

# Co-payment and adolescents' use of psychologist treatment: Spill over effects on mental health care and on suicide attempts

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## Abstract

The literature around co-payment shows evidence of increasing consumption following reduced co-payment. We apply difference-in-difference methods to assess the effect of abolishing the co-payment on psychologist treatment of anxiety and depression in 18 to 21-year olds. We apply nationwide individual level data with individuals close to this age interval as control group. The population amounts to approximately 1.2 million individuals and a total of 51 million patient months of observations. We show that after removing co-payment, the use of psychologist treatment almost doubles. We find that this increase involves moderately positive spill over effects on outpatient psychiatric care and on prescriptions of antidepressants. In the heterogeneity analysis we find evidence of higher effects on adolescents from families with lower income, indicating that reduced co-payments may increase equality in access. We also see that effects are higher for individuals listed with general practitioners (GPs) with a reluctant referral style; indicating that these GPs' behavior is affected by patient co-payment rates. Interestingly, we find evidence of significant reductions in suicide attempts – primarily among high-income women and low-income men. This indicates that better access to mental health care for adolescents may have a positive impact on their mental health and well-being.

## KEYWORDS

adolescents, co-payment, mental health, suicide attempts

## 1 | INTRODUCTION

### 1.1 | Motivation

Mental health care is known to be subject to higher rates of co-payment as well as higher price elasticities, compared to physical health care (Frank & McGuire, 2000). This dilemma renders undertreatment of mental health care a likely scenario in many health care systems (Kessler et al., 2007). Further, health economics' research in mental health is limited, in particular childhood mental health and the “missing middle” years of adolescence, as emphasized in a recent paper by Currie (2020).

Indeed, the importance of adolescent's mental health and wellbeing is increasingly recognized. Globally, an estimated 10%–20% of adolescents experience mental health conditions, although many remain underdiagnosed and undertreated (Kessler et al., 2007). The most prevalent mental disorders are depression and anxiety, which together are estimated to affect nearly 1 in

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10 people worldwide (UNSTATS, 2017). These conditions may have fatal consequences: the WHO reports that an estimated 62,000 adolescents died in 2016 as a result of self-harm and that suicide is the third leading cause of death in older adolescents (15–19 years) (WHO, 2020). The United Nations sustainable development goals include reduction of suicide mortality rates (UNSTATS, 2017), rendering focus on access to effective mental health care even more important. Although low and middle income countries may face the largest challenges, data from 2006 from Denmark, a high income country with universal health-care coverage, show that attempted suicide was the most common cause of hospital admissions among 15–34 years old, and that suicide was among the most common causes of death in this age group (Christoffersen, 2009).

There is compelling evidence of moral hazard in health insurance—that is, individuals, on average, consume less health care when out of pocket payments increase (Einav & Finkelstein, 2018). This literature relates to the relation between consumption and co-payment. Increased consumption following a decrease in co-payment may, as noted above, reflect previous underconsumption or moral hazard. A number of studies indicate that the rate of co-payment on mental health care is associated with suicide (O'Reilly et al., 2020). This association may indicate that a high co-payment leads to underconsumption and through this to worse mental health. Hence there is a link between co-payment and suicide because co-payment is expected to affect mental health care use and mental health care use is expected to affect suicide attempts and suicide. Adolescents may be extra vulnerable to co-payment because they either have low income due to just having entered the labor market, or because they are still dependent on their parents' financial support. Furthermore, mental health is often associated with stigma which may be more pronounced among adolescents.

## 1.2 | Aim of this study

In this paper we study the effects of abolishing the co-payment for psychologist treatment of anxiety or depression in adolescents 18–21 years of age. We assess consumption effects by studying the effect of the policy change on use of psychologist treatment for anxiety and depression. Furthermore, we assess if the change in co-payment causes spill over effects on other mental health care services (outpatient psychiatric care, anti-depressant prescription drugs, talk therapy offered by the patients' General Practitioner [GP]). Finally, we assess if any changes in use of mental health care following the new insurance structure impact on the level of suicide attempts.

## 1.3 | Previous literature

Important knowledge has been gained from changes in insurance coverage of adolescents in the US. Effects of both improved and reduced coverage have been analyzed and studies generally suggest that adolescents covered by their parents' health insurance have higher use of mental health care compared to adolescents not covered by parents' insurance. For example, Anderson et al. (2012) and Anderson et al. (2014) study the impact of adolescents losing coverage of their parents' insurance at the age of 19 and 23. They find that adolescents aging out of their parents' health insurance incur a 40% reduction in emergency department visits and a 61% reduction in inpatient hospital admissions (Anderson et al., 2012).

Since the “Affordable Care Act (ACA) Young Adult Mandate” allowed adolescents to regain access to parents' insurance, studies have been able to show that access to parents' health insurance led to an increase in somatic inpatient admissions of 3.5% and a substantially larger increase in mental health visits (9%) (Akosa Antwi et al., 2015). This supports the hypothesis of higher price elasticities for mental health care compared to somatic health care, at least for adolescents. Contrary to these findings, several studies find low impact on admissions of the insurance expansion in Massachusetts in 2007 (Kolstad & Kowalski, 2012; Meara et al., 2014).

The impact of insurance coverage of mental health care on suicide has been analyzed by O'Reilly et al. (2020) and Lang (2013). Lang (2013) shows that those US states that introduced parity laws ensuring the same level of coverage for mental health care as for somatic care, experienced a 5% reduction in suicide.

Few studies from European settings exist, although a couple of studies assess the effect of increases in mental health co-payment for adults in the Netherlands in 2012. They find that the increases in co-payment incurred a reduction in use of psychologist and psychiatric outpatient care but an increase in prescription medications and acute psychiatric care (Lambregts & van Vliet, 2018; Lopes et al., 2022; van der Lee, de Haan, & Beekman, 2019).

To summarize the evidence from the literature discussed above we claim that increased access, via reduced co-payment may have positive effects on mental health and well-being. Most of the evidence is written from a US setting and only few studies assess the effects of changes in use of care on mental health and well-being as measured by suicide attempt or suicide.

## 1.4 | Contribution

This paper contributes to the scarce health economics literature on adolescents' mental health and adds to the literature on co-payment and insurance coverage in mental health care use. Our contribution has three dimensions. First, we provide evidence of demand response to reduced co-payment in a European context with full coverage on most mental health care services but not on first-line psychologist treatment. As the new insurance coverage is offered to all citizens, we do not face the adverse selection issues often present in studies of systems based on private health insurance. Second, our analysis is based on nationwide high-quality individual level data with full population, which renders selection bias based on sociodemographic differences between treatment and control groups a minor problem. The rich data set allows for the inclusion of within-individual variation for individuals turning 18 and hence becoming exposed to the change in co-payment within the study period. Third, we can assess spill over effects on other mental health care services as well as on suicide attempts, which may be regarded as a proxy for the mental well-being of the population.

Our results show that reducing co-payment from 40% to zero almost doubles the use of psychologist treatment. In the heterogeneity analysis we find evidence of higher effects on adolescents from families with lower income, indicating that reduced co-payments may increase equality in access. We also see that the magnitudes of the effects are higher for individuals listed with GPs with a reluctant referral style, indicating that these GPs behavior are affected by patient co-payment rates. The increase in psychologist treatment involves moderately positive spill over effects on outpatient psychiatric care (7.5% increase) and on prescription of antidepressants (11.6% increase). Hence, reducing co-payments on psychologist treatment increases use of mental health services not directly affected by the changed co-payments. Interestingly, we find evidence of significant reductions in suicide attempts in the age group affected by the abolishment of co-payment – primarily among high-income women and low-income men. This indicates that better access to mental health care for adolescents may have a positive impact on their mental health and well-being.

## 2 | CONTEXT

The Danish Health Care system is largely tax financed. Eighty-four percent of total health expenditures in Denmark are covered by the government, 14% through out of pocket payments and just two percent by voluntary private health insurance (OECD, 2019).

Primary and secondary health care, including psychiatric care, is free at the point of delivery. Other services delivered outside of hospitals such as dental care, physiotherapy and psychologist treatment are subject to co-payments with some exceptions. The co-payment rate for psychologist treatment is 40% upon referral from a GP. The co-payment scheme covers psychologist treatment for anxiety or depression and other treatments, including treatment after traumatic experiences. Medicines prescribed in primary health care, for example, by a GP, are also subject to co-payments although by a decreasing rate and with an annual maximum expenditure per capita of around €600, while medicines prescribed at hospitals are free at the point of delivery (Olejaz et al., 2012). An important feature of the Danish health care system is that GPs act as gatekeepers for specialized care, including psychologists. This means that patients have open and fully covered access to their GP but that access to specialized care needs to be based on a referral from the GP. Hence, access to reimbursed psychologist treatment needs to go through the GP, thus incurring the possibility that the GP referral style has an impact on access. Furthermore, psychologists are spread geographically uneven across the country, causing a potential barrier for patients. Some studies on populations with known symptoms of anxiety and depression find that individuals with longer distances to mental health providers have lower utilization (Packness et al., 2017, 2021). The combination of financial and distance barriers may be important, and studies have shown that an increase in distance to the nearest psychologist by 5 km involve as much as 11% lower use of psychologist treatment for individuals having low income (Packness et al., 2017). Hence, co-payment may incur heterogenous effects in the presence of distance barriers.

