De-specialization in health care: Evidence from mental health treatments

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Abstract

To meet growing healthcare demands, many healthcare systems have shifted responsibilities from specialists to General Practitioners (GPs). We examine the consequences of this despecialization for patients in the context of depression treatment in Denmark. Specifically, we exploit a change in clinical guidelines stating that patients under the age of 25 should see a psychiatrist before being prescribed antidepressants. This reform creates an abrupt reversal of despecialization, enabling us to compare identical patients in two distinct states: (1) treated by a GP, and (2) treated by a specialist. Using administrative data from 2008 to 2022 and a combination of Difference-in-Differences (DID) and event study methods, we find that GPs and specialists administer markedly different treatments. Patients treated by specialists are more likely to be prescribed advanced types of antidepressants and are 36 percentage points more likely to receive other psychotropic medications, primarily driven by an increase in prescriptions for antipsychotic drugs. We provide suggestive evidence that these differences are driven by GPs with lower diagnostic accuracy. As a result, patients treated by specialists are 5 percentage points less likely to attempt suicide. Additionally, we find positive and persistent effects on their labor market participation. These findings suggest that despecialization can have significant negative consequences for patients and should be implemented cautiously, with additional GP training and comprehensive clinical guidelines.

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1 Introduction

Mental illness is a leading cause of disability worldwide with enormous costs to society and the individual (Biasi et al., 2021, Greve and Nielsen, 2013, Currie and Stabile, 2006). Individuals experiencing mental health issues typically have lower incomes, receive more public transfers, and have higher healthcare costs (Christensen et al., 2022). The aggregate economic burden attributable to mental illness amounts to approximately 4% of GDP (OECD, 2014).

While effective treatments have existed for decades, less than half of individuals suffering from depression and anxiety receive treatment (Alonso et al., 2018, Thornicroft et al., 2017, Kohn et al., 2004). This treatment gap is partly driven by the high cost and low supply of mental health specialists (OECD, 2023). In response, whether driven by policy or necessity, a large part of the treatment for mild to moderate mental illness has gradually shifted from specialists to general practitioners (GPs) (OECD, 2014). While such despecialization increases the supply of mental health care, it is unclear whether GPs are sufficiently skilled to take on this responsibility.

GPs face three important tasks: First, they must diagnose the patient accurately. Second, they must decide whether to treat the patient themselves or refer the patient to specialized care. Lastly, if they treat the patient themselves, they must decide on a course of treatment. Medical literature has shown that GPs often make inaccurate diagnoses for psychiatric disorders (Mitchell et al., 2009). Furthermore, the treatment of anxiety and depression with psychotropic drugs is complicated and requires extensive diagnostic skills and pharmacological knowledge (Currie and MacLeod, 2020), which GPs may lack.

In this paper, we ask the following questions: Are GPs sufficiently skilled to care for mental health patients? Do they know when to refer patients to specialized care? How does the treatment provided by a generalist compare to that of a specialist, and what are the consequences for patients?

We study these questions in the context of antidepressants, which are used to treat depression and anxiety. We exploit a reform in Denmark in 2015 that made the initial prescription of antidepressants for individuals below the age of 25 a task for medical specialists. This policy caused an abrupt reversal of a stable trend of despecialization, which allows us to estimate the causal effect of being treated by a specialist rather than a GP for patients on the margin of despecialization. Linking several population wide registers for individuals experiencing a mental

health shock between ages 20-29, we use the variation generated by the reform in a combined event study and Difference-in-Difference design. We estimate the causal impact on mental health treatments and, to assess patient welfare, changes in mental health and labor market outcomes. We provide five sets of results.

First, we find that the change in medical guidelines increased the probability of seeing a medical specialist following a mental health shock by 15-25 percent compared to the mean. Among the individuals who were referred to a medical specialist (henceforth referred to as compliers), we can compare the medical treatment prescribed by specialists and GPs.

