2021 Nov;42(6):471-476. doi: 10.4082/kjfm.20.0106. Epub 2021 Nov 20. PMID: 34871488; PMCID: PMC8648491.

Klint Carlander AK, Thorsell M, Demetry Y, Nikodell S, Kopp Kallner H, Skoglund C. Knowledge, challenges, and standard of care of young women with ADHD at Swedish youth clinics. Sex Reprod Healthc. 2022 Jun;32:100727. doi: 10.1016/j.srhc.2022.100727. Epub 2022 Apr 15. PMID: 35461165.

Lara C, Fayyad J, de Graaf R, Kessler RC, Aguilar-Gaxiola S, Angermeyer M, Demytteneare K, de Girolamo G, Haro JM, Jin R, Karam EG, Lépine JP, Mora ME, Ormel J, Posada-Villa J, Sampson N. Childhood predictors of adult attention-deficit/hyperactivity disorder: results from the World Health Organization World Mental Health Survey Initiative. Biol Psychiatry. 2009 Jan 1;65(1):46-54. doi: 10.1016/j.biopsych.2008.10.005. Epub 2008 Nov 12. PMID: 19006789; PMCID: PMC2629074.

Larsen SV, Köhler-Forsberg K, Dam VH, Poulsen AS, Svarer C, Jensen PS, Knudsen GM, Fisher PM, Ozenne B, Frokjaer VG. Oral contraceptives and the serotonin 4 receptor: a molecular brain imaging study in healthy women. Acta Psychiatr Scand. 2020 Oct;142(4):294-306. doi: 10.1111/acps.13211. Epub 2020 Jul 21. PMID: 33314049; PMCID: PMC7586815.

Larson K, Russ SA, Kahn RS, Halfon N. Patterns of comorbidity, functioning, and service use for US children with ADHD, 2007. Pediatrics. 2011 Mar;127(3):462-70. doi: 10.1542/peds.2010-0165. Epub 2011 Feb 7. PMID: 21300675; PMCID: PMC3065146.

Legro RS, Arslanian SA, Ehrmann DA, Hoeger KM, Murad MH, Pasquali R, Welt CK; Endocrine Society. Diagnosis and treatment of polycystic ovary syndrome: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab. 2013 Dec;98(12):4565-92. doi: 10.1210/jc.2013-2350. Epub 2013 Oct 22. Erratum in: J Clin Endocrinol Metab. 2021 May 13;106(6):e2462. doi: 10.1210/clinem/dgab248. PMID: 24151290; PMCID: PMC5399492.

Lethaby A, Wise MR, Weterings MA, Bofill Rodriguez M, Brown J. Combined hormonal contraceptives for heavy menstrual bleeding. Cochrane Database Syst Rev. 2019 Feb 11;2(2):CD000154. doi: 10.1002/14651858.CD000154.pub3. PMID: 30742315; PMCID: PMC6369862.

Lidegaard Ø, Kreiner S. Contraceptives and cerebral thrombosis: a five-year national case-control study. Contraception. 2002 Mar;65(3):197-205. doi: 10.1016/s0010-7824(01)00306-7. PMID: 11929641.

Lidegaard Ø, Løkkegaard E, Jensen A, Skovlund CW, Keiding N. Thrombotic stroke and myocardial infarction with hormonal contraception. N Engl J Med. 2012 Jun 14;366(24):2257-66. doi: 10.1056/NEJMoa1111840. PMID: 22693997.

Lidegaard Ø, Milsom I, Geirsson RT, Skjeldestad FE. Hormonal contraception and venous thromboembolism. Acta Obstet Gynecol Scand 2012; 91:769–778.

Lindberg M, Foldemo A, Josefsson A, Wiréhn AB. Differences in prescription rates and odds ratios of antidepressant drugs in relation to individual hormonal contraceptives: a nationwide population-based study with age-specific analyses. Eur J Contracept Reprod Health Care. 2012 Apr;17(2):106-18. doi: 10.3109/13625187.2012.658925. Epub 2012 Mar 4. PMID: 22385398.

Lindh I, Skjeldestad FE, Gemzell-Danielsson K, Heikinheimo O, Hognert H, Milsom I, Lidegaard Ø. Contraceptive use in the Nordic countries. Acta Obstet Gynecol Scand. 2017 Jan;96(1):19-28. doi: 10.1111/aogs.13055. PMID: 27861709.

Lorençatto C, Petta CA, Navarro MJ, Bahamondes L, Matos A. Depression in women with endometriosis with and without chronic pelvic pain. Acta Obstet Gynecol Scand.

2006;85(1):88-92. doi: 10.1080/00016340500456118. PMID: 16521687.

Lundin C Wikman A Lampa E Bixo M Gemzell-Danielsson K Wikman P Ljung R Sundström Poromaa I There is no association between combined oral hormonal contraceptives and depression: a Swedish register-based cohort study. BJOG 2022; https://doi.org/10.1111/1471-0528.17028. 129: 917–925.

Lundin C, Wikman A, Wikman P, Kallner HK, Sundström-Poromaa I, Skoglund C. Hormonal Contraceptive Use and Risk of Depression Among Young Women With Attention-Deficit/Hyperactivity Disorder. J Am Acad Child Adolesc Psychiatry. 2023 Jun;62(6):665-674. doi: 10.1016/j.jaac.2022.07.847. Epub 2022 Nov 1. PMID: 36332846.

Mansour D, Gemzell-Danielsson K, Inki P, Jensen JT. Fertility after discontinuation of contraception: a comprehensive review of the literature. Contraception. 2011 Nov;84(5):465-77. doi: 10.1016/j.contraception.2011.04.002. Epub 2011 Jun 8. PMID: 22018120.

Moubasher AEA, Abdel Basset HA, Khalil AAM, Youssef EMK. Levonorgestrel vs combined oral contraceptive pills in treatment of female acne and hirsutism. Dermatologic Therapy. 2020; 33:e13700. https://doi.org/10.1111/dth.13700

Mu E, Kulkarni J. Hormonal contraception and mood disorders. Aust Prescr. 2022 Jun;45(3):75-79. doi: 10.18773/austprescr.2022.025. Epub 2022 Jun 1. Erratum in: Aust Prescr. 2022 Aug;45(4):147. doi: 10.18773/austprescr.2022.037. PMID: 35755988; PMCID: PMC9218393.

Nader S., Diamanti-Kandarakis E., Polycystic ovary syndrome, oral contraceptives and metabolic issues: new perspectives and a unifying hypothesis, Human Reproduction, Volume 22, Issue 2, 1 February 2007, Pages 317–322, https://doi.org/10.1093/humrep/del407

Natale, V., & Albertazzi, P. (2006). Mood swings across the menstrual cycle: a comparison between oral contraceptive users and non-users. Biological Rhythm Research, 37(6), 489–495. https://doi.org/10.1080/09291010600772451

Nguyen AT, Curtis KM, Tepper NK, et al. U.S. Medical Eligibility Criteria for Contraceptive Use, 2024. MMWR Recomm Rep 2024;73(No. RR-4):1–126. DOI: http://dx.doi.org/10.15585/mmwr.rr7304a1.

Noachtar IA, Frokjaer VG, Pletzer B. Mental Health Symptoms in Oral Contraceptive Users During Short-Term Hormone Withdrawal. JAMA Netw Open. 2023 Sep 5;6(9):e2335957. doi: 10.1001/jamanetworkopen.2023.35957. PMID: 37755829; PMCID: PMC10534273.

Ragan, K. S. (2025). The Power of The Pill: Evidence from Oral Contraceptive Sales. Economic Journal. https://doi.org/10.1093/ej/ueaf017

Rapkin, A. J., Korotkaya, Y., & Taylor, K. C. (2019). Contraception counseling for women with premenstrual dysphoric disorder (PMDD): current perspectives. Open Access Journal of Contraception, 10, 27–39. https://doi.org/10.2147/OAJC.S183193

Ribeiro CCM, Shimo AKK, Lopes MHBM, Lamas JLT. Effects of different hormonal contraceptives in women's blood pressure values. Rev Bras Enferm. 2018;71(suppl 3):1453-1459. English, Portuguese. doi: 10.1590/0034-7167-2017-0317. PMID: 29972547.

Sarver DE, McCart MR, Sheidow AJ, Letourneau EJ. ADHD and risky sexual behavior in adolescents: conduct problems and substance use as mediators of risk. J Child Psychol Psychiatry. 2014 Dec;55(12):1345-53. doi: 10.1111/jcpp.12249. Epub 2014 May 12. PMID: 24813803; PMCID: PMC4479401.

Shorey S, Ng ED, Wong CHJ. Global prevalence of depression and elevated depressive symptoms among adolescents: A systematic review and meta-analysis. Br J Clin Psychol. 2022 Jun;61(2):287-305. doi: 10.1111/bjc.12333. Epub 2021 Sep 26. PMID: 34569066.

Sibley MH, Swanson JM, Arnold LE, Hechtman LT, Owens EB, Stehli A, Abikoff H, Hinshaw SP, Molina BSG, Mitchell JT, Jensen PS, Howard AL, Lakes KD, Pelham WE; MTA Cooperative Group. Defining ADHD symptom persistence in adulthood: optimizing sensitivity and specificity. J Child Psychol Psychiatry. 2017 Jun;58(6):655-662. doi: 10.1111/jcpp.12620. Epub 2016 Sep 19. PMID: 27642116; PMCID: PMC5809153.

Skoglund C, Kopp Kallner H, Skalkidou A, Wikström AK, Lundin C, Hesselman S, Wikman A, Sundström Poromaa I. Association of Attention-Deficit/Hyperactivity Disorder With Teenage Birth Among Women and Girls in Sweden. JAMA Netw Open. 2019 Oct 2;2(10):e1912463. doi: 10.1001/jamanetworkopen.2019.12463. PMID: 31577361; PMCID: PMC6777395.

Skovlund CW, Mørch LS, Kessing LV, Lidegaard Ø. Association of Hormonal Contraception With Depression. JAMA Psychiatry. 2016 Nov 1;73(11):1154-1162. doi: 10.1001/jamapsychiatry.2016.2387. Erratum in: JAMA Psychiatry. 2017 Jul 1;74(7):764. doi: 10.1001/jamapsychiatry.2017.1446. PMID: 27680324.