GPs can offer talk therapy to their patients, at no co-payment, which to some extent may substitute psychologist treatment. All GPs and psychiatrists can prescribe antidepressants, while psychologists are not allowed to prescribe any medication.

Private health insurance only covers around two percent of the total health care market and predominantly takes two forms. The first, being the non-profit health insurance company “danmark”, is purchased by consumers and covers psychologist treatment with a fixed amount of around €40 per consultation (approximately 30% of the total fee), provided it is already reimbursed by the public health insurance. Children up to the age of 16 are covered by their parents' insurance. The second form of insurance scheme is for-profit and predominantly employer-paid by private sector employers. This type of insurance is mostly

used for privately paid surgery (48% in 2018), physiotherapy, chiropractic treatment and similar (32%) and to a lesser extent psychologist and psychiatrist treatment (15%) (Olsen & Kristensen, 2021). Only few of these insurances cover the children of the insured.

## 2.1 | The natural experiment

In this paper we study the effect of a natural experiment, where one group gained full public insurance coverage of psychologist treatment for anxiety and depression upon referral from a GP. When a GP refers a patient to psychologist treatment, they register the reason for referral. The reason for referral could be anxiety, depression, or a list of trauma-related other causes (victim of robbery, rape, violence; traffic injury or other trauma; death of close relative etc.). Until July 2018 psychologist treatment was subject to a 40% co-payment rate for all age groups, although only patients aged 18 and older could be referred for treatment of anxiety or depression. The rate of co-payment was approximately €50 per consultation (40%) resulting in an out-of-pocket payment of €600 for a course of the maximum of 12 consultations. From July 2018 the Danish government introduced a pilot phase removing all co-payments on psychologist treatment for adolescents between the age of 18 and 21<sup>1</sup> for anxiety and depression only.

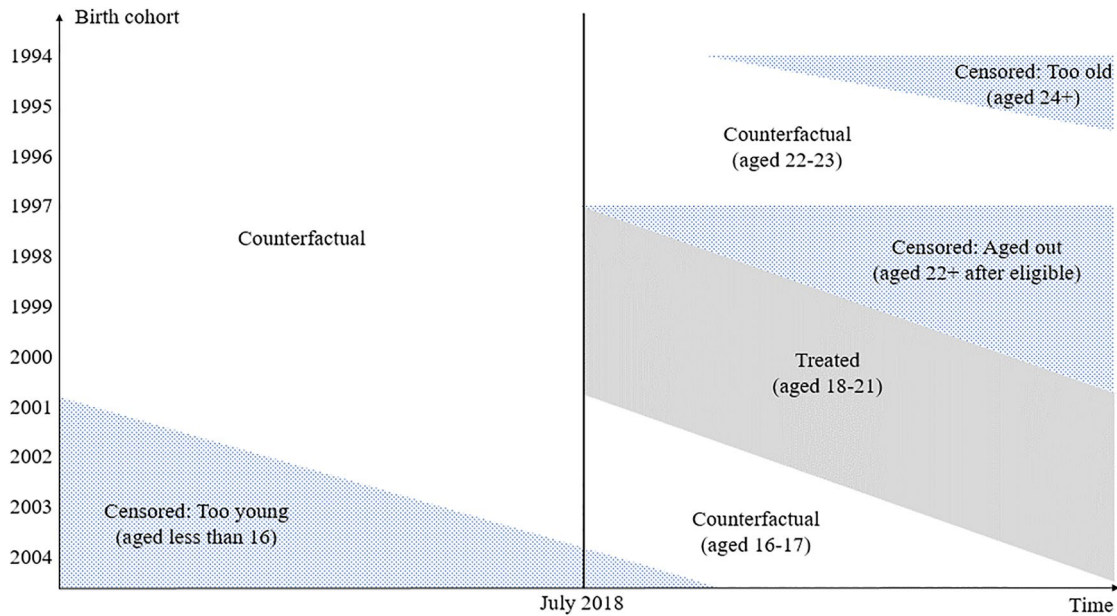
The exact range of the age interval covered by this policy change was decided for budgetary reasons, which allows us to assume that age groups close to this interval are comparable in terms of their risk of mental health problems and need for psychologist treatment for anxiety and depression. This provides an excellent opportunity to assess the effect of co-payment on utilization of psychologist treatment, the spill over effects on other mental health care services and the effect on suicide attempts. As the experiment is based on a public insurance scheme that applies to all individuals in the given age group after July 2018, we do not face problems related to adverse selection, which is otherwise common in studies based on private insurance programs.

## 3 | DATA

This study is based on a nationwide population of all individuals living in Denmark and born between 1994 and 2004. The population is followed from July 2014 until December 2020 or until they reach age 24. Individuals enter the population when they turn 16 or if they immigrate and receive a Danish social security number (usually granted upon approved permanent or temporary residence). We use a combined control group of adolescents and young adults at both ends of the treated age band. that is, we use 16 to 17-year-olds and 22 to 23-year-olds as controls. This leaves the control group as close in age to the exposed as possible. Also, the analysis includes a large number of individuals who start as unexposed (16 to 17-years-old) but become exposed in our follow-up period and includes individuals above the 18–21-year threshold (22–23 years of age) as well. The patient months of individuals turning 22 after the policy change (i.e., being part of the treatment group before turning 22) are omitted from the control group, because there may be lasting treatment effects which could bias the control group. However, a sensitivity analysis (not reported) showed that the decision to remove this group is not important for our results. An overview of the population by birth cohorts is presented in the Figure 1. The blue shaded areas show the person months that are censored due to individuals being too young (<16 years of age), too old (>23 years of age) or are aging out of exposure (turning 22 years of age after having been exposed).

Individuals' health care utilization across primary and secondary care can be tracked using the unique social security number, hence individuals can be followed over time. Health care utilization is measured at the monthly level. The population amounts to approximately 1.2 million individuals and a total of 51 million patient months of observations.

The abolishment of co-payment only applied to citizens in the age interval 18–21. As common in the literature, we use age groups close to this interval as the counterfactual. Age groups below 18-year of age (e.g., 16 to 17-year of age) and above 21-year of age (e.g., 22 to 23-year of age) are used under the identifying assumption that no differences in risk of anxiety or depression nor in need for psychologist treatment exist. Although we have no reason to believe that this assumption is violated, a number of points relating to the use of these age groups as controls can be raised. For the younger part of the control group (16 to 17-year of age), the analysis is challenged by the fact that Danish health law specifies that the responsibility for psychiatric care is transferred from child psychiatry to adult psychiatry by the age of 18. Hence psychiatric health care utilization may change at this exact age because some providers may be reluctant to refer adolescents to adult psychiatric care. On the other hand, an advantage of using the younger age group as control is that during the total time period of six and a half years (July



**FIGURE 1** Illustration of the study population. The birth cohorts are displayed on the y-axis, and the development over time on the x-axis. Before July 2018, the entire population aged 16+ are counterfactual (controls), while after July 2018, individuals aged 18–21 are treated (gray), 16–17 and 22–23 are counterfactual, and individuals aged 24+ are censored (blue). In addition, individuals, that have been treated (aged less than 22 in July 2018) but age out of the intervention, are censored as well (blue)

2014–2020) a high number of these individuals turn 18, thus allowing us to observe these individuals as both unexposed and exposed (once they turn 18) which contributes to the analysis with within-individual variation.

Our outcome variables are obtained from linking data from several nationwide Danish administrative healthcare registers to the population, including: The National Patient Register (Lyng et al., 2011); the National Health Service Register (Andersen et al., 2011); the National Prescription Register (Kildemoes et al., 2011; Pottegard et al., 2017). To assess the hypothesis that use of psychologist treatment will increase, we extract data on use of all psychologist treatment being subject to a referral option of anxiety or depression from the National Health Service Register. All outcome variables are coded as binary measures at individual monthly level. that is, for all months and for all individuals, we register if the individual used the given health service (psychologist [AD], psychologist [other], outpatient psychiatrists, antidepressant prescription) or if they had a suicide attempt. The latter is identified using contacts to somatic or psychiatric emergency departments (A&E) with attempted suicide as cause. Thus, death by suicide, and attempted suicides that were not reported to an A&E, were not included.