Second, we find large differences in the medical treatment prescribed by GPs and specialists to otherwise identical patients. Patients who were referred to a medical specialist were more likely to receive "non-standard"- antidepressants, and consequently, were prescribed more specialized medication.[1] In addition, patients treated by a specialist were 31 percentage points more likely to receive other types of psychotropic drugs. This result is driven by anti-psychotic medication, which are usually prescribed to patients with schizophrenia or severe depression. While we find no effect on contacts to psychiatric hospitals related to schizophrenia, we observe an increase in contacts related to severe depression following the change in medical guidelines. This patient group should not have been affected by the reform, as severe cases should always be referred to a specialist. This result indicates that GPs are either not sufficiently skilled at accurately diagnosing patients, or are reluctant to refer even severe patients to specialists (excessively high threshold for referral).

Third, we investigate how specialized care affects mental health. As a measure of mental health, we follow the literature and use suicide attempts (Serena, 2021). We find that following the change in medical guidelines, patients had a lower probability of attempting to take their own life, suggesting that specialized care had a positive impact on mental health. In addition, we also find evidence of a decrease in hospital contacts related to eating disorders. Medical literature have suggested that eating disorders can be a consequences of untreated depression or anxiety.

Fourth , we investigate if the change in care for depression and anxiety affected labor market outcomes. For this analysis, we focus on the oldest part of our sample, individuals aged 22-24. We find that following the change in medical guidelines, they had an increased probability of

[1]Currie and MacLeod (2020) shows that medical specialists have a larger variation in their antidepressant prescriptions compared to generalists, and that both among specialists and generalists, a larger variation in antidepressant prescription predicts better patient health outcomes.

being employed and a lower probability of being outside the labor force and relying on public assistance.

Finally, we show empirically that the observed discrepancies in treatment between specialists and generalists are driven by GPs with low diagnostic skills, who make poor referral decisions and end up treating some severe patients who should have been referred to a specialist. Conversely, among mild-to-moderate patients, discrepancies in the prescribed treatments are small, suggesting that GPs are sufficiently skilled to care for these patients. Hence, while our results point to a significant downside to despecialization, they also point to a possible solution that doesn't require specialists to treat every patient: If we improve the diagnostic skills of GPs and ensure a better allocation of patients across GPs and specialists, we can improve overall health without increasing health care budgets and despecialization can be a viable policy.

Our work relates to two strands of literature. Firstly, a large literature has shown that greater access to mental health care improves mental health, e.g. through insurance coverage expansions (Serena, 2021, Solomon and Dasgupta, 2022, Lang, 2013, Klick and Markowitz, 2006), reduced capacity constraints (Deza et al., 2022, Landersø and Fallesen, 2021), increased access to medical therapeutics (Biasi et al., 2021, Bütikofer et al., 2020, Dalsgaard et al., 2014, Ludwig and Marcotte, 2005), or expansions of prescription or practice authorities (Chan et al., 2022, Alexander and Schnell, 2019). Most relevant to our paper is Chan et al. (2022), who study a policy granting Nurse Practitioners (NPs) the authority to provide care to patients in the Veterans Health Administration. They examine the effect in emergency department settings and find that NPs use more resources than physicians, and that patients experience worse health outcomes. Similar to our study, they hold access to care constant but show a negative effect but show a negative effect of despecialization in the ED setting. Alexander and Schnell (2019) investigate a policy allowing NPs to prescribe medications and find that it improved mental health by increasing access to care in underserved areas. In this light, despecialization appears to be an effective solution to address the low supply of specialists. However, we show that moving patients from specialists to generalists comes at a cost.

Secondly, we contribute to a growing body of work examining inappropriate prescribing practices in the context of mental health patients. Cuddy and Currie (2020) and Currie and Zhang (2023) show that a substantial share of children receive treatments that violate medical guidelines, with adverse consequences for their mental health. Cuddy and Currie (2020) demonstrate that these prescribing practices lead to more emergency room visits and drug treatments in the

future. In addition, Currie and MacLeod (2020) shows that non-psychiatrists have worse treatment skills compared to psychiatrists and that physicians vary substantially in their treatment skills, which has consequences for health outcomes of patients. In line with this literature, our study suggests that GPs may not always provide adequate care to their patients, often due to a lack of diagnostic skills required to refer the right patients to specialized treatment.