Słopień R, Milewska E, Rynio P, Męczekalski B. Use of oral contraceptives for management of acne vulgaris and hirsutism in women of reproductive and late reproductive age. Prz Menopauzalny. 2018 Mar;17(1):1-4. doi: 10.5114/pm.2018.74895. Epub 2018 Apr 11. PMID: 29725277; PMCID: PMC5925193.

Steingrimsdottir, H. (2016). Reproductive Rights and the Career Plans of U.S. College Freshmen. Labour Economics, 43, 29-41. https://doi.org/10.1016/j.labeco.2016.07.001

Toffol E, Heikinheimo O, Koponen P, Luoto R, Partonen T. Further evidence for lack of negative associations between hormonal contraception and mental health. Contraception. 2012 Nov;86(5):470-80. doi: 10.1016/j.contraception.2012.02.014. Epub 2012 Mar 31.

PMID: 22465115.

Uhlenhake E, Yentzer BA, Feldman SR. Acne vulgaris and depression: a retrospective examination. J Cosmet Dermatol. 2010 Mar;9(1):59-63. doi: 10.1111/j.1473-2165.2010.00478.x. PMID: 20367674.

United Nations, Department of Economic and Social Affairs, Population Division (2019). Contraceptive Use by Method 2019: Data Booklet (ST/ESA/SER.A/435)

United Nations, Department of Economic and Social Affairs, Population Division (2022). World Contraceptive Use 2022 and Estimates and Projections of Family Planning Indicators 2022. Methodology report. POP/DB/CP/Rev2022 and POP/DB/FP/Rev2022

United Nations Department of Economic and Social Affairs, Population Division (2022). World Family Planning 2022: Meeting the changing needs for family planning: Contraceptive use by age and method. UN DESA/POP/2022/TR/NO. 4.

Valder, Franziska, Two Sides of the Same Pill? Fertility Control and Mental Health Effect of the Contraceptive Pill (April 21, 2022). Univ. of Copenhagen Dept. of Economics Discussion Paper, CEBI Working Paper 03/22, Available at SSRN: https://ssrn.com/abstract=4089991 or http://dx.doi.org/10.2139/ssrn.4089991

Vrbíková J., Cibula D., Combined oral contraceptives in the treatment of polycystic ovary syndrome, Human Reproduction Update, Volume 11, Issue 3, May/June 2005, Pages 277–291, https://doi.org/10.1093/humupd/dmi005

Wallin K, Alehagen S, Hanberger L, Lundell IW, Hultsjö S. Sexual and reproductive health in young women with ADHD from the view of health care professionals. BMC Womens Health. 2024 Jul 5;24(1):389. doi: 10.1186/s12905-024-03230-9. PMID: 38970031; PMCID: PMC11225155.

Weyand AC, Fitzgerald KD, McGrath M, Gupta V, Braun TM, Quint EH, Choi SW. Depression in Female Adolescents with Heavy Menstrual Bleeding. J Pediatr. 2022 Jan;240:171-176. doi: 10.1016/j.jpeds.2021.09.007. Epub 2021 Sep 10. PMID: 34517012; PMCID: PMC9055780.

Wiréhn AB, Foldemo A, Josefsson A, Lindberg M. Use of hormonal contraceptives in relation to antidepressant therapy: A nationwide population-based study. Eur J Contracept Reprod Health Care. 2010 Feb;15(1):41-7. doi: 10.3109/13625181003587004. PMID: 20136568.

World Health Organisation (2019). ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD). Retrieved from https://iris.who.int/handle/10665/364129

World Health Organisation (2023). Depressive disorder (depression). Retrieved from https://www.who.int/news-room/fact-sheets/detail/depression

World Health Organisation (2024) Mental health of adolescents. Retrieved from https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health

Worly, Brett L.; Gur, Tamar L.; Schaffir, Jonathan. The Relationship Between Progestin Hormonal Contraception and Depression: A Systematic Review. Obstetrical & Gynecological Survey 73(10):p 584-585, October 2018. | DOI: 10.1097/01.ogx.0000546212.98329.0e

Yang YC, Tu HP, Hong CH, Chang WC, Fu HC, Ho JC, Chang WP, Chuang HY, Lee CH. Female gender and acne disease are jointly and independently associated with the risk of major depression and suicide: a national population-based study. Biomed Res Int. 2014;2014:504279. doi: 10.1155/2014/504279. Epub 2014 Feb 11. PMID: 24678508; PMCID: PMC3942337.

Young S, Klassen LJ, Reitmeier SD, Matheson JD, Gudjonsson GH. Let's Talk about Sex... and ADHD: Findings from an Anonymous Online Survey. Int J Environ Res Public Health. 2023 Jan 22;20(3):2037. doi: 10.3390/ijerph20032037. PMID: 36767401; PMCID: PMC9915044.

Zethraeus N, Dreber A, Ranehill E, Blomberg L, Labrie F, von Schoultz B, Johannesson M, Hirschberg AL. A first-choice combined oral contraceptive influences general well-being in healthy women: a double-blind, randomized, placebo-controlled trial. Fertil Steril. 2017 May;107(5):1238-1245. doi: 10.1016/j.fertnstert.2017.02.120. Epub 2017 Apr 19. PMID: 28433366.

Zimmerman Y, Eijkemans MJ, Coelingh Bennink HJ, Blankenstein MA, Fauser BC. The effect of combined oral contraception on testosterone levels in healthy women: a systematic review and meta-analysis. Hum Reprod Update. 2014 Jan-Feb;20(1):76-105. doi: 10.1093/humupd/dmt038. Epub 2013 Sep 29. PMID: 24082040; PMCID: PMC3845679.

# A. Appendix

**Figure A1: Mean Pre-Initiation Outpatient Visits by ICD Code for Treated and Control Groups, by Age at Initiation**

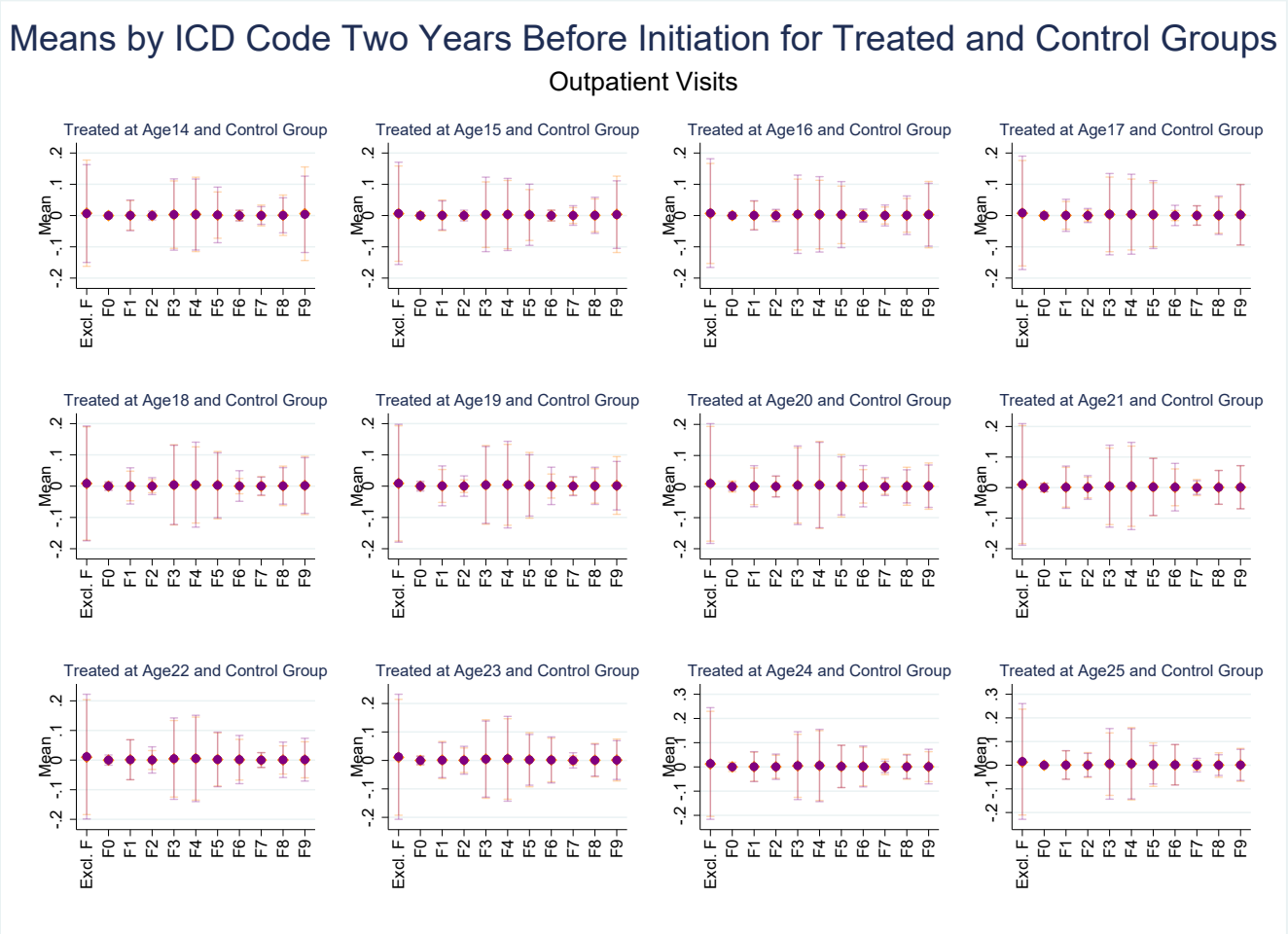


Figure A1: This figure presents the mean probability of having an outpatient visit (by ICD code) for treated and control women, separately by age at initiation of oral contraceptives. The means are calculated for up to two years (eight quarters) before initiation. Treated women are shown with purple circles, and control women with orange diamonds. The analysis covers the period July 2005 to December 2017 and includes women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016. The comparison group consists of women born in the same year and quarter who initiated oral contraceptives one or two years later. Vertical lines indicate 95% confidence intervals.