## 4 | METHODS

Exposure to the new insurance coverage is defined by two thresholds: an age threshold ( $18 \leq \text{age} \leq 21$ ) and a time threshold (after July 1, 2018). As is common in the literature, we use a difference-in-difference (DD) approach with individuals in age intervals close to the exposed as control group (Akosa Antwi et al., 2015; Kolstad & Kowalski, 2012; Lambregts & van Vliet, 2018; O'Reilly et al., 2020; van der Lee et al., 2019). Our main identifying variation is at the individual level over age and time. Our basic model is thus a standard two way fixed effect model (2WFE):

$$Y_{it}^g = \lambda \text{age}_{it,18-21} + \gamma D_{t,july2018} + \beta (D_{t,july2018} * \text{age}_{it,18-21}) + \alpha_i + \text{month}_t + \text{year}_t + \varepsilon_{it}, \quad (1)$$

where  $Y_{it}^g$  is the outcome of interest for individual  $i$  at time  $t$  for gender  $g$ .  $\text{age}_{it,18-21}$  is a dummy variable that equals 1 when an individual is in the age interval 18 to 21-year. Hence, this dummy variable turns 1 in the month each individual turns 18 and turns 0 again when each individual turns 22.  $D_{t,july2018}$  is a dummy variable equal to 1 for all observations after July 2018 and  $\alpha_i$ ,  $\text{month}_t$  and  $\text{year}_t$  are individual-, month- and year-fixed effects, respectively.  $D_{t,july2018} * \text{age}_{it,18-21}$  define the interaction of being in the exposed age interval in the exposed time-interval. Hence,  $\beta$  is the treatment effect of interest estimating the causal effect of removing co-payment for psychologist treatment on  $Y_{it}^g$ . Notice that because we follow individuals over time



and exposure is defined in two dimensions (age and time), our dataset includes observations of individuals that at some points of time are in the exposed age interval but outside the time exposure. Hence,  $age_{it,18-21}$  will not be perfectly correlated with the individual fixed effects. As the estimates from the 2WFE have been shown to be a weighted average of all possible 2 x 2 DD estimators in the dataset including 2 x 2 DDs using early treated as controls for later treated (Goodman-Bacon, 2021), we have used the estimator proposed by (Callaway & Sant'Anna, 2021), CS difference in difference (CSDID), to assess if this is a problem in our case. With many groups ( $G$ ) and many time periods we randomly select 10% of the individuals from each group to make the estimator run reasonably fast. We use the doubly robust inverse probability weighting (dripw) method with 50 replications for estimating wildbootstrap standard errors (Sant'Anna & Zhao, 2020).

In line with Akosa Antwi et al. (2015) and Kolstad and Kowalski (2012), we apply linear probability models to estimate model (1). As our model only includes dummy variables as covariates, we basically estimate a non-parametric model and are not bounded by any linearity assumptions (Lechner, 2010). As discussed in the context section, access to psychologist treatment is granted by GP referrals, which means that observations of individuals listed with the same GP may not be independent. We therefore cluster error terms at the GP level, using knowledge of which GP the individual is listed with.

By using a control group approach, we intuitively assume that the treated group (18 to 21-year-olds) are comparable to the age groups used as controls (16 to 17-year-olds and 22 to 23-year-olds) regarding their need for mental health care and ability to pay. We also assume that no other things that could affect outcomes change at the time of treatment for any of the age groups. Utilization of a population comprising all Danish residents in the relevant age groups, in a context where the change in insurance covers all residents defined by their age band, renders adverse selection a minor problem. The specific identifying assumption for the difference-in-difference model is the assumption of common pre-treatment trends in the outcome variables. The validity of this assumption is assessed by graphical inspection of trend graphs, by running an event study version of model (1), and by assessing the effect of placebo treatments in the pre-treatment period.

We acknowledge that income and gatekeeper practice style may be important barriers to access, and therefore run heterogeneity analyses where we stratify the population by their parents' income and by the practice style of the gatekeeping GP. The parents' income is measured by the average of the family equivalent disposable income<sup>2</sup> over the two pre-policy years 2016 and 2017. The adolescents are divided into three groups based on their parents' income; "low income", where the parents' income is less than the 25th income percentile, "medium income": between the 25th and the 90th percentile, and "high income": at or above the 90th percentile.

The gatekeeper practice style is measured by the historic propensity to refer adolescents to psychologist, dividing GPs into high- (fourth quartile), moderate (second and third quartile) and low (first quartile) referrers. The referral pattern will reflect the GPs' belief in the effectiveness of psychological treatment as well as any local variation in access to psychologist, for example, the distance to the nearest psychologists or the number of psychologists per inhabitants in the local area. In order to disentangle GP effects from patient behavior, each individual is linked to the GP they were listed with in December 2017 and the GP practice style is kept at the level of 2014–2017. Therefore, if individuals change to a GP with a different practice style, this is not reflected in the data.

By design, we have fewer observation of individuals at the tail of the follow up period. To see if this affects the results, we run a sensitivity analysis with a balanced panel of six birth cohorts followed over 4 years such that all individuals had complete observations for the 24 months pre-period as well as the 24 months of follow-up. The results of the balanced panel analysis are shown in the online Supplementary Material as Figure 3A and Tables 2A through 4A.

## 5 | RESULTS

### 5.1 | Summary statistics

Table 1 shows summary statistics for all outcome variables, divided into before and after July 2018. Data is displayed in crude numbers and in rates per 100,000 person months, and stratified by group (the treatment group of 18 to 21-year olds and the control group of 16 to 17-year olds and 22 to 23-year olds). The number of individuals receiving psychologist treatment for anxiety and depression increases by 303 per 100,000 for the age group experiencing abolishment of co-payment. A small reduction (–12 per 100,000) occurred in the control group such that the crude difference-in-difference estimate is 315 per 100,000. Comparing this with the baseline value for the treatment group (306 per 100,000) indicates an increase in psychologist treatment of more than 100%. Hence, according to our descriptive statistics we would expect that demand for psychologist treatment would double. The crude changes in use of other mental health services differ by type. While use of outpatient psychiatric care and prescriptions of antidepressants show larger increases in the treatment group compared to the control group, we see

TABLE 1 Differences in outcomes by age groups (# per month and per 100,000 patient months)

	18-21 years-of-age		$\Delta$	16-17 and 22-23 years-of-age		$\Delta$	$\Delta \Delta$
	Before	After		Before	After		
Number of individuals	318,861	393,673		576,030	585,227		
Person months	2,925,692	7,906,992		5,112,071	9,000,012		
Outcome variables							
Psychologist (AD) (# per month)	8943	48,130		12,345	20,626		
Per 100,000 pt. months	306	609	303	241	229	-12	315
Psychologist (other) (# per month)	3954	10,368		7639	13,769		
Per 100,000 pt. months	135	131	-4	149	153	4	-8
Psychiatrist (# per month)	13,576	44,044		19,046	36,945		
Per 100,000 pt. months	464	557	93	373	410	38	55
Antidepressants (# per month)	22,073	55,319		40,033	67,012		
Per 100,000 pt. months	754	895	140	783	840	57	83
GP talk therapy (# per month)	9607	28,009		16,965	31,369		
Per 100,000 pt. months	328	354	26	332	349	17	9
Suicide attempts (# per month)	290	678		234	602		
Per 100,000 pt. months	10	9	-1	5	7	2	-3

Note: All variables are defined at the individual monthly level as 0/1. The “before” period is 12 months before the policy change – that is, July 1st, 2017 – June 30th, 2018.

Abbreviations: AD, anxiety and depression; Pt., patient.

reductions in psychologist treatment for other reasons than anxiety and depression. The apparent fall in suicide attempts of  $-3$  per 100,000 indicates a health effect of the increasing use of mental health care. Below we will assess the treatment effects as estimated by the 2WFE model in Equation (1).

## 5.2 | DD regressions

Table 2 shows the results of the difference-in-difference model in Equation (1) with psychologist treatment, divided into treatment for anxiety or depression and psychologist treatment of other causes as outcome variables. As described in the context section, the policy change removed the co-payment of 40% on treatment for anxiety and depression while treatment with trauma as referral cause was unchanged at 40% co-payment. Estimates for treatment for anxiety or depression for both the total population and for men and women separately are highly significant. The magnitude of the increase in psychologist treatment for anxiety or depression is around 75% in the 2WFE model with small differences between the two genders. As expected, we find a reduction in treatment by psychologist with trauma as referral. The magnitude of this decline is  $-25\%$  for men and  $-23\%$  for women. The results point toward remarkably strong indications of undertreatment under the co-payment regime. GPs seems to substitute some referrals for trauma with referrals for anxiety and depression after the latter option gained full coverage. Notice that our measure of psychologist treatment is measured as service months, that is, person months with at least one consultation per individual. This can be seen as a combination of the extensive (number of individuals treated) and intensive (number of services per individual) margin since patients often continue in treatment across several months. However, we expect that the effects are being driven by changes in the extensive margin because the number of services that the insurance cover is fixed at 12 consultations. This is confirmed by our earlier work, where we conducted a study of the same intervention but over a shorter time period and with fewer outcomes (Kruse et al., 2020).

## 5.3 | DD regressions - spill over effects

Psychologist treatment for anxiety and depression could in some cases be first line treatment for more severe mental health challenges, therefore increases in the number of individuals that visit a psychologist may cause spill over effects on visits to

TABLE 2 DD Estimates of effects on psychologist visits

	All	Men	Women
Psychologist (AD) - DD [95%CI]	0.0023*** [0.002;0.0026]	0.0013*** [0.001;0.0015]	0.0034*** [0.003;0.0038]
SE	0.0001	0.0001	0.0002
<i>p</i> -value	<0.0001	<0.0001	<0.0001
Baseline	0.0031	0.0016	0.0045
% Change	75.3	78.0	74.9
Psychologist (other) - DD [95%CI]	-0.0003*** [-0.0004;-0.0002]	-0.0002** [-0.0003;-0.0001]	-0.0005*** [-0.0007;-0.0002]
SE	0.0001	0.0001	0.0001
<i>p</i> -value	<0.0001	0.0030	<0.0001
Baseline	0.0014	0.0007	0.0020
% Change	-23.2	-25.2	-22.6
<i>N</i> (person month)	50,606,384	25,623,797	24,982,587
<i>N</i> (individuals)	1,200,792	608,303	592,489

Note: Results of difference-in-differences models with month and year dummies. Only coefficients of the DD estimates are reported. The baseline is the outcome variable measured for the treatment group over 12 months before  $t = 0$ . AD: anxiety and depression. 95% confidence interval in squared brackets.