Part of the above mentioned literature on having access to mental health treatment or not, also estimate the effect on school and labor market outcomes. Landersø and Fallesen (2021) exploits contact intensity at the psychiatric hospital leading up to the first contact to instrument for admission rates at the time of the first contact. They find that access to care reduces criminal behavior both in the short and long run but also reduces labor market attachment. The authors explain the lower labor market attachment by a potential higher eligibility for welfare benefits. They do not find strong evidence of a substitution effect, wherein patients not receiving care at the psychiatric hospital receive more care from other specialists or from their GP.[2] [3] Dalsgaard et al. (2014) finds that children with ADHD with higher access to ADHD medication had fewer hospital contacts and lower criminal behavior. They exploit variation in psychiatrists' propensity to prescribe to instrument for access to medical treatment. Biasi et al. (2021) studies the introduction of lithium to treat bipolar disorder and find large positive effects from treatment on labor market outcomes by reducing the chance of ending up on disability insurance. This literature suggests that medical treatment, and perhaps also the type of treatment, has a large impact on both mental health and can have spill-over effects to criminal behavior and labor market outcomes. Bütikofer et al. (2020) shows reduced labor market participation for women with a history of depression after the FDA's expanded black box warning on antidepressants.

2 Institutional setting and data

Denmark has a universal public health insurance system, ensuring equal access to healthcare for all citizens. Each citizen is registered with a specific primary care physician (GP) clinic of their choice.[4] Primary care physicians work in small privately owned clinics and operate

[2] In their preferred specification, they find a decrease in specialist practitioners due to lower hospital constraints at a 10 percent significance level.

[3] A large literature study on the impact of mental health care on criminal behavior, e.g., Deza et al. (2022).

[4] Patients retain the freedom to change their GP if desired. The cost of switching is approximately $30, unless the patient relocates to a different municipality or if the current physician closes the clinic. However, changing GP may be challenging due to limited availability of physicians in the local area. Patients can select from clinics open to new patients within a radius of 15 kilometers of their residence (5 kilometers in the Copenhagen area).

under a hybrid reimbursement framework that combines capitation and fee-for-service models. The primary care physicians are the link between the patient and the rest of the health care system. Their responsibilities include conducting initial diagnoses, implementing therapeutic interventions, dispensing prescriptions, managing chronic conditions, providing preventive care, and facilitating referrals to specialized medical practitioners in clinics or hospitals.[5]

2.1 Mental health treatment

Mental health treatment is provided by four different providers depending on the severity of the condition. GPs is the first point of contact for most mental health conditions. GP assess the severity of the condition. To diagnose and classify conditions, physicians rely on the World Health Organization's classification system, ICD-10. Primary care physicians are recommended to use either the Hamilton Depression Scale or the Major Depression Inventory for assessing the presence and severity of depression. The GP is reimbursed for performing the test and we can for that reason observe conducted test in the data. From the assessment, the physician can characterize the condition into the categories no depression, potential depression, mild depression, or moderate to severe depression.

The GP acts both as a provider of mental health services and as a gatekeeper to the specialized system. If the GP asses that the condition is mild to moderate depression or anxiety the GP can can provide medical treatment to the patient (depending on the age of the patients), e.g., anti-depressants or anti-anxiety medication.[6] According to official guidelines GP should provide some sort of psychotherapy or other psychosocial-support for patients with all types of depression. For all patients with depression and anxiety the GP should see the patient frequently.[7]

Following a psychometric test, 33 % of patients aged 20-24 in the period 2012-2014 were provided a mental health consultation and the patients were provided 0.84 mental health consultations on average within the first year, see appendix table 12. However, there are substantial

Information available to patients when selecting a clinic includes the physician's name, age, and gender.

[5]The private health insurance market in Denmark is relatively small, as public health insurance provides full coverage for most healthcare services.

[6]If the GP assesses the depression to be moderate, they can start treatment with an SSRI (Citalopram, Escitalopram, or Sertraline). If there are no signs of improvement within 2-4 weeks, they should change prescriptions to another class of antidepressants (e.g. Venlafaxin, Dulozetin, Mirtaxapin). If there are still no signs of improvement within 2-4 weeks, they should consult a psychiatrist. More severe cases should be referred to a psychiatrist.