**Figure A2: Mean Pre-Initiation Inpatient Episodes by ICD Code for Treated and Control Groups, by Age at Initiation**


Figure A2: This figure presents the mean probability of having an inpatient episode (by ICD code) for treated and control women, separately by age at initiation of oral contraceptives. The means are calculated for up to two years (eight quarters) before initiation. Treated women are shown with purple circles, and control women with orange diamonds. The analysis covers the period July 2005 to December 2017 and includes women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016. The comparison group consists of women born in the same year and quarter who initiated oral contraceptives one or two years later. Vertical lines indicate 95% confidence intervals.

**Figure A3: Difference in Mean Pre-Treatment Outpatient Visits (by ICD Code) between Treated and Control Groups, by Age at Initiation**

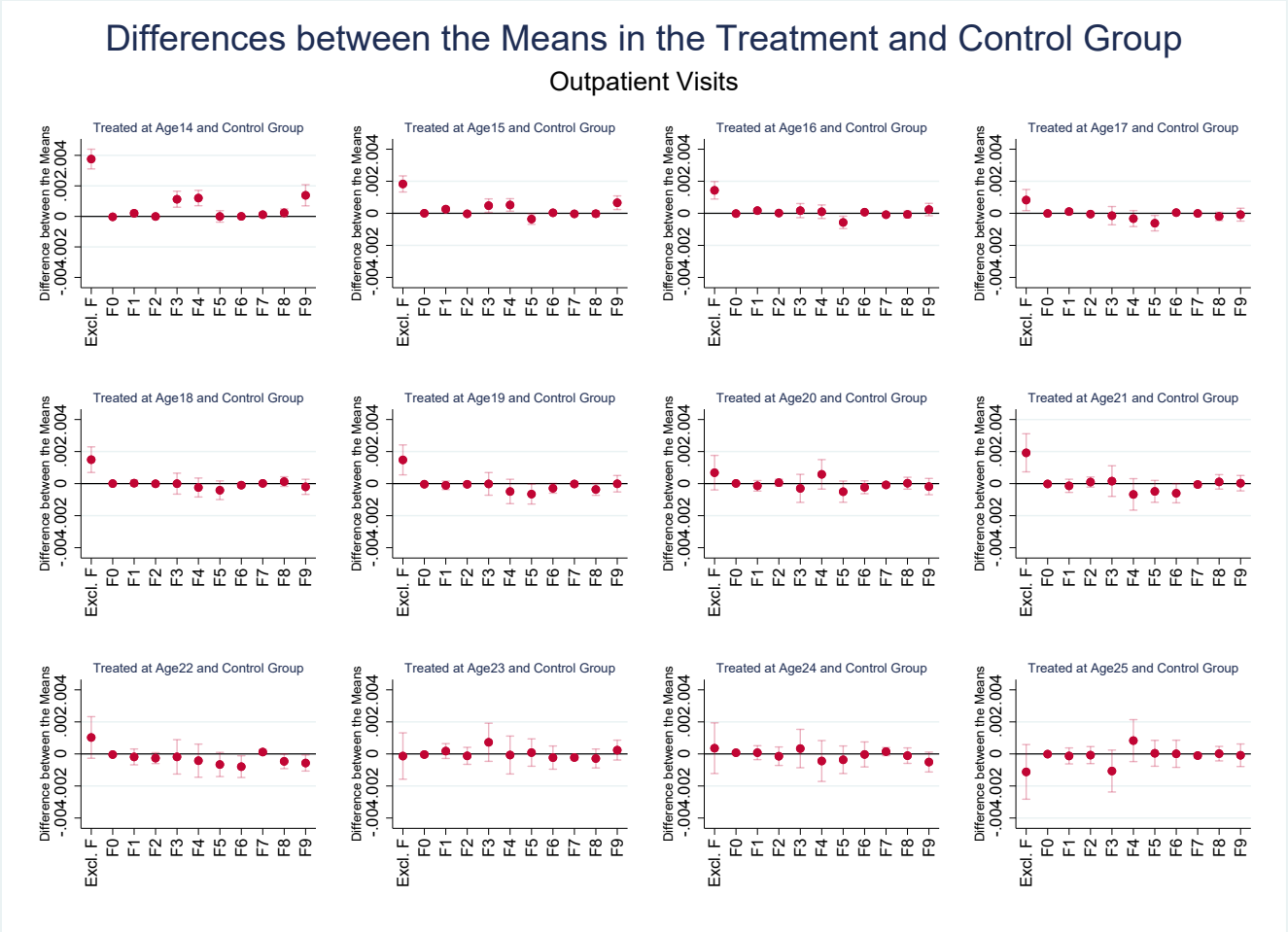


Figure A3: This figure presents the difference in mean pre-treatment probabilities of having an outpatient visit (by ICD code) between treated and control women adjusted for age, birth year and birth quarter, separately by age at initiation of oral contraceptives. The means are calculated for up to two years (eight quarters) before initiation. The analysis covers the period July 2005 to December 2017 and includes women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016. The comparison group consists of women born in the same year and quarter who initiated oral contraceptives one or two years later. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

**Figure A4: Difference in Mean Pre-Treatment Inpatient Episodes (by ICD Code) between Treated and Control Groups, by Age at Initiation**

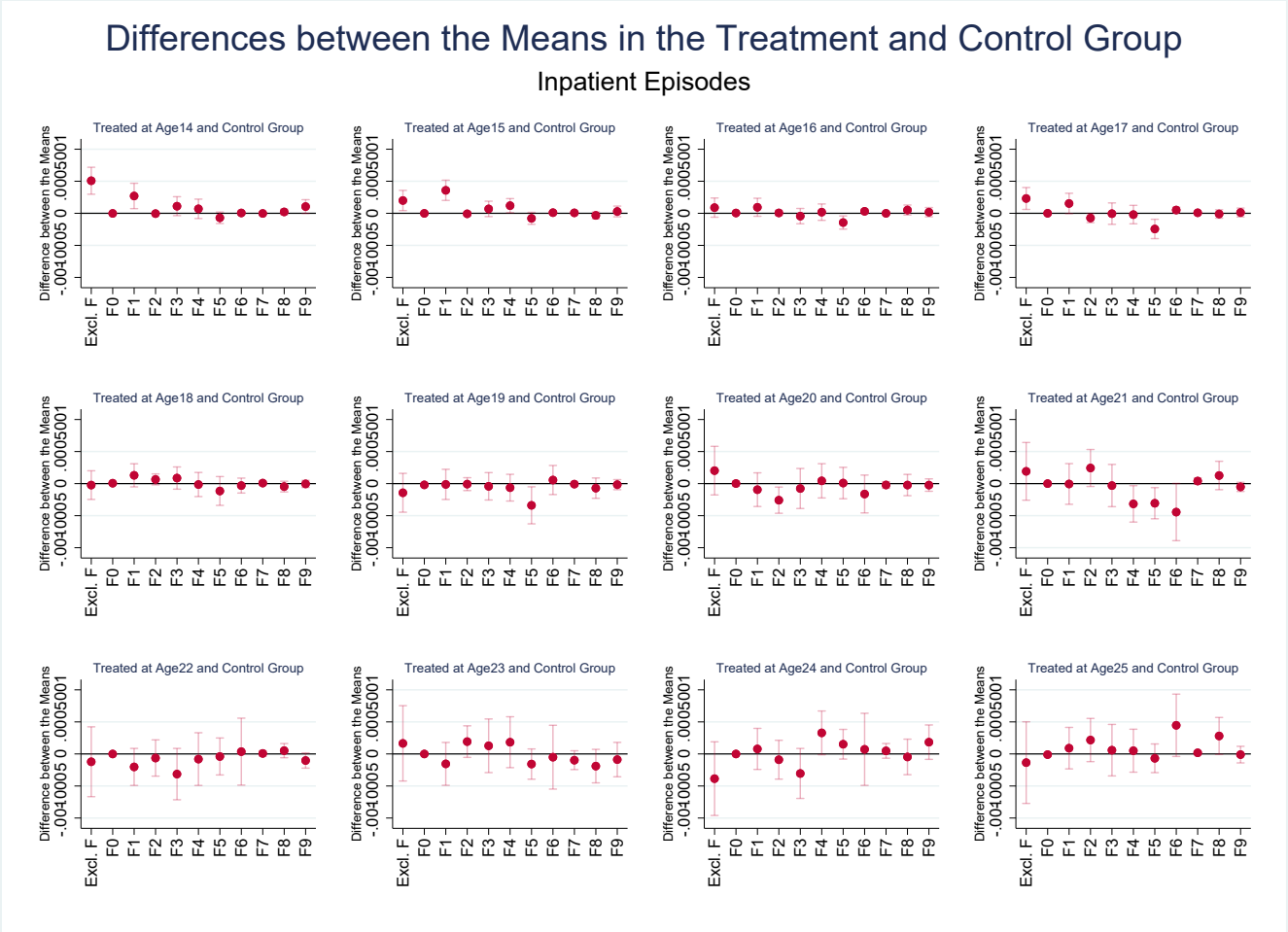


Figure A4: This figure presents the difference in mean pre-treatment probabilities of having an inpatient episode (by ICD code) between treated and control women adjusted for age, birth year and birth quarter, separately by age at initiation of oral contraceptives. The means are calculated for up to two years (eight quarters) before initiation. The analysis covers the period July 2005 to December 2017 and includes women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016. The comparison group consists of women born in the same year and quarter who initiated oral contraceptives one or two years later. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