Significance levels: \*0.05, \*\*0.01, \*\*\*0.001.

TABLE 3 DD Estimates of spill over effects on other mental health services

	All	Men	Women
Psychiatrist - DD [95%CI]	0.00035** [0.00014;0.00056]	0.00029* [0.00004;0.00053]	0.00042* [0.00007;0.00077]
SE	0.0001	0.0001	0.0002
<i>p</i> -value	0.001	0.022	0.018
Baseline	0.00464027	0.003719453	0.005583357
% Change	7.5	7.7	7.5
Antidepressants DD [95%CI]	0.0004*** [0.0002;0.0006]	0.0004** [0.0001;0.0006]	0.0004* [0.0001;0.0007]
SE	0.0001	0.0001	0.0002
<i>p</i> -value	<0.0001	0.002	0.020
Baseline	0.003283668	0.001987401	0.004611286
% Change	11.6	18.3	8.7
GP talk therapy DD [95%CI]	-0.00003 [-0.00017;0.00011]	-0.00006 [-0.0002;0.00007]	0.00001 [-0.00022;0.00024]
SE	0.0001	0.0001	0.0001
<i>p</i> -value	0.678	0.358	0.945
Baseline	0.00754454	0.004440917	0.010723228
% Change	-0.4	-1.5	0.1
<i>N</i>	50,606,384	25,623,797	24,982,587
<i>N</i> (individuals)	1,200,792	608,303	592,489

Note: Results of difference-in-differences models with month and year dummies. Only coefficients of the DD estimates are reported. The baseline is the outcome variable measured for the treatment group over 12 months before  $t = 0$ . 95% confidence interval in squared brackets.

Significance levels: \*0.05, \*\*0.01, \*\*\*0.001.

psychiatric care. Moreover, therapy is often combined with pharmaceutical treatment, and we may therefore also see an impact on prescriptions of antidepressants. As GPs act as gatekeepers to psychologist treatment and also have the option to provide talk therapy, the new insurance coverage may also impact on their choice between referring to psychologists and offering treatment in their own practice – the latter having been exempt from co-payment at all times. The results in Table 3 show moderate spill over effects on outpatient psychiatric care (7.5%) and prescription of antidepressants (11%) whereas we see no change in GPs amount of talk therapy.



## 5.4 | DD regressions - suicide attempts

Table 4 shows the impact of gaining access to full coverage for psychologist treatment for anxiety or depression on suicide attempts. At baseline, 9.9 suicide attempts occur for each 100,000 person months and results shows a reduction by 2.4 per 100,000 person months – or around 25%. Stratifying by gender, we find larger estimates for women than for men (−0.000032 vs. −0.000017). However, relative to baseline the largest reduction is seen for men (−46% vs. −20%).

## 6 | VALIDITY OF THE STUDY DESIGN

Our study design relies on the assumption that the control groups of 16–17 and 22 to 23-year olds are comparable to the 18–21 year-olds in relation to the need for psychologist treatment and other mental health services and in relation to their risk of suicide attempt. Because we use the full population in a country with public and universal health insurance, we have no major concerns about adverse selection or huge differences in sociodemographic or morbidity patterns between the treatment and control groups. The main selection problems may be related to age specific differences in need. Need for mental health care is unobservable, however we are guided by Figure 2, top panels that shows self-reported symptoms of mental health challenges by age and gender. The data underlying the two top panels come from the Danish National Health Survey (2017), which is based on self-reported health for a random sample of more than 180,000 respondents (approximately three percent of the Danish population). The graphs display only small age variations in the frequencies of self-reported mental health challenges for this particular age group, which increases our confidence in using age bands close to the exposed 18 to 21-year olds as control group. The bottom panels of the figure shows use of psychologist for anxiety or depression by age and gender before the policy change. These graphs also support the assumption, that there are only small differences in mental health utilization over these age groups.

However, the main identifying assumption for our study design is the common pre-treatment trends that we present for graphical inspection aggregated to half-year periods in Figure 3. Generally, the common trend assumptions seem to hold, as the trends occur parallel in the periods before  $t = 0$  for all outcomes. To further assess the validity of our model, we run placebo tests using placebo dates of the co-payment policy change. Table 5 shows the results of three placebo tests for each outcome variable, namely shifting the policy date back to July 2015, 2016 and 2017 respectively and ending follow-up before the policy start in July 2018. The first thing we notice is that all estimates are insignificant for the psychologist (AD) and suicide attempt outcomes, indicating strong support for the treatment effects found in Table 2 and Table 4 for these outcomes. The results are less distinct for the other outcomes, in particular for women that show falling use of psychologist (other) treatments and increasing trends of use of psychiatric care, which challenges the common trend assumption for these outcomes. This leaves the spill over effects for women less likely to be caused by the policy change.

Finally, we present the results of applying the CSDID estimator proposed by (Callaway & Sant'Anna, 2021). This estimator removes the bad controls discussed by Goodman-Bacon (2021). Table 6 shows the results as compared to 2WFE model presented in Table 2.

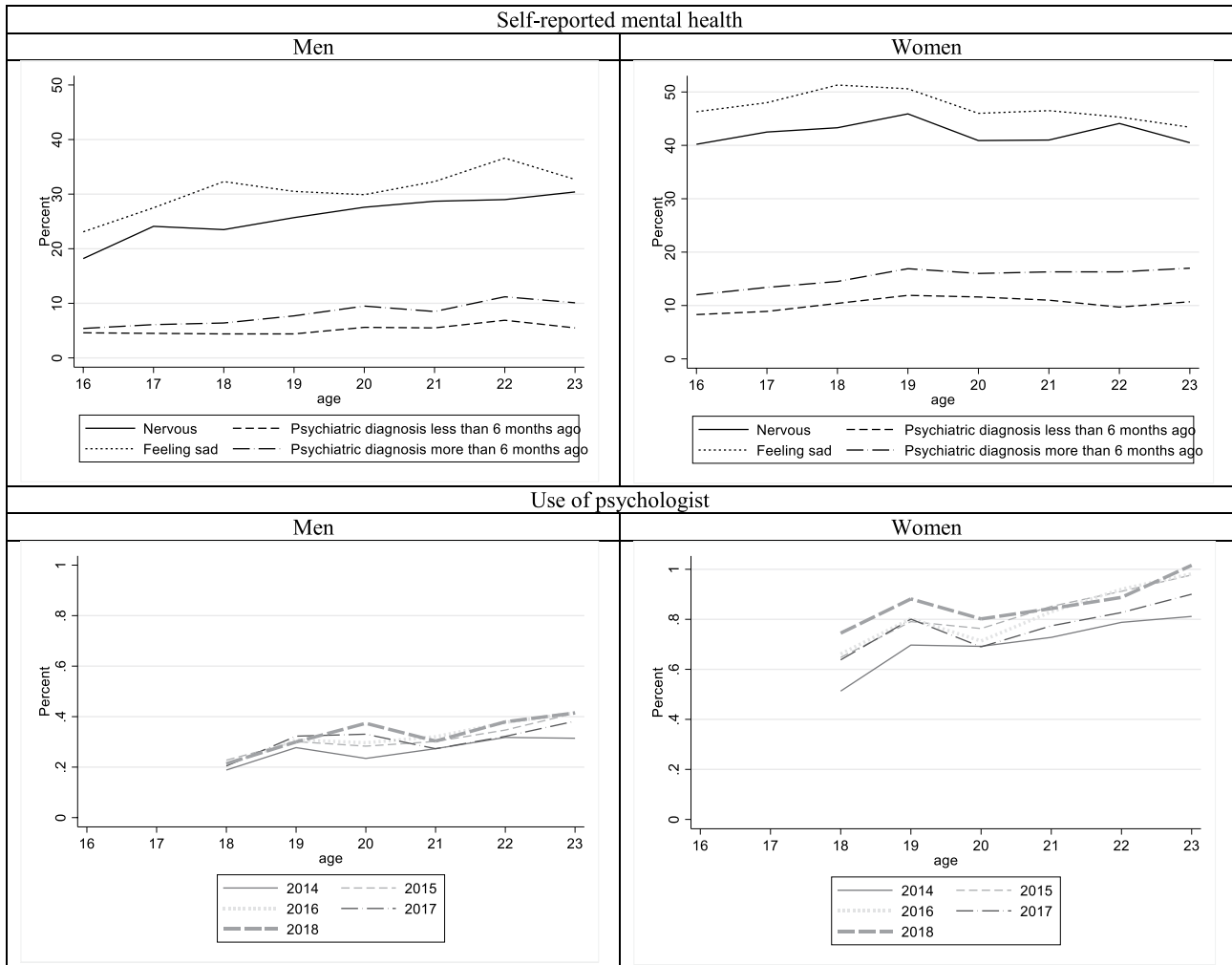
The first column shows the main 2WFE results from Table 2 for convenience. The second column shows results using the CSDID estimator on a 10% random sample. First, we observe that the effects on treatment for anxiety or depression between

TABLE 4 DD Estimates of suicide attempts

	All	Men	Women
Suicide attempts DD [95%CI]	−0.000024** [−0.000041;−0.000008]	−0.000017* [−0.00003;−0.000003]	−0.000032* [−0.000062;−0.000002]
SE	0.000008	0.000007	0.000015
<i>p</i> -value	0.004	0.014	0.035
Baseline	0.000099	0.000037	0.000163
% Change	−24.6	−45.5	−19.8
<i>N</i>	50,606,384	25,623,797	24,982,587
<i>N</i> (individuals)	1,200,792	608,303	592,489

Note: Results of difference-in-differences model with month and year dummies. Only coefficient of the DD coefficients reported. The baseline is the outcome variable measured for the treatment group 12 months before  $t = 0$ . 95% confidence interval in squared brackets.