[7]https://www.sundhed.dk/sundhedsfaglig/laegehaandbogen/psykiatri/tilstande-og-sygdomme/depressioner/depression/

variation in the services provided between physicians. The 10th percentile GP provide on average 0.06 mental health consultation to their patients aged 20-24 in the period 2012-2014, while the 90th percentile GP provides 1.7 mental health consultations on average as shown in Appendix Table 13.

GP is the gatekeeper to specialized mental health services. They can refer mild and moderate cases of depression and anxiety to psychotherapy. Since 2008, patients above age 18 with mild and moderate cases of depression and anxiety could get 60 % of the cost to psychologist covered by the state (Serena, 2021).[8]

Moderate to severe cases should be referred to a psychiatrists that are organized in either a small private practise clinic, or at psychiatric hospitals.[9] Following long waiting time, a guarantee to be diagnosed by a psychiatrist within 30 days from referral which was implemented in 2013. The waiting time from referral to the first contact with a specialist decreased during our analysis window, as seen in Appendix Figure 12 panel A.[10] Severe depression can in some cases be treated with antipsychotic medication, which is mainly used to treat schizophrenia. Treatment with antipsychotic medication should be initiated by psychiatrits and not by GPs.

2.2 Anti-depressants and change in the medical guidelines

Antidepressant medication is primarily used to treat depression and anxiety. For both depression and anxiety, psychotherapy is the first line of treatment for mild and moderate cases. Medical treatment can be considered as a supplement to psychotherapy for moderate cases, as well as treating more severe instances.[11] There are five broad classes of antidepressants,

[8] In the data, we can only observe contacts with psychologists covered by public health insurance. While private alternatives exist, we are unable to observe the usage. 29 % of patients were in contact with public provided psychologist, and the patients on average had additional 0.6 psychometric tests within the first year, The 10th percentile GP refer 14% of their patients to a psychologist while the 90th percentile GP refer 44 % of their patients, see appendix tables 12 and 13.

[9] Deciding on where the patient should be treated depends not only on the severity but also on prior depressions, the presence of suicidal thoughts, somatic conditions, network, among other things.https://www.sst.dk/~/media/6F9CE14B6FF245AABCD222575787FEB7.ashx

[10] In 2010, "treatment packages" were introduced in the psychiatric hospital system, initially in the capital region, and then in 2012, across the rest of the country. These packages included a different procedures that should take place when a patient was diagnosed and referred to the the psychiatric hospital. The packages included different components: an assessment component (including diagnosis assessment, severity evaluation, and non-pharmaceutical treatment type), non-pharmaceutical treatment (either individual or group therapy), pharmaceutical treatment (initiation, coordination, and assessment of effectiveness and side effects), and a continuity component. Approximately 14 hours of "treatment" were allocated for patients with anxiety, while patients with depression received a total of 16 hours. We are unable to distinguish between the different components in the data, but we can observe the number of contacts and the duration of each outpatient visit.

[11] https://www.sundhed.dk/sundhedsfaglig/laegehaandbogen/psykiatri/tilstande-og-sygdomme/depressioner/depression/

each operating through different biochemical processes, and there are more than 30 different active molecules to choose from.[12] There is significant variation in the effectiveness of medical treatment, and predicting how well a particular type of medication will work for an individual is challenging. Treating depression medically can involve a process of trial and error until an effective treatment is found.[13]

In the late 1990's and early 2000s, Denmark witnessed a significant increase in the use of antidepressants across the entire population, and in particular among younger and older individuals. Figure 1 panel A shows the share of individuals ages 18-24 and 25-29 who were prescribed anti-depressants in the population. In 1995 around 1% of the sample filled at least one prescription of antidepressants. In 2010, this number was around 5% for the younger group and 7% for the older group. These numbers are comparable to the US.[14] The increase in prescriptions was driven by GPs. Figure 1 panel B shows the share of first-time antidepressant prescriptions initiated by GPs. The figure illustrates a trend of despecialization from 1995 to 2010, with GPs initiating an increasing share of first-time prescriptions. In 1995, approximately 60% of antidepressant treatments for individuals aged 18-24 were initiated by GPs, increasing to 80% by 2010.[15] The rapid increase in the use of antidepressants raised questions about the appropriateness of the prescriptions. In an attempt to curb this trend, the Danish Health Authorities implemented various measures to limit prescription of psychotropic medication, in particular focusing on the role of primary care physicians and the prescriptions for children and young individuals.[16]