## Figure A5: Event-Time Coefficients for Antidepressant Prescriptions by Age at Oral Contraceptive Initiation

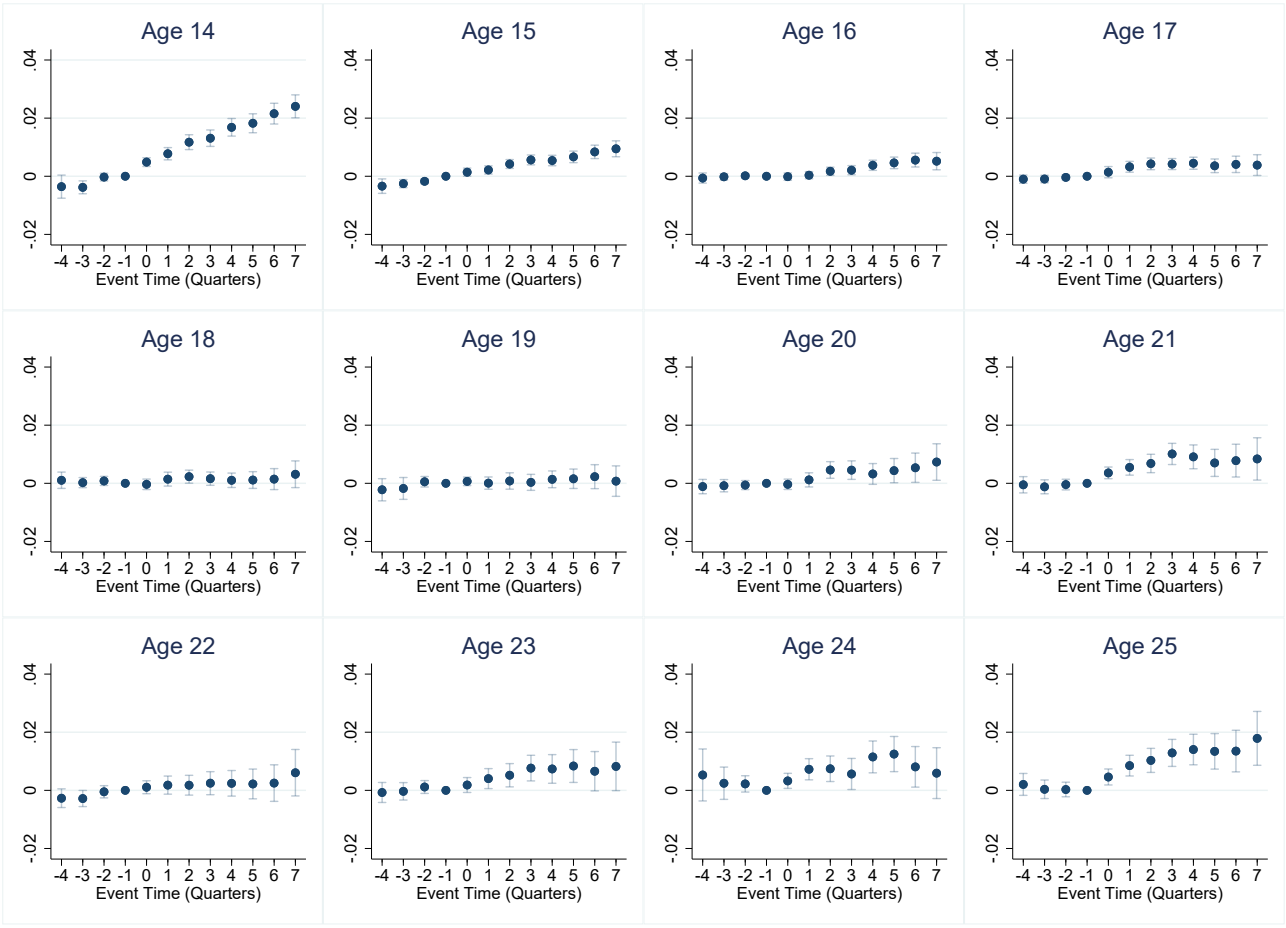


Figure A5: These figures present estimated event-time coefficients for each age-at-initiation cohort, based on equation (4), for women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016. Coefficients are measured relative to one quarter before initiation. The analysis covers the period July 2005 to December 2017, following individuals from eight quarters before to seven quarters after initiation. The comparison group consists of women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

## Figure A6: Aggregated Event-Time Coefficients for Antidepressant Prescriptions by Age at Oral Contraceptive Initiation, Excluding Women with Prior Depression Diagnoses in Outpatient and Inpatient Care

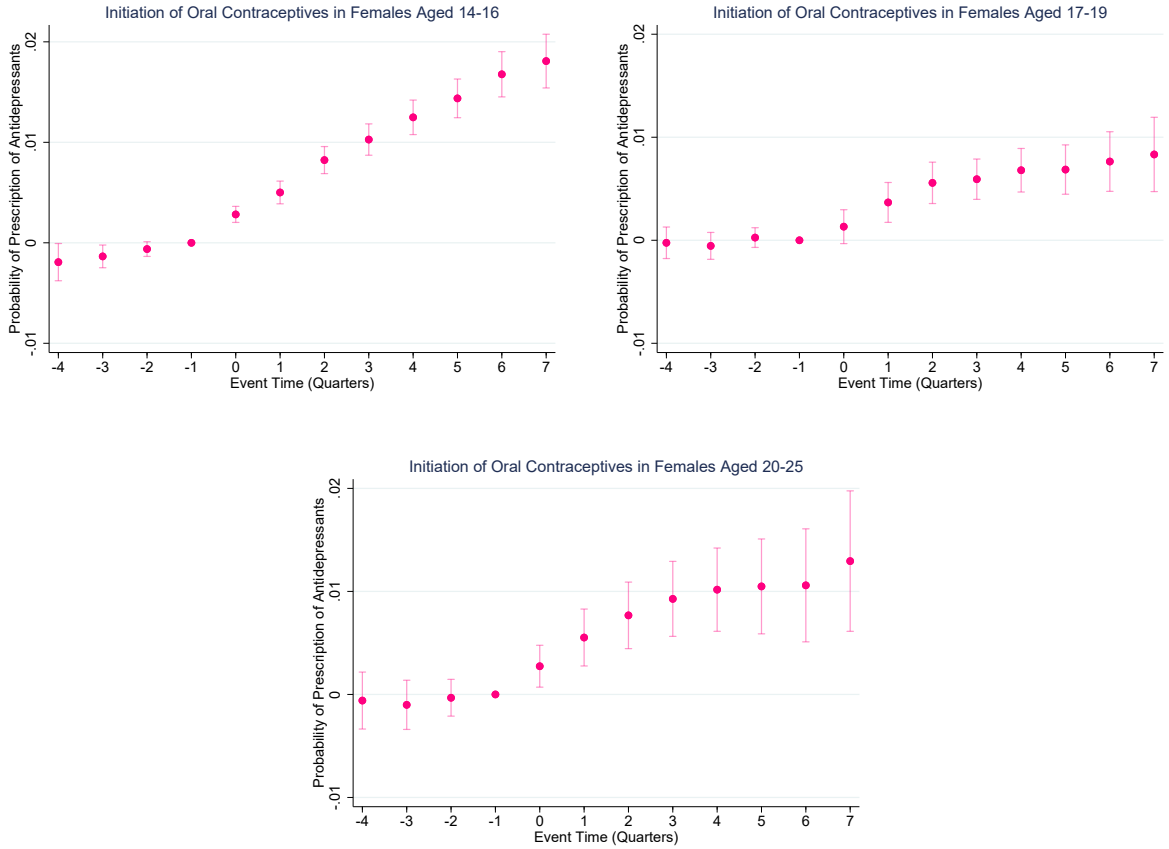


Figure A6: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016, measured relative to one quarter before initiation. The analysis excludes women with any diagnosis of depression recorded in outpatient or inpatient care during the two years preceding contraceptive initiation. The panels show separate estimates for women aged 14–16 (top left), 17–19 (top right), and 20–25 (bottom). The mean probability of having an antidepressant prescription in the quarter before initiation is 0.019, 0.020, and 0.034, respectively. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

## Figure A7: Event-Time Coefficients for Depression Diagnoses in Outpatient Care by Age at Oral Contraceptive Initiation

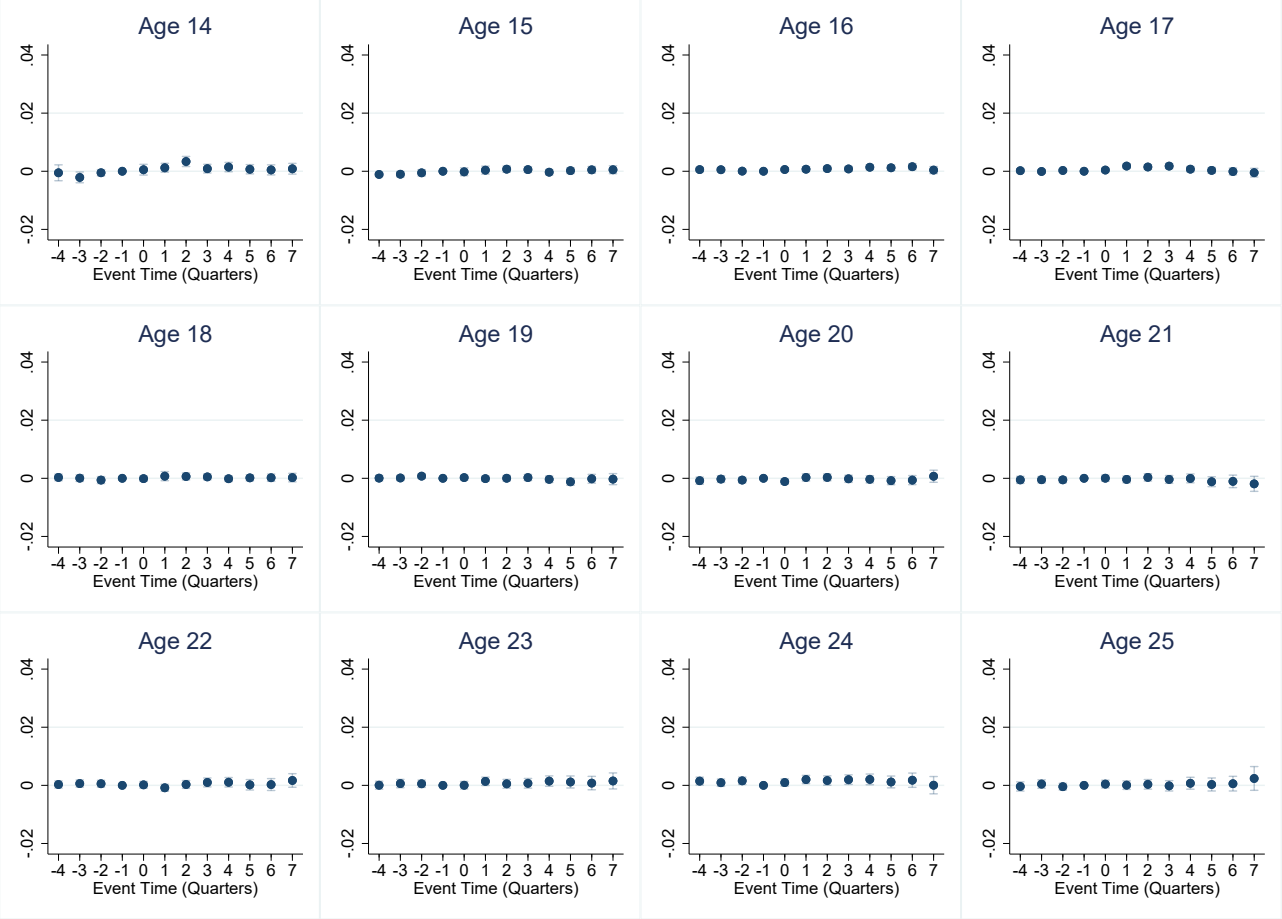


Figure A7: These figures present estimated event-time coefficients for each age-at-initiation cohort, based on equation (4), for women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016. Coefficients are measured relative to one quarter before initiation. The analysis covers the period July 2005 to December 2017, following individuals from eight quarters before to seven quarters after initiation. The comparison group consists of women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an outpatient visit with a depressive diagnosis, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