Significance levels: \*0.05, \*\*0.01, \*\*\*0.001.

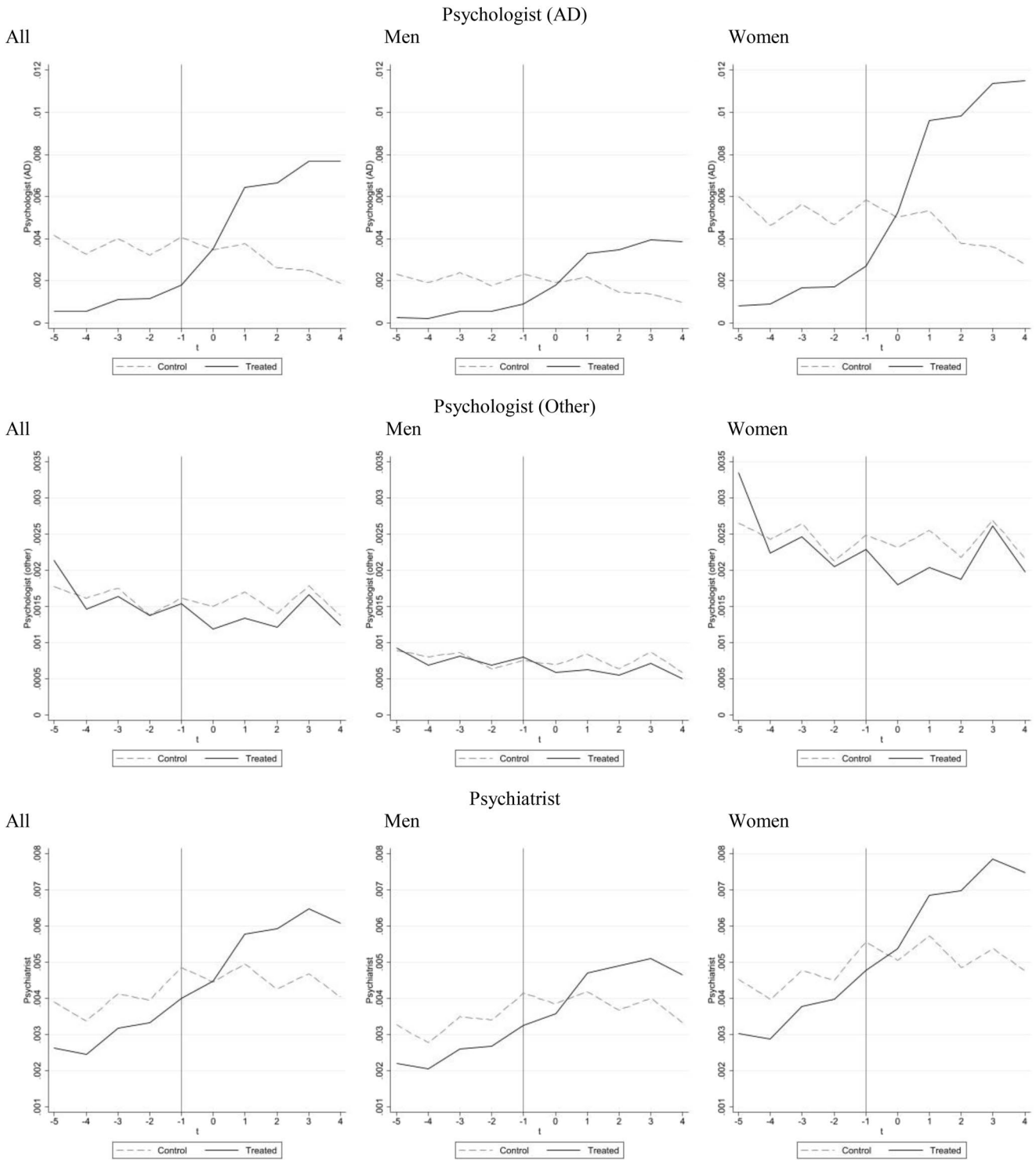


**FIGURE 2** Self-reported mental health challenges and use of psychologist for anxiety or depression, by age and gender. Top panels are based on data from The National Health Survey (2017). The Danish National Health Survey was funded by The Capital Region, Region Zealand, The South Denmark Region, The Central Denmark Region, The North Denmark Region, The Ministry of Health and the National Institute of Public Health, University of Southern Denmark (Jensen et al., 2018). Bottom panels are based on register data, for the pre-policy period

2WFE and CSDID are very similar. Second, while the effect on trauma as referral cause turns insignificant due to a markedly lower sample size, the point-estimates between 2WFE and CSDID are almost identical. Hence, we conclude that “bad controls” is, if anything, a minor problem in our 2WFE results.

## 7 | HETEROGENEITY ANALYSIS

The results above estimate the average effects for the full two-and-a-half years of follow up. However, effects may change over time, rendering 2.5-year averages imprecise evidence of the true effects over time. We therefore conduct event study analyses to assess dynamic effects. Figure 4 shows graphs based on event study models where  $t = -1$  is used as baseline and differences between treatment and control are estimated relative to this baseline. The graphs are based on monthly data; therefore, some erratic patterns must be expected. The graphs for psychologist treatment for anxiety or depression show quite constant effects reaching a steady level after approximately 8 months. For trauma-related psychologist referral options (psychologist – other), we see that the effects for women are generally negative but have some striking positive coefficients at 20–21 months. The 21th follow up month equals March 2020 for all those exposed at the introduction of the co-payment policy in July 2018 – that is, it coincides with the COVID-19 lockdown. Our study design is not suited to assess if the 21th month’s development is indeed a lock-down effect, affecting exposed adolescents differently than unexposed, however changes in effect occur later for this outcome. Above, we found that outpatient psychiatric care increased slightly for both men and women following the policy



**FIGURE 3** Common trend. Common trend graphs of outcome variables aggregated to half-year periods before and after the removal of co-payment. The period  $t = 0$  corresponds to the first half year after the removal

change. However, the event study graphs indicate that these increases mainly occur mid-period whereas in the beginning and the end of the follow-up period, outpatient psychiatric care seem to decline. The reason for this is not clear but it may be hypothesized that the increased number of adolescents seeing a psychologist disguises an unmet need for more severe psychiatric care which then increases on the medium term. GP talk therapy shows a striking reduction for women after 15 months of follow up while we see a tendency of positive treatment estimates for the consumption of antidepressants toward the end of the study period. Hence, in conclusion, we find evidence of effects changing over time.