In late 2014, the Health Authorities introduced new guidelines regarding the prescription of antidepressants for children aged 18-24. These guidelines were implemented in response to medical literature that questioned the effectiveness of antidepressant treatment for children

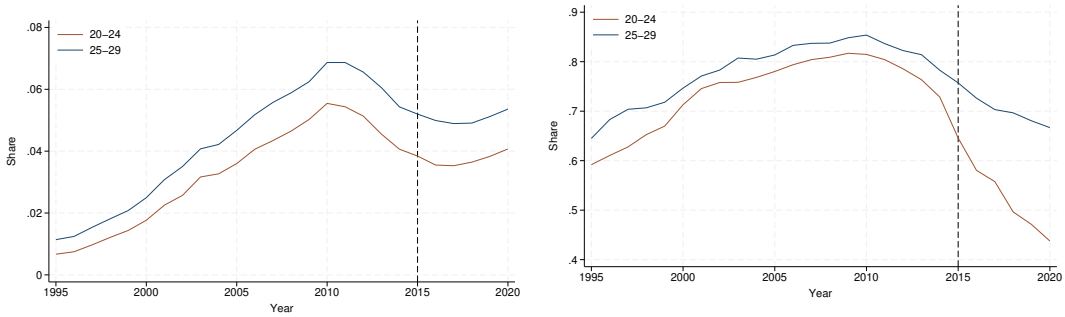
[12]The first antidepressants were discovered in the 1950s. Up until the introduction of newer-generation antidepressants known as SSRIs in the early 1990s, depression was primarily treated by psychiatrists. With the new generation of antidepressant medications, treatment for depression shifted from specialists to primary care physicians. In most parts of the world, mild to moderate depression is now primarily treated by primary care physicians, and relatively few patients see a psychiatrist (Lieberman, 2003).

[13]Rush et al. (2006) finds that 28 % of patients responded successfully to the first line of treatment (SSRI). Of the people who did not get an effect from the first treatment either switch to a new drug or add another drug on top in the first round after 12 weeks. Of those, 25 percent responded successfully. After 4 different rounds of treatment, 70 percent of patients were symptom-free.

[14]https://www.cdc.gov/nchs/data/databriefs/db377-H.pdf

[15]Figure 1, panel B, defines GP prescriptions based solely on the prescriber ID. In Appendix Figure 9, panel A, we redefine this measure by excluding patients with any contact with a psychiatrist within 3 months of their first AD prescription. Using this redefined measure presents a very similar pattern to Figure 1, panel B.

[16]https://sundhedsdatastyrelsen.dk/-/media/sds/filer/find-tal-og-analyser/laegemidler/kvartalets-medicinsalg/medicinforbrugindblik_2016_boernunge-antidepresiva.pdf?la=da



A: Share of population prescribed AD

B: Share of first time AD prescribed by GPs

Figure 1: Antidepressants (AD) prescriptions and GP prescription share

Note: Panel A shows the share of the respective age group who received at least one antidepressant prescription in a given year. Panel B shows the share of new antidepressant prescriptions initiated by general practitioners (GPs). GP initiation is determined based on the prescriber ID associated with the first prescription.

and young adults and highlighted the increased suicide risks in younger individuals following the initiation of antidepressant treatment.[17][18] Prior to this change in guidelines, GP were authorized to initiate and manage antidepressant medication for moderate cases of depression and anxiety, while patients with more severe depression were to be referred to specialists for treatment initiation.[19] After the change in guidelines, the primary care physicians should refer moderate cases to specialists to initiate antidepressant treatment.[20] Figure 1 panel B shows that the change in medical guidelines significantly changed prescription patterns around 2015. After 2015, GPs initiated fewer anti-depressant treatments. by 2020 less than 50% of anti-depressant treatments were initialed by GPs for the individuals ages 20-24.[21]