## Figure A8: Event-Time Coefficients for Depression Diagnoses in Inpatient Care by Age at Oral Contraceptive Initiation

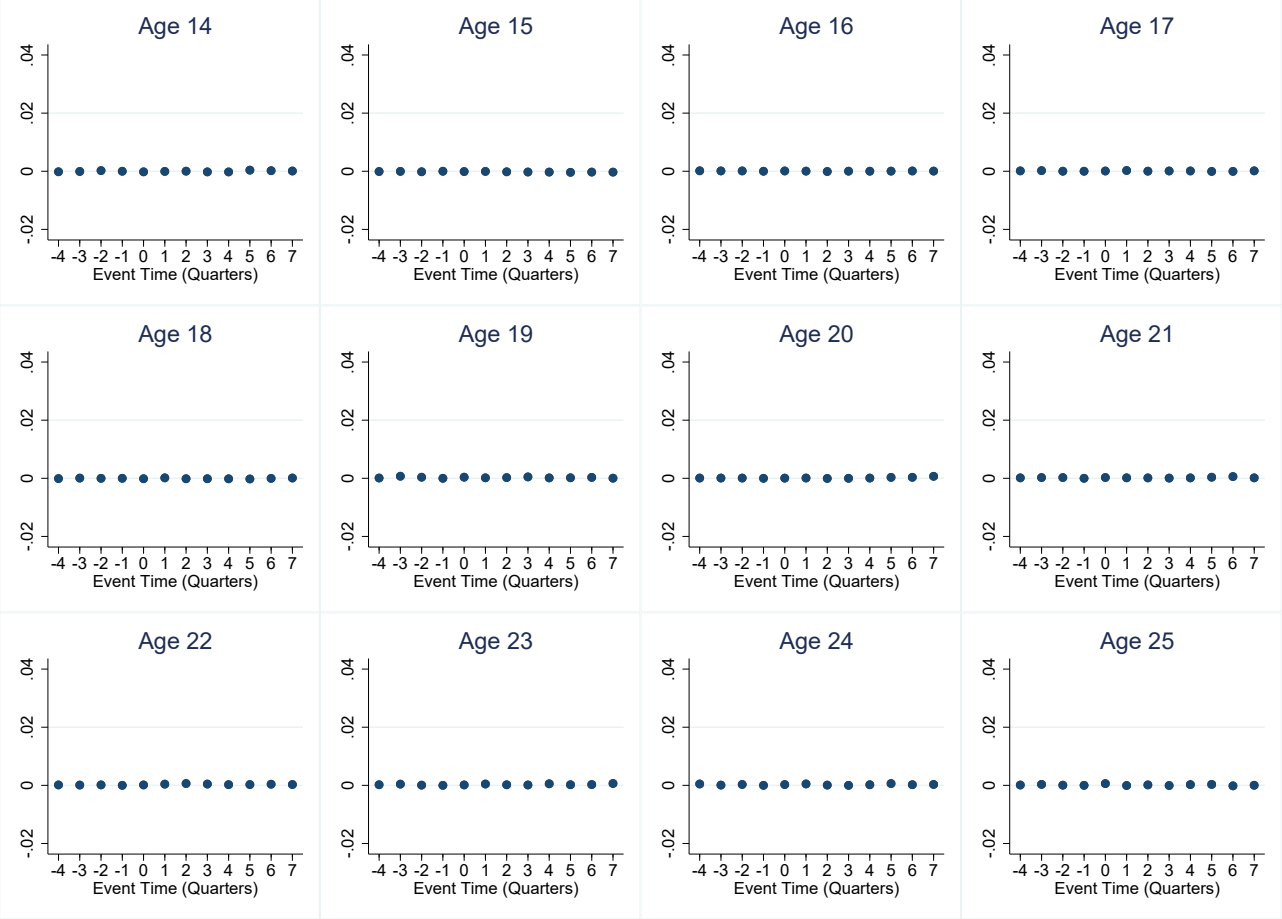


Figure A8: These figures present estimated event-time coefficients for each age-at-initiation cohort, based on equation (4), for women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016. Coefficients are measured relative to one quarter before initiation. The analysis covers the period July 2005 to December 2017, following individuals from eight quarters before to seven quarters after initiation. The comparison group consists of women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an inpatient episode with a depressive diagnosis, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

# Figure A9: Aggregated Event-Time Coefficients for Antidepressant Prescriptions by Age at Oral Contraceptive Initiation, Comparing Women Who Initiated One Year Later

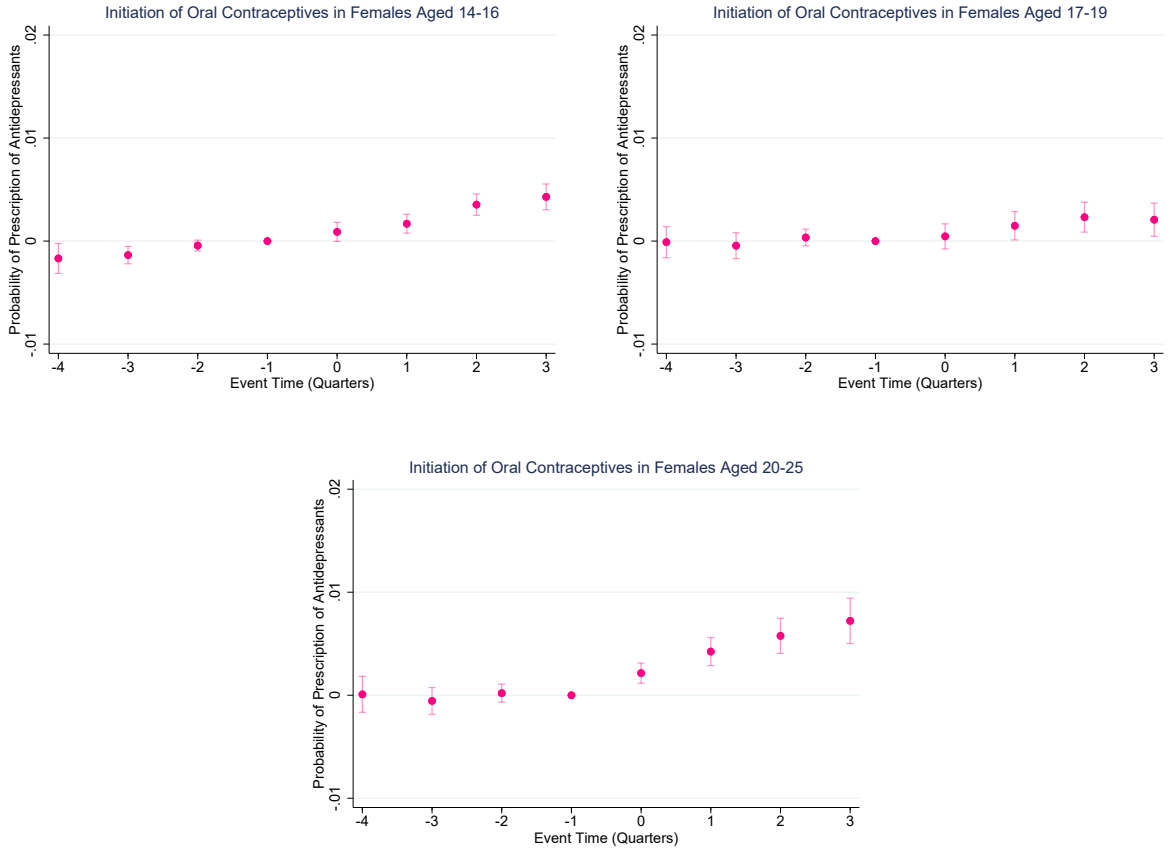


Figure A9: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016, with coefficients measured relative to one quarter before initiation. The panels show separate estimates for women aged 14–16 (top left), 17–19 (top right), and 20–25 (bottom). The mean probability of having an antidepressant prescription in the quarter before initiation is 0.026, 0.030, and 0.046, respectively. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to three quarters after initiation. The comparison group includes women born in the same year and quarter who initiated oral contraceptives only one year later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

## Figure A10: Aggregated Event-Time Coefficients for Antidepressant Prescriptions by Age at Oral Contraceptive Initiation, Comparing Women Who Initiated Two Years Later