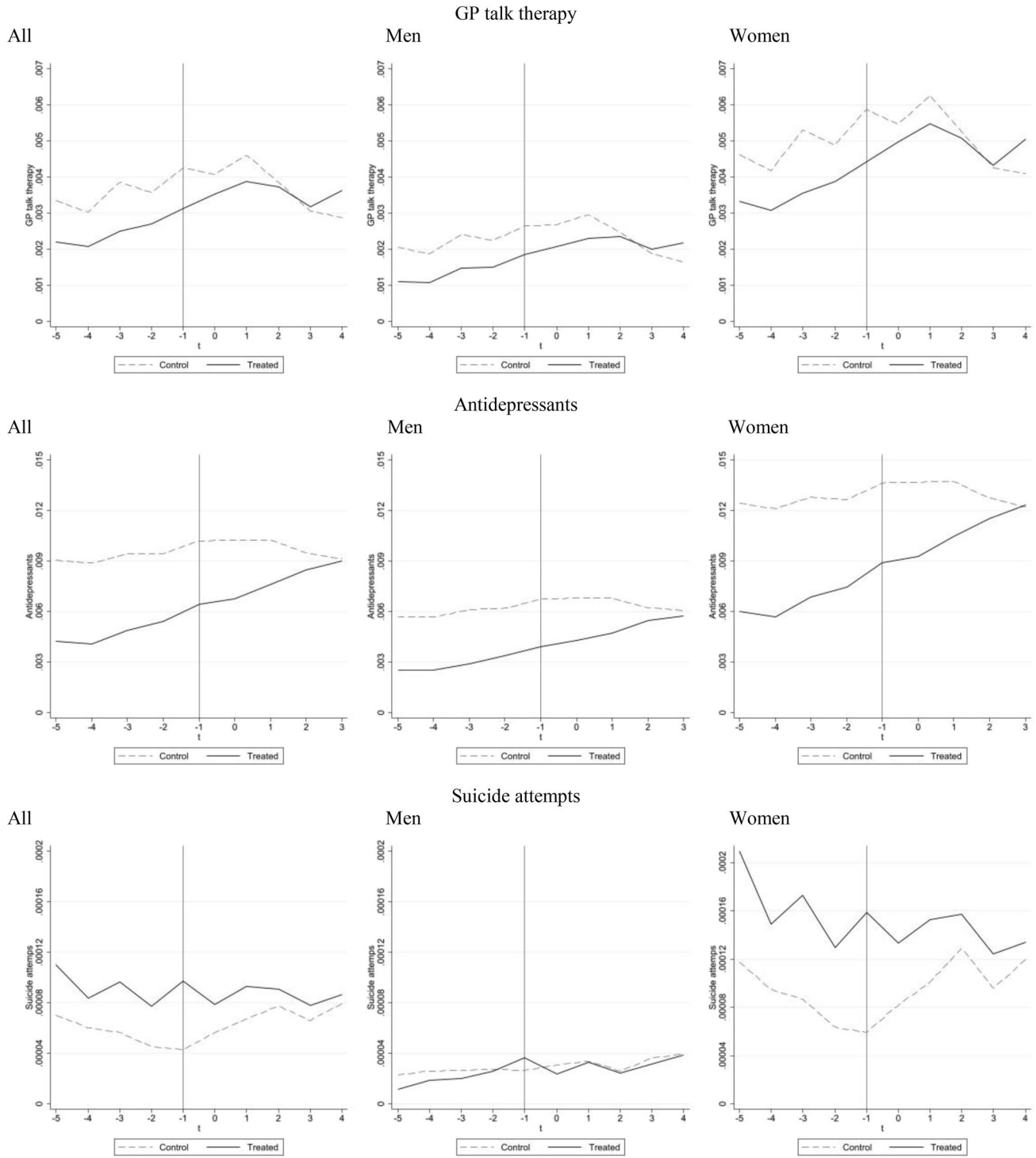


FIGURE 3 (Continued)

By design, we have fewer observation of individuals at the tail of the follow up period. To see if this affects the results, we run a sensitivity analysis with a balanced panel of six birth cohorts followed in 4 years such that all individuals had complete observations for the 24 months pre-period as well as the 24 months of follow-up. Results are shown in the online Supplementary Material. Especially, one might worry that erratic patterns in the tails of the Event study graphs could be a result of a moving population and fewer observations with 24 months follow-up. By and large we find similar patterns using a balanced panel and hence, conclude that erratic patterns are mainly due to monthly variation in the data and true dynamic effects.

TABLE 5 Placebo tests

	All			Men			Women		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Psychologist (AD)	0.00009	0.00012	0.00019	0.00003	0.00008	0.00016	0.00016	0.00017	0.00021
<i>p</i> -value	0.345	0.199	0.072	0.754	0.404	0.101	0.344	0.29	0.237
Psychologist (other)	-0.00018*	-0.00022**	-0.00026***	-0.00005	-0.00001	-0.00006	-0.0003*	-0.00043**	-0.00047***
<i>p</i> -value	0.017	0.003	0.001	0.407	0.829	0.353	0.019	0.002	0.001
Psychiatrist	0.00035***	0.00036***	0.00024*	0.00028*	0.00031**	0.00011	0.00043**	0.0004**	0.00037*
<i>p</i> -value	<0.0001	<0.0001	0.025	0.016	0.005	0.395	0.003	0.003	0.022
GP talk therapy	-0.00024**	-0.00022*	-0.00016	0.000004	0.00003	-0.00004	-0.00049**	-0.00047**	-0.00028
<i>p</i> -value	0.008	0.011	0.085	0.96	0.667	0.674	0.003	0.002	0.06
Antidepressants	-0.0001	0.00036***	0.00053***	-0.00009	0.00019	0.00028*	-0.0001	0.00053***	0.00079***
<i>p</i> -value	0.382	<0.0001	<0.0001	0.42	0.067	0.016	0.577	0.001	<0.0001
Suicide attempts	-0.00002	-0.000001	0.00001	-0.000002	0.00001	0.00002*	-0.00004	-0.00001	0.00001
<i>p</i> -value	0.068	0.902	0.203	0.84	0.133	0.043	0.063	0.432	0.601
<i>N</i>		33,699,380			17,036,498			16,662,882	
<i>N</i> (individuals)		1,035,262			523,713			511,549	

Note: Results of difference-in-differences model with month and year dummies for shifting the policy date back to respectively July of 2015, 2016, and 2017. Only coefficient of the DD coefficients reported.

Significance levels: \*0.05, \*\*0.01, \*\*\*0.001.



TABLE 6 Results using the Callaway &amp; Sant'Anna estimator

	TWFE (main result)	CSDID on 10% sample
Psychologist (AD) – DD [95%CI]	0.0023*** [0.0020;0.0026]	0.0030*** [0.0022;0.0040]
SE	0.0001	0.0005
<i>p</i> -value	<0.0001	<0.0001
Psychologist (other) – DD [95%CI]	–0.0003*** [–0.0004;–0.0002]	–0.0003 [–0.0009;0.0003]
SE	0.0001	0.0003
<i>p</i> -value	<0.0001	0.316
<i>N</i>	50,606,384	5,067,304
<i>N</i> (individuals)	1,200,792	120,080

Note: Results of CSDID estimations. TWFE estimations included for comparison. The first column shows the main results from Table 2 for convenience. The second column shows results using the CSDID estimator on a 10% sample, using doubly robust inverse probability weighting (dripw) with 50 replications used for estimating wildbootstrap standard errors. 95% confidence interval in squared brackets.

Significance levels: \*0.05, \*\*0.01, \*\*\*0.001.

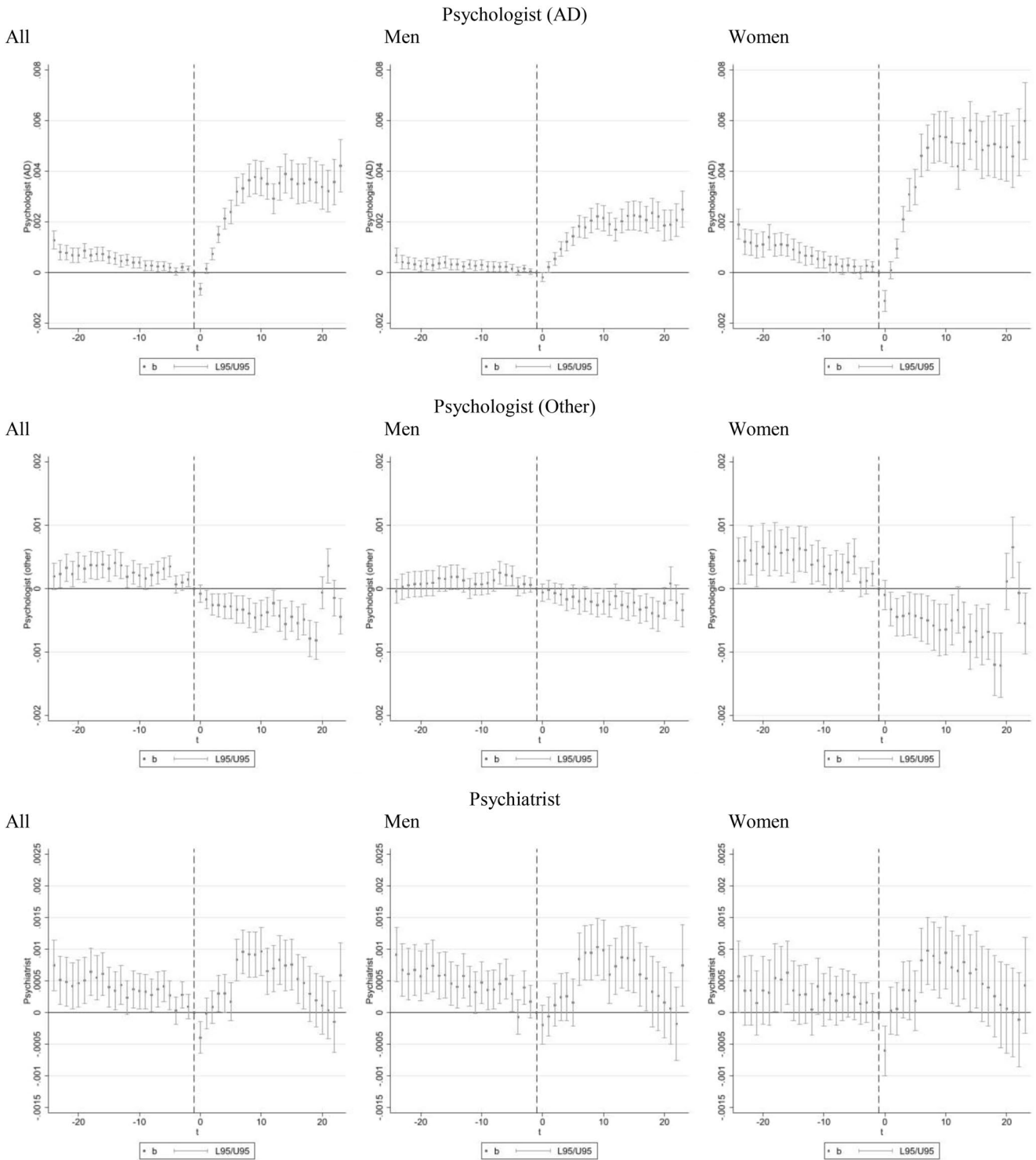
Access to full coverage may be of greater importance for adolescents with low income and financial constraints. To assess if the change in insurance coverage had different effects on different income groups, we stratify the population by the income level of their parents. The adolescents are divided into three groups based on their parents' income: low, medium, and high income. Estimates for these income strata are displayed in Table 7, which shows strong indications of larger effects among adolescents with parents in the lowest income category. For psychologist services subject to zero co-payment, we see increases of close to 100% for both men and women whereas increases are more modest (below 65%) for the high- and moderate-income groups. The same pattern holds for most of the outcomes – except for psychiatric care which shows higher increases for men in the high-income group. Another interesting observation is that the reduction in suicide attempts among men is mainly driven by the low-income group (a reduction of 69%), whereas the largest reduction for women is seen in the high-income group (130%).