Currie and MacLeod (2017) shows that psychiatrists and non-psychiatrists have different antidepressant prescription patterns, particularly in terms of the variety of antidepressants prescribed. Figure 2 Panel A illustrates the proportion of all antidepressants that are prescribed by either GPs or psychiatrists that belongs to specific subgroups at the molecular level. Figure 2 Panel B groups the prescriptions by the most common types of antidepressants. The figure shows that GPs prescribe a higher proportion of the most common types of antidepressants. For instance, approximately 75% of all antidepressants prescribed by GPs are either Sertraline,

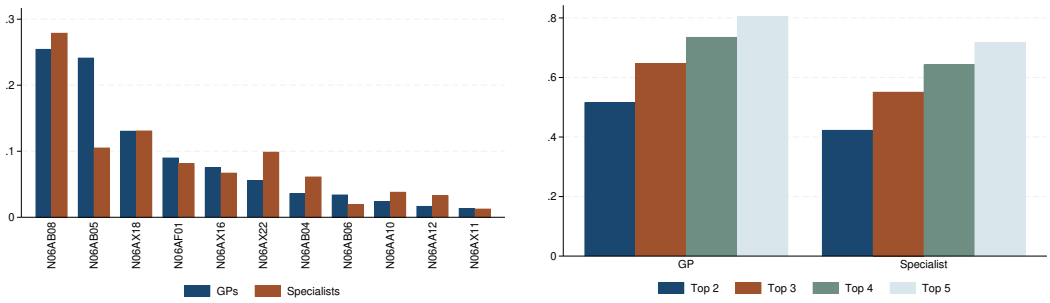
[17] https://sundhedsdatastyrelsen.dk/-/media/sds/filer/find-tal-og-analyser/laegemidler/kvartalets-medicinsalg/medicinforbrugindblik_2016_boernunge-antidepresiva.pdf?la=da. Medical study cited: Stone et al. (2009). No effect: Khan et al. (2000).

[18] The 2014 reform was an extension of a 2011 change in medical guidelines, which introduced a similar adjustment for individuals under the age of 18. In the robustness section, we show that our results are robust to removing individuals that may have been double treated.

[19] https://www.retsinformation.dk/eli/retsinfo/2000/9469

[20] https://www.retsinformation.dk/eli/retsinfo/2014/9899

[21] Table on non-compliance here?



A: Prescribed AD on the molecule level **B:** Prescribed AD in Top categories

Figure 2: GP and specialist prescription of AD

Note: Panel A shows the distribution of first AD prescriptions by GPs and specialists, categorized at the molecule level. Panel B shows the share of the most commonly prescribed antidepressants initiated by GPs and specialists. The most common molecules are defined as the 2–5 most frequently prescribed antidepressants at the molecule level within a given year and age group (Ages 20-24 and 25-29). These categories may vary over time and between age groups.

Citalopram, Mirtazapine, or Venlafaxine, while these medications account for around 55% of specialist prescriptions.

As described, the treatment provided by GP and an psychiatrists may differ in many dimensions, which implies that the effect we are measuring goes beyond being assessed and prescribed psychotropic drugs by a specialist as opposed to a generalist. It includes other aspects of treatment associated with "seeing a specialist."

2.3 Data

We merge several nationwide administrative registers, starting with the entire Danish population from years 2008 to 2022. We link demographic information with data on healthcare utilization, including GP visits and services, contacts with private practice psychiatrists, and contacts with psychiatric and somatic hospitals. Additionally, we incorporate data on prescription drug purchases. We link individuals to their parents and incorporate details on parental socio-economic status.

Following Serena (2021), we restrict our main analysis sample to individuals experiencing a mental health shock between ages 20-29, defining a mental health shock as the first GP psychometric test in a 12-month period. We focus on the sample getting a psychometric test as these patients are a relevant population for either AD prescription or specialist treatment.[22]

[22]Appendix Figure 9 panel B shows that below 1 percent of people prescribed AD for the first time have not received a psychometric test by their GP before the prescription was filled. In section 4.2 we provide empirical evidence for that there is no manipulation in the use of these tests that could potentially affect our results. We consider individuals who experienced a mental health shock between 2012-2017. In 2008, the same group gained

The treatment group consists of individuals who experienced the mental health shock in 2015 or later between ages 20-24. The other group serves as the control group. The dataset is a balanced panel on a monthly basis around a mental health shock following individuals 4 years before and after a mental health shock. We allow for up to 4 mental health shocks per individual. We also provide robustness checks using the full population, without conditioning on a mental health shock.