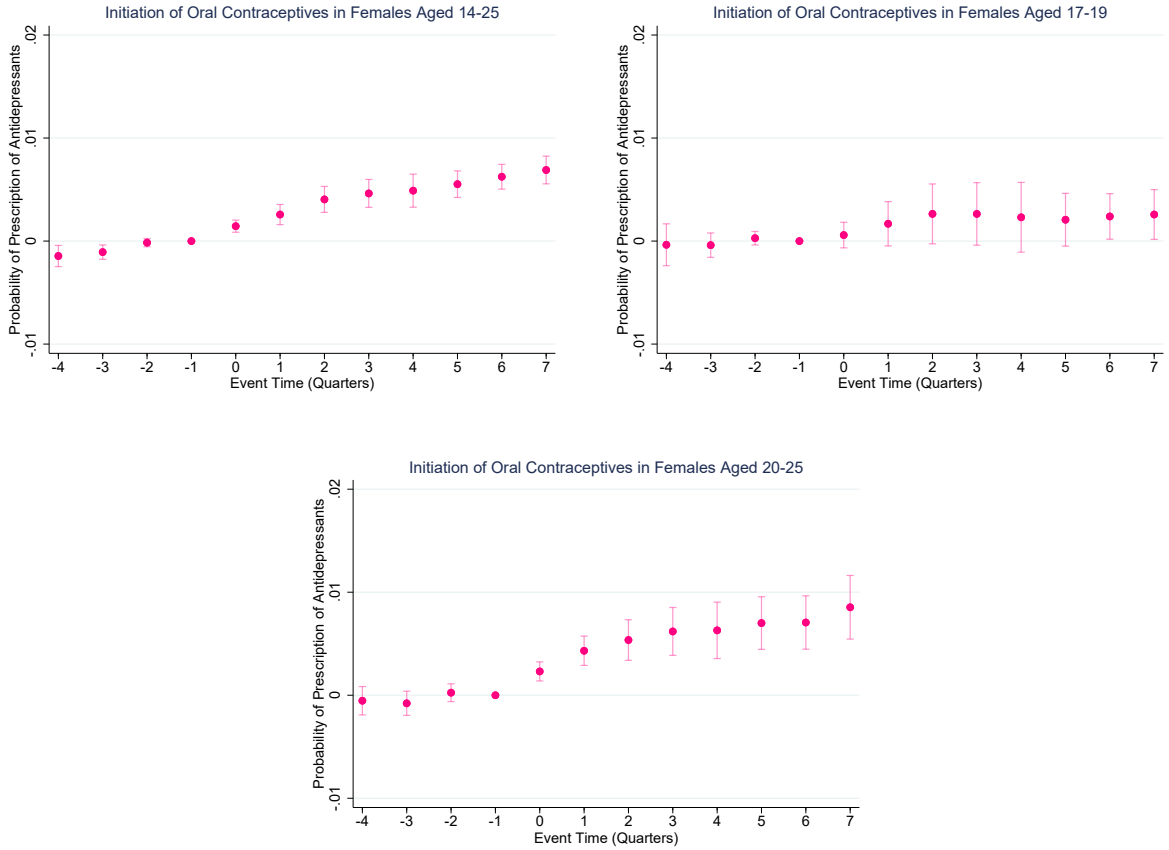


Figure A10: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016, with coefficients measured relative to one quarter before initiation. The panels show separate estimates for women aged 14–16 (top left), 17–19 (top right), and 20–25 (bottom). The mean probability of having an antidepressant prescription in the quarter before initiation is 0.026, 0.030, and 0.046, respectively. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women born in the same year and quarter who initiated oral contraceptives only two years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

## Figure A11: Aggregated Event-Time Coefficients for Antidepressant Prescriptions by Age at Oral Contraceptive Initiation, Comparing Treated Individuals with Not-Yet-Treated Peers Who Initiated at the Same Age One or Two Calendar Years Later

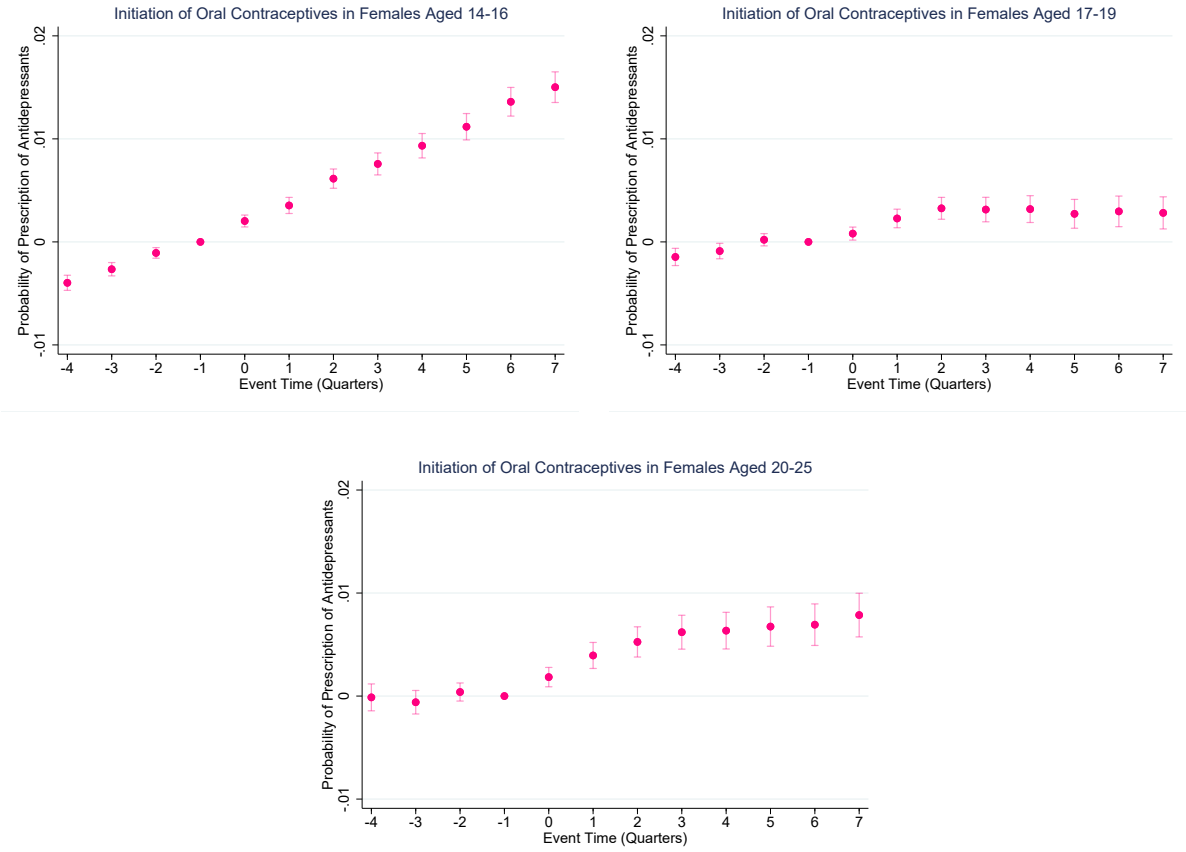


Figure A11: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016, with coefficients measured relative to one quarter before initiation. The panels show separate estimates for women aged 14–16 (top left), 17–19 (top right), and 20–25 (bottom). The mean probability of having an antidepressant prescription in the quarter before initiation is 0.026, 0.030, and 0.046, respectively. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women who initiated oral contraceptives on the same age but one or two calendar years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

## Figure A12: Aggregated Event-Time Coefficients for Antidepressant Prescriptions by Age at Oral Contraceptive Initiation, Comparing Treated Individuals with Never-Treated Peers

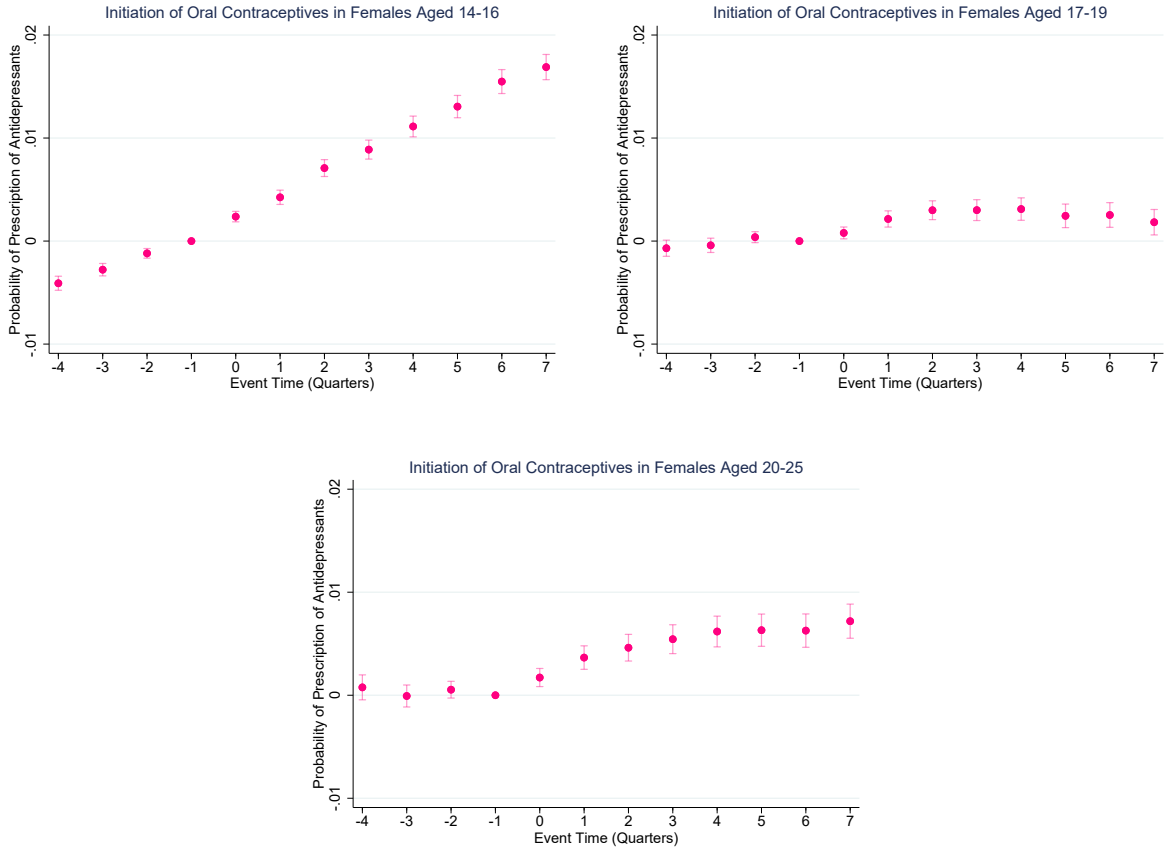


Figure A12: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016, with coefficients measured relative to one quarter before initiation. The panels show separate estimates for women aged 14–16 (top left), 17–19 (top right), and 20–25 (bottom). The mean probability of having an antidepressant prescription in the quarter before initiation is 0.026, 0.030, and 0.046, respectively. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group consists of women who have never used any type of hormonal contraceptives between 2005 and 2017. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