Another barrier to access may be the gatekeeper practice style of the GP that the adolescent patient is listed with. Differences in practice style may relate to the GPs belief in the effectiveness of psychologist treatment or, more practically, on the local access to psychologist which in Denmark shows some geographical dispersion primarily being centered around the larger cities. Hence, we conduct a heterogeneity analysis where we stratify the population by GP type, where GP type is based on the historical frequencies of referring to psychologists. Here, the gatekeeper practice style is measured by the historical frequencies of referral to psychologists, dividing GPs into high- (fourth quartile), moderate (second and third quartile) and low (first quartile) referrers. Table 8 shows the estimates for patients in these strata. Most importantly, we see that the increases in psychologist treatment for anxiety and depression are large and significant for adolescents listed with all three GP types. However, the magnitude of the increase is largest for adolescents listed with reluctant referrers – that is, the GPs with the lowest historical referral style. To some extent, we see the same trends for prescriptions of antidepressant and for suicide attempts for men, whereas for women we see higher changes in suicide attempts and antidepressant prescriptions among the patients with GPs in the medium referral group.

## 8 | DISCUSSION

### 8.1 | Summary

Our results show that reducing co-payment from 40% to zero almost doubles the use of psychologist treatment. In the heterogeneity analysis we find evidence of higher effects in adolescents from families with lower income, indicating that reduced co-payments may increase equality in access. We also see that effects are higher for individuals listed with GPs with a reluctant referral style indicating that these GPs behavior is affected by patient co-payment rates. The increase in psychologist treatment incurs moderately positive spill over effects on outpatient psychiatric care (7.5% increase) and prescriptions of antidepressants (11.6% increase). Hence, reducing co-payments on psychologist treatment increases use of mental health services not directly affected by changed co-payments. Interestingly, we find evidence of significant reductions in suicide attempts among the age group affected by the abolishment of co-payment – primarily among high-income women and low-income men. This indicates that better access to mental health care for adolescents may have a positive impact on their mental health and well-being. The relatively larger reduction in suicide attempts among high-income women in combination with a relatively higher increase in in



**FIGURE 4** Event study. Event graphs for each outcome for respectively all, and for men and women separately. The period  $t = 0$  corresponds to the first month year after the removal of co-payment and  $t = -1$  is the month of reference. The red vertical bars are 95% confidence intervals for each monthly estimated effect (blue dot)

psychologist treatment among low-income women may indicate that high-income women are at higher risk of suicide attempt – maybe because of higher stigmatization issues in this group. Hence, even relatively smaller increases in access for this group may have high impact on suicide attempts.

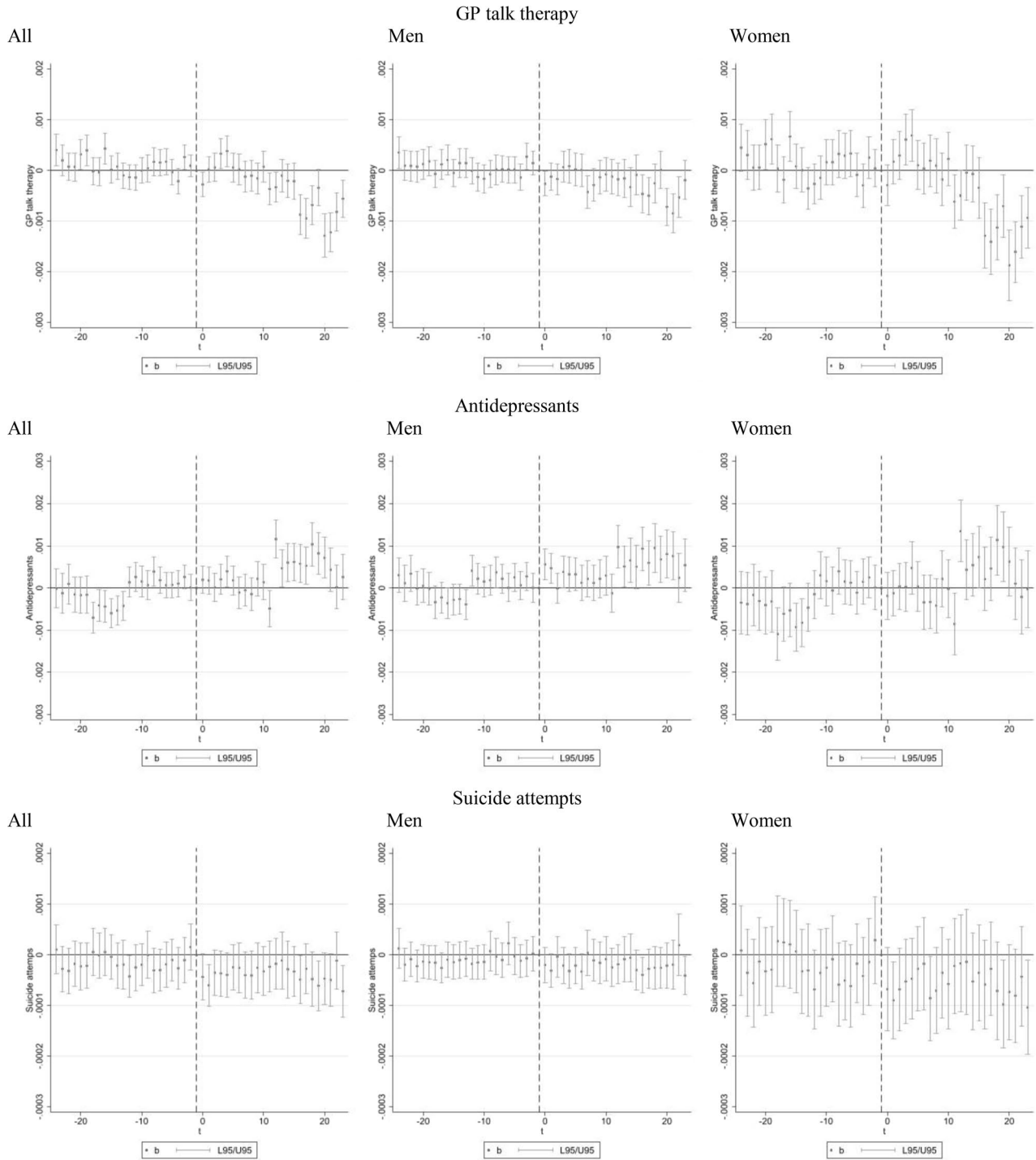


FIGURE 4 (Continued)

## 8.2 | Bias and generalizations

The unique data in which the full national population can be followed over time, in combination with the natural experiment where the insurance policy affected individuals in a limited age interval (18–21-year-of age), allows for a strong empirical design where individuals in age groups that are still adolescents (16–17 and 22–23) but unexposed to the policy change are used as the counterfactual. Any remaining selection bias may stem from variation in need for mental health care in the various adolescent age intervals (18–21; 16–17; 22–23). As the insurance policy change is affecting all in the eligible age interval, there is no adverse selection into insurance coverage.

TABLE 7 DD estimates stratified by income

	All			Men			Women			% Change		
	DD	p-value	Baseline	% Change	DD	p-value	Baseline	% Change	DD		p-value	Baseline
<b>Psychologist AD</b>												
Low income	0.00230***	<0.001	0.00241	95.4	0.00110***	<0.001	0.00131	83.9	0.00360***	<0.001	0.00359	100.4
Medium income	0.00260***	<0.001	0.00385	67.6	0.00140***	<0.001	0.00197	71.0	0.00370***	<0.001	0.00580	63.8
High income	0.00150***	<0.001	0.00372	40.3	0.00110**	0.002	0.00195	56.3	0.00190**	0.002	0.00556	34.2
<b>Psychologist other</b>												
Low income	-0.00040***	<0.001	0.00103	-38.8	-0.00030**	0.007	0.00056	-53.9	-0.00060**	0.005	0.00154	-39.0
Medium income	-0.00030***	<0.001	0.00174	-17.2	-0.00020	0.057	0.00086	-23.3	-0.00050***	<0.001	0.00266	-18.8
High income	0.00000	0.867	0.00146	0.0	-0.00020	0.487	0.00092	-21.8	0.00010	0.878	0.00202	4.9
<b>Psychiatrist</b>												
Low income	0.00040*	0.036	0.00382	10.5	0.00020	0.371	0.00309	6.5	0.00060*	0.037	0.00459	13.1
Medium income	0.00020	0.199	0.00577	3.5	0.00020	0.334	0.00457	4.4	0.00020	0.381	0.00702	2.8
High income	0.00090*	0.016	0.00576	15.6	0.00120*	0.020	0.00446	26.9	0.00070	0.264	0.00712	9.8
<b>Antidepressants</b>												
Low income	0.00080***	<0.001	0.00320	25.0	0.00050*	0.014	0.00183	27.3	0.00110***	0.001	0.00466	23.6
Medium income	0.00030	0.050	0.00397	7.6	0.00030	0.092	0.00238	12.6	0.00030	0.232	0.00563	5.3
High income	0.00000	0.909	0.00331	0.0	0.00100*	0.025	0.00212	47.1	-0.00090	0.121	0.00455	-19.8
<b>GP talk therapy</b>												
Low income	0.00010	0.463	0.00638	1.6	0.00010	0.682	0.00397	2.5	0.00010	0.546	0.00896	1.1
Medium income	-0.00010	0.361	0.00936	-1.1	-0.00020	0.058	0.00536	-3.7	0.00000	0.940	0.01353	0.0
High income	-0.00010	0.579	0.00873	-1.1	0.00030	0.300	0.00492	6.1	-0.00050	0.186	0.01270	-3.9
<b>Suicide attempts</b>												
Low income	-0.00004*	0.029	0.00012	-32.7	-0.00003*	0.038	0.00004	-69.8	-0.00005	0.130	0.00021	-23.8
Medium income	-0.00002	0.092	0.00012	-16.3	-0.00002	0.143	0.00004	-34.3	-0.00002	0.245	0.00019	-12.5
High income	-0.00006*	0.020	0.00004	-131.7	0.00000	0.994	0.00000	0.0	-0.00011*	0.016	0.00009	-130.3
N low	11,277,391			5,823,618					5,453,773			
N low (individuals)	264,017			135,719					128,298			
N medium	28,927,229			14,776,163					14,151,066			
N medium (individuals)	686,452			350,719					335,733			