## Figure A13: Aggregated Event-Time Coefficients for Antidepressant Prescriptions by Age at Oral Contraceptive Initiation among Women Born in Sweden

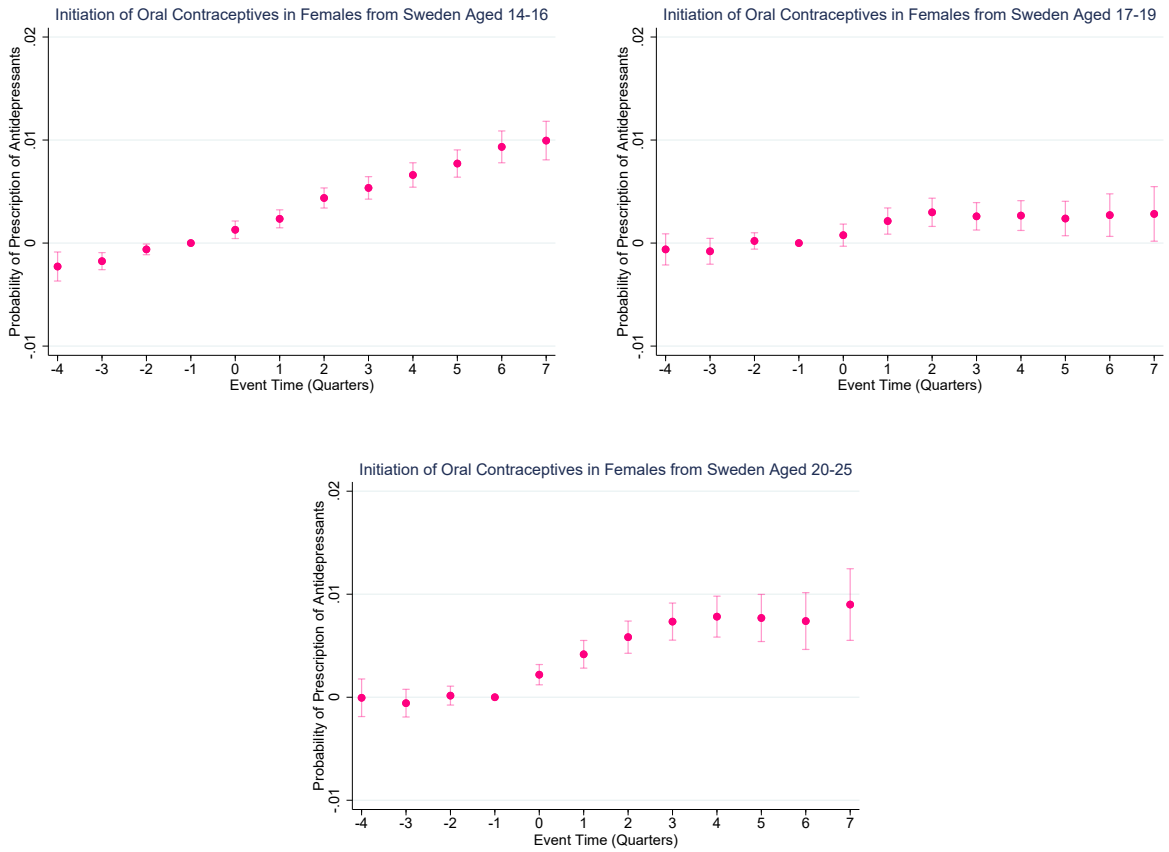


Figure A13: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women born in Sweden who initiated oral contraceptives between ages 14 and 25 from July 2007 to March 2016, with coefficients measured relative to one quarter before initiation. The panels show separate estimates for women aged 14–16 (top left), 17–19 (top right), and 20–25 (bottom). The mean probability of having an antidepressant prescription in the quarter before initiation is 0.026, 0.030, and 0.048, respectively. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

## Figure A14: Aggregated Event-Time Coefficients for Antidepressant Prescriptions by Age at Oral Contraceptive Initiation among Women without ADHD

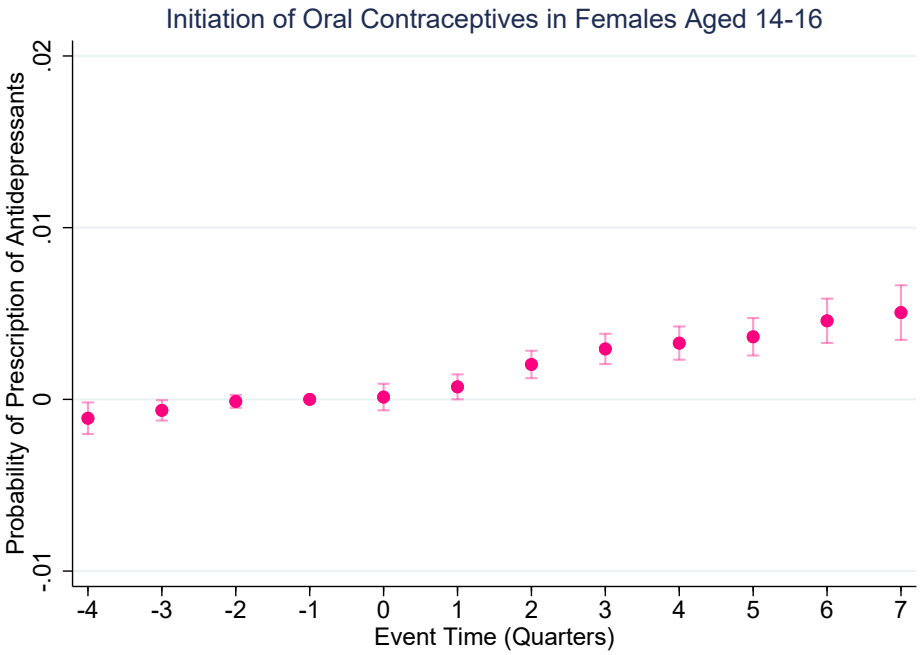


Figure A14: This figure displays aggregated event-time coefficients for women without an ADHD diagnosis who initiated oral contraceptives between ages 14-16 from July 2007 to March 2016, measured relative to one quarter before initiation. The baseline probability of having an antidepressant prescription in the quarter before initiation is 0.013. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

**Figure A15: Aggregated Event-Time Coefficients for Antidepressant Prescriptions by Age at Oral Contraceptive Initiation among Women with and without ADHD, for Age Groups 17–19 and 20–25**

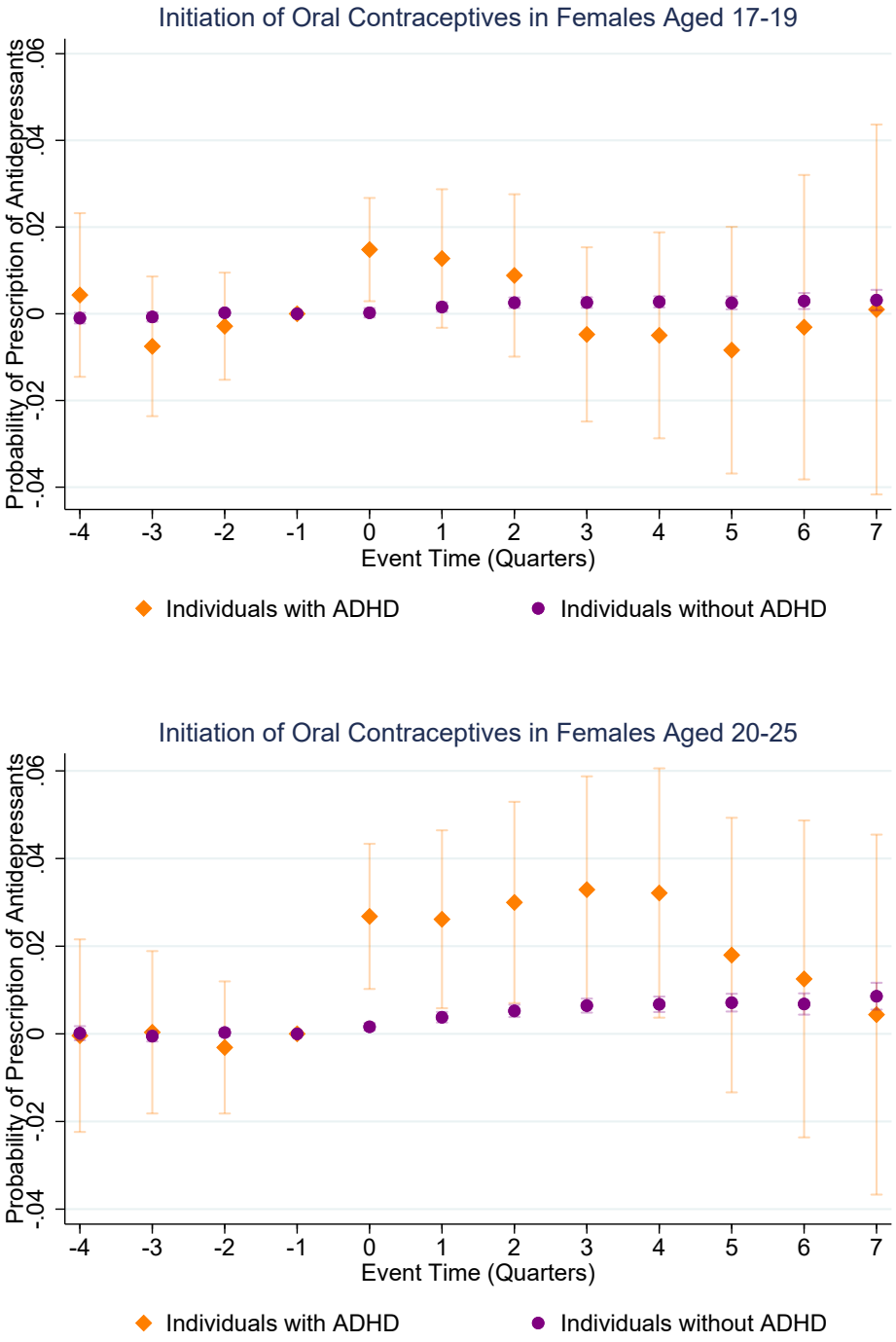


Figure A15: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women who initiated oral contraceptives between ages 17–25 from July 2007 to March 2016, measured relative to one quarter before initiation. Results are shown separately for women without an ADHD diagnosis (purple circles) and women with ADHD (orange diamonds). The top panel displays estimates for women aged 17–19, and the bottom panel for women aged 20–25. The mean probability of having an antidepressant prescription in the quarter before initiation is 0.022 for women without ADHD and 0.34 for women with ADHD among initiators aged 17–19, and 0.039 for women without ADHD and 0.36 for women with ADHD among initiators aged 20–25. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women born in the same year and quarter who initiated oral contraceptives one or two years later. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