(Continues)

TABLE 7 (Continued)

	All			Men			Women		
	DD	p-value	% Change	DD	p-value	% Change	DD	p-value	% Change
N high	4,200,099			2,101,725			2,098,374		
N high (individuals)	105,606			53,086			52,520		

Note: Results of difference-in-differences models with month and year dummies. Only coefficients of the DD estimates are reported. The baseline is the outcome variable measured for the treatment group 12 months before  $t = 0$ . Significance levels: \*0.05, \*\*0.01, \*\*\*0.001.



TABLE 8 DD estimates stratified by GP referral style

	All			Men			Women			% Change		
	DD	p-value	Baseline	% Change	DD	p-value	Baseline	% Change	DD		p-value	Baseline
<b>Psychologist AD</b>												
Low referral type	0.0020***	<0.0001	0.0019	103.9	0.0012***	<0.0001	0.0010	115.7	0.0026***	<0.0001	0.0028	92.1
Medium referral type	0.0026***	<0.0001	0.0037	69.8	0.0013***	<0.0001	0.0019	68.6	0.0040***	<0.0001	0.0056	70.9
High referral type	0.0022***	<0.0001	0.0027	81.5	0.0015***	<0.0001	0.0016	96.4	0.0030***	<0.0001	0.0038	78.8
<b>Psychologist other</b>												
Low referral type	-0.0004*	0.0330	0.0008	-47.3	0.0001	0.6380	0.0004	28.6	-0.0009**	0.0080	0.0013	-66.8
Medium referral type	-0.0004***	<0.0001	0.0016	-24.8	-0.0004***	<0.0001	0.0009	-46.3	-0.0004**	0.0040	0.0024	-16.7
High referral type	-0.0001	0.3890	0.0013	-7.7	0.0001	0.3120	0.0007	14.5	-0.0004	0.1200	0.0019	-21.0
<b>Psychiatrist</b>												
Low referral type	0.0000	0.9560	0.0019	0.0	0.0000	0.9570	0.0015	0.0	0.0000	0.9470	0.0023	0.0
Medium referral type	0.0003*	0.0330	0.0050	6.0	0.0002	0.3050	0.0040	5.0	0.0005	0.0570	0.0061	8.2
High referral type	0.0007**	0.0070	0.0074	9.5	0.0009*	0.0150	0.0061	14.7	0.0006	0.1490	0.0086	7.0
<b>Antidepressants</b>												
Low referral type	0.0010***	0.0010	0.0018	55.7	0.0010***	<0.0001	0.0011	87.9	0.0008	0.0830	0.0025	32.5
Medium referral type	0.0004**	0.0040	0.0040	10.0	0.0003	0.0650	0.0024	12.6	0.0006*	0.0270	0.0057	10.6
High referral type	0.0000	0.9860	0.0033	0.0	0.0002	0.3920	0.0020	10.0	-0.0002	0.6600	0.0046	-4.3
<b>GP talk therapy</b>												
Low referral type	-0.0002	0.2370	0.0046	-4.4	-0.0001	0.6330	0.0027	-3.7	-0.0003	0.2880	0.0065	-4.6
Medium referral type	0.0000	0.6650	0.0087	0.0	-0.0001	0.3070	0.0051	-2.0	0.0002	0.2560	0.0125	1.6
High referral type	-0.0001	0.6980	0.0083	-1.2	0.0000	0.9580	0.0050	0.0	-0.0001	0.6780	0.0115	-0.9
<b>Suicide attempts</b>												
Low referral type	0.0000	0.0800	0.0001	-52.2	-0.0001***	<0.0001	0.0001	-153.7	0.0000	0.8430	0.0001	8.2
Medium referral type	0.0000**	0.0050	0.0001	-29.3	0.0000	0.6740	0.0000	-14.1	-0.0001**	0.0030	0.0002	-32.6
High referral type	0.0000	0.8210	0.0001	5.9	0.0000	0.5990	0.0000	45.3	0.0000	0.9760	0.0001	1.1
N low	7,316,380			3,973,234				3,343,146				
N low (individuals)	168,461			91,633				76,828				
N medium	26,458,329			13,595,745				12,862,584				
N medium (individuals)	621,060			319,345				301,715				

(Continues)

TABLE 8 (Continued)

	All			Men			Women		
	DD	p-value	% Change	DD	p-value	% Change	DD	p-value	% Change
N high	10,678,230			5,141,345			5,536,885		
N high (individuals)	263,601			126,851			136,750		

Note: Results of difference-in-differences models with month and year dummies. Only coefficients of the DD estimates are reported. The baseline is the outcome variable measured for the treatment group 12 months before  $t = 0$ . Significance levels: \*0.05, \*\*0.01, \*\*\*0.001.

This nice analytical setting and the resulting strong confidence in the estimated causal effects come at the price of generalizability of results. Our results may be generalized to settings comparable to the Danish context – that is, the Nordic countries, the Netherlands, the British NHS and other health care systems with almost full universal coverage but where some mental health services remain subject to co-payment. In addition, also systems aiming toward more universal coverage may be interested in the finding that maintaining co-payment on first-line mental health care could have a high impact on health and well-being.

### 8.3 | Limitations

A limitation of the study is that we are not able to observe individuals' use of fully privately purchased psychologist treatment. However private health insurance is limited, and we have no reason to believe that 18 to 21-years-olds are different in terms of their use of private health insurance than a control group of 16 to 17-years-olds and 22 to 23-years-olds, therefore it may be considered a minor problem.

### 8.4 | Impact

The results of our study point toward the relevance of access to first-line mental health care for adolescents. Our study confirms the hypothesis of undertreatment in mental health care in general and among adolescents in particular. It further indicates that free access to psychologist treatment may be a means of contributing to the United Nations sustainability goal of improved mental health and well-being. Future studies should assess if the evidence of reductions in suicide attempts translate into reductions in the death by suicide rate.

A policy change, like the one analyzed here, which increases the treatment of a previously undertreated condition, will impact on health care expenditures as well. Preliminary analyses of the budget impact of the first 12 months of the policy change showed a major rise in expenditures. The rapid increase in use of psychologist treatment and the increase in antidepressants together cost the third-party payer €1.7 million over the first 12 months, while savings in other parts of the health care sector only amounted to less than 10% of that amount, resulting in a net increase in expenditure of about €1.58 million, or €7.37 per capita in the affected age group. In addition to this, we expect that adolescents that age out of treatment will have a higher level of consumption than those never treated. Since this group face a 40% co-payment, there will be an increase in costs for this group as well as for the third-party payer. The magnitude of this increase has not yet been estimated because consumption patterns are likely to have been disrupted by COVID-19. We find a decrease in registered suicide attempts following the policy change. This may lead to a decline in the number of suicides. These effects should indeed be considered when evaluating expenditures.

## 9 | CONCLUSION

We conclude that abolishment of co-payment on first-line mental health care may have a positive impact on mental health and well-being, as measured by reductions in suicide attempts, in a high-income country with high levels of universal coverage. We further conclude that lower co-payments may increase equality in access to care because low-income adolescents tend to gain the highest increases in use. Finally, we find some evidence that GPs with reluctant referral styles may increase their referrals when financial barriers for patients are reduced.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## DATA AVAILABILITY STATEMENT

This study is based on micro-data analyzed at a server on Statistics Denmark. Data are only available for Danish Research Institutions and cannot be shared outside the server. The study complies with GDPR and Danish data security regulations and is approved by the SDU legal service with list no. 10.107.

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## ENDNOTES

<sup>1</sup> Until September 2019 the age interval was 18–20 years of age but was then extended to include 21-year olds. In this paper, for simplicity, we use the term 18–21 about the eligible group throughout.

<sup>2</sup> Computed as the average between the income of the two biological or adoptive parents. If there is only one parent alive in Denmark, this parent's income will count as the average. The family equivalent disposable income is computed by Statistics Denmark and accounts for the number of children in the household.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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