**Figure A16: Aggregated Event-Time Coefficients for Antidepressant Prescriptions by Age at Oral Contraceptive Initiation among Women with and without ADHD, by Contraceptive Type, for Ages 14–16**

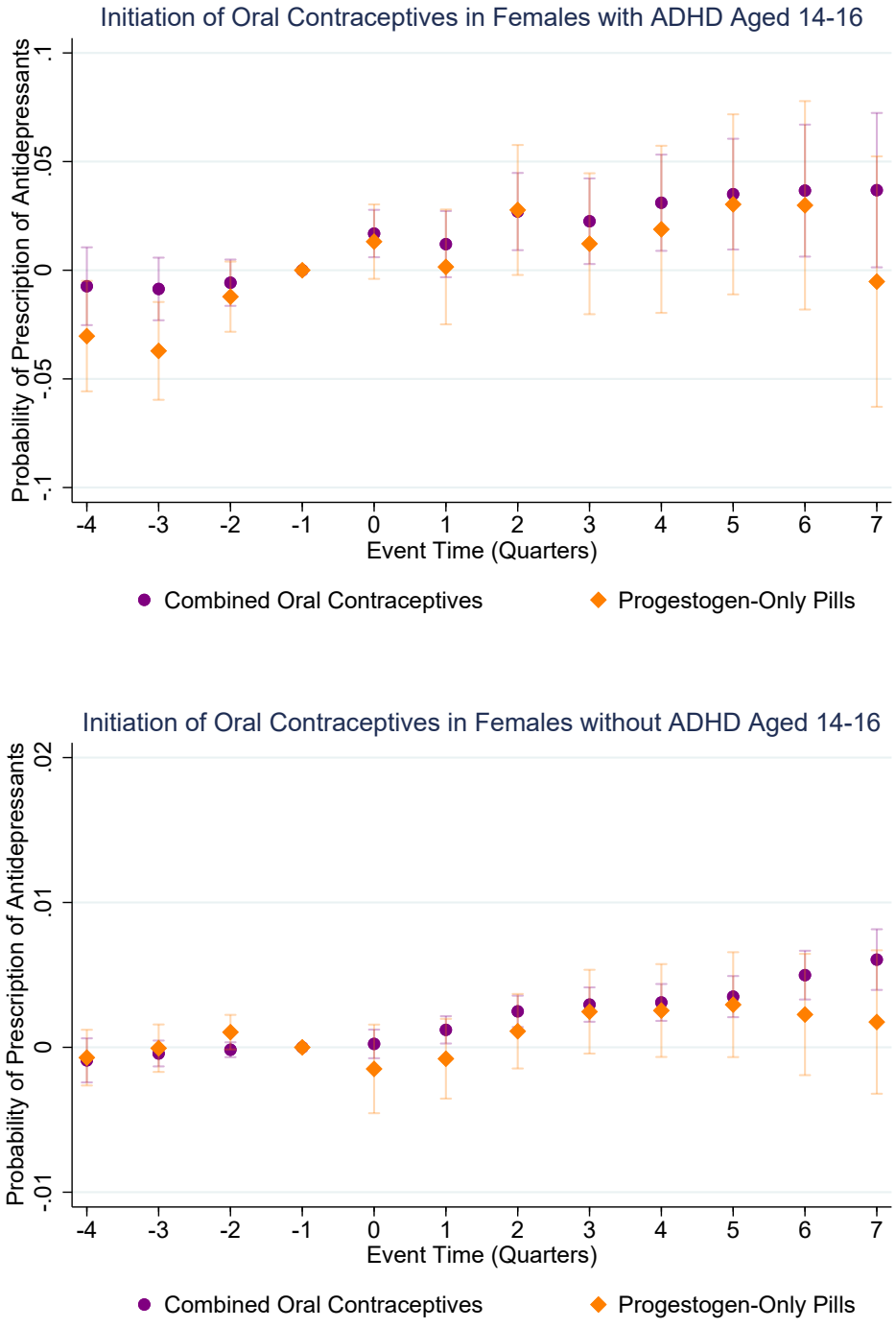


Figure A16: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women aged 14–16 who initiated oral contraceptives between July 2007 and March 2016, with coefficients measured relative to one quarter before initiation. Results are shown separately for combined oral contraceptive users (purple circles) and progestogen-only users (orange diamonds). The top panel displays estimates for women with a diagnosis of ADHD, and the bottom panel for women without ADHD. The mean probability of having an antidepressant prescription in the quarter before initiation is 0.29 for combined and 0.29 for progestogen-only users among women with ADHD, and 0.012 for combined and 0.018 for progestogen-only users among women without ADHD. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women who have never used any type of hormonal contraceptives between 2005 and 2017. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.

**Figure A17: Aggregated Event-Time Coefficients for Antidepressant Prescriptions by Age at Oral Contraceptive Initiation among Women with and without ADHD, by Initiation Motives, for Ages 14–16**

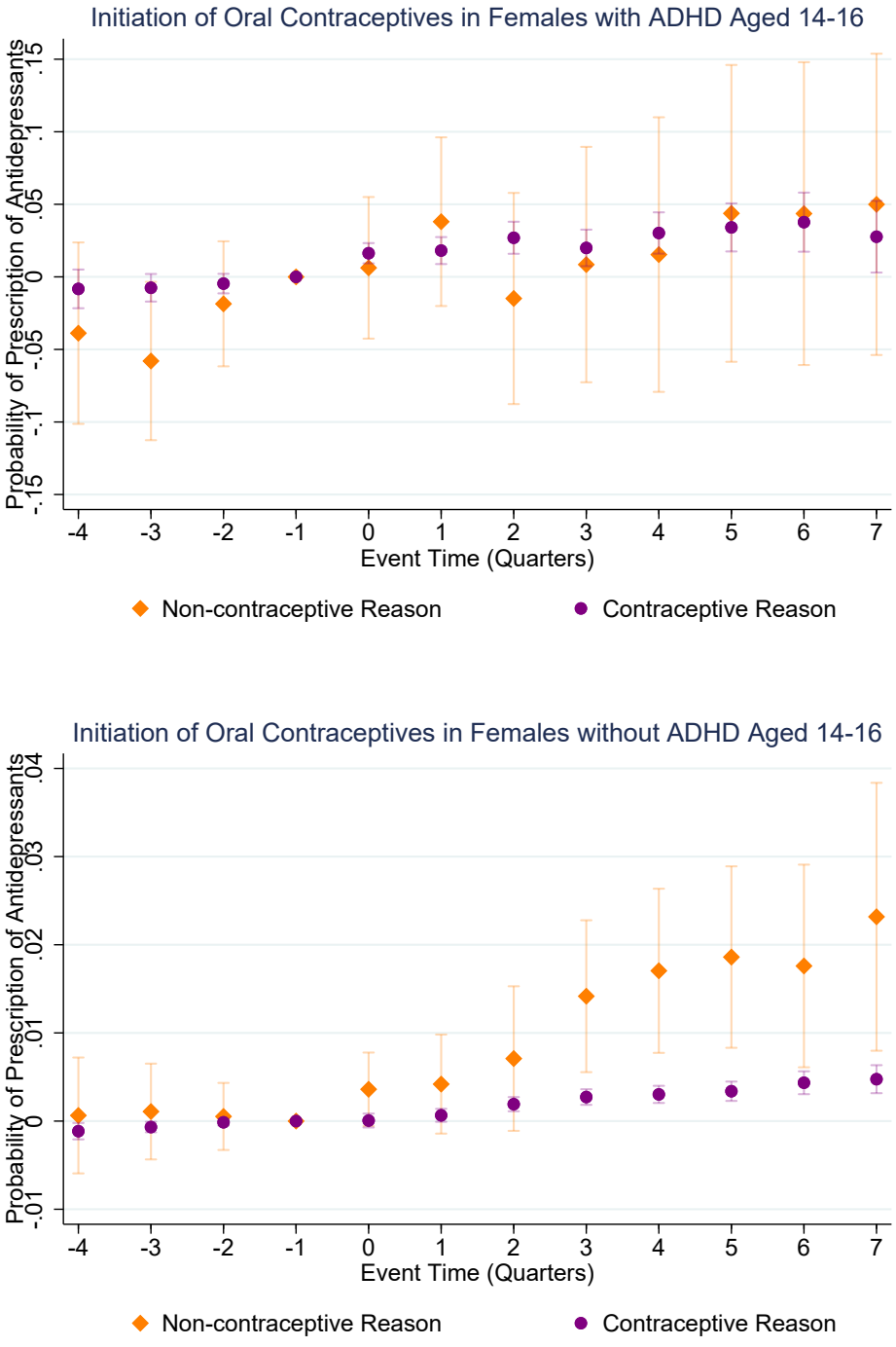


Figure A17: This figure presents aggregated event-time coefficients for antidepressant prescriptions among women aged 14–16 who initiated oral contraceptives between July 2007 and March 2016, with coefficients measured relative to one quarter before initiation. Results are shown separately by initiation motive, which are contraceptive reason (purple circles) and non-contraceptive reason (orange diamonds). The top panel displays estimates for women with a diagnosis of ADHD, and the bottom panel for women without ADHD. The mean probability of having an antidepressant prescription in the quarter before initiation is 0.26 for contraceptive and 0.35 for non-contraceptive users among women with ADHD, and 0.013 for contraceptive and 0.022 for non-contraceptive users among women without ADHD. The analysis covers the period July 2005 to December 2017, following individuals from four quarters before to seven quarters after initiation. The comparison group includes women who have never used any type of hormonal contraceptives between 2005 and 2017. The y-axis shows the probability of having an antidepressant prescription, and the x-axis represents event time in quarters. Vertical lines indicate 95% confidence intervals based on standard errors clustered at the individual level.