Compared to the relevant background population, our main analysis sample is more female, more likely to belong to the ethnic majority, more likely to come from low-SES families, less likely to have completed high school, and more likely to have parents with a history of mental health conditions, see Appendix table 9. Our analysis sample consist of 90,000 individuals, which is around 7.5% of the relevant birth cohorts.

Health care provision: We link individuals to their GP and background characteristics on the GPs. We can observe the services provided by the GP, e.g., psychometric test, mental health consultation, and in addition we observe contacts with specialists.

As mentioned, there are two types of specialists in our setting. We define contacts with a mental health specialist as visiting either a private practice psychiatrist or a psychiatric hospital. We observe all hospital contacts during the period, including the type of contact (inpatient, outpatient, and emergency contacts).[23]

Diagnoses: For contacts with psychiatric and somatic hospitals, we have detailed information on diagnoses. Diagnoses are coded using ICD-10 during the period of interest. While we focus on changes in prescription practices for antidepressants used to treat depression, anxiety, and PTSD due to the reform, we also examine psychiatric hospital contacts involving other psychiatric diagnoses.[24] For somatic hospital contacts, we focus on interactions related to self-harm and suicide attempts. From the diagnosis code we can separate depression diagnosis into four categories: mild, moderate, severe, and severe with psychotic symptoms.

access to state-subsidized therapy, which had a significant impact on mental health (Serena, 2021). To avoid confounding effects from this reform, we concentrate on the period after 2008, ensuring that all individuals in the sample had the same therapy coverage.

[23]Some outpatient contacts covers extended periods, and we code these contacts to include all periods included in the contact, and not just the time of admission. Hence, if an admission starts in January and ends in December, we code all months in between the two points in time as contacts with the hospital.

[24]We use all types of diagnosis, both the primary cause of the admission, but also secondary diagnoses.

Prescription drugs: Our dataset covers all prescription drugs purchased during the specified period. Prescription drugs are coded using ATC codes with full digits. This allows us to precisely identify the type of drug prescribed. In our analysis, we focus not only on antidepressants but also on a broader range of psychotropic drugs. In addition, we categorize antidepressants based on their types and by their prevalence within our analysis sample. We can observe the exact date of the drug purchase, the physician ID number of the prescriber, and subsequently determine whether a GP or a specialist prescribed the drug.

Labor market outcomes: We construct three mutually exclusive labor market outcomes using the DREAM register. The first group consists of individuals receiving transitory public transfers, such as sickness benefits, unemployment benefits, or cash benefits. The second group includes individuals who are either employed or studying, defined as those receiving public education stipends and not receiving transitory public transfers during a given month. For example, an employed individual receiving sickness benefits is classified as receiving transitory public transfers rather than being in the labor market. The third group comprises individuals who are not receiving transitory public transfers, participating in the labor market, enrolled in education, or receiving disability insurance. We define this group as being outside the labor force.

Some of the public transfers, such as the education stipend, is not available for individuals below age 18. For that reason, we only consider 2 years prior to the mental health shock, as this ensures that we can observe the labor market attachment for all individuals in our analysis group in all relative periods.

3 Theory

To model physician's referral decisions, we employ a model from Currie and MacLeod (2013, 2017). GPs choose between referring the patient ($R = 1$) and treating the patient themselves ($R = 0$), yielding the following utilities:

$$U_{ij}(1) = h_{ij}^{1} - \tau \tag{1}$$

$$U_{ij}(0) = h_{ij}^{0} + s_j \tag{2}$$

, where $h_{ij}^R = h_i^R + \epsilon_{ij}^R$ is the observed condition of the patient in the two scenarios, while h_i^R is the patient's true condition, assuming the GP is of average treatment skill. The term s_j measures deviations from this average, and the treatment skills of the GP. The term τ represents a cost of referring the patient and captures both loss of revenue and non-pecuniary "moral" costs, as the GP acts as a gatekeeper. Conditional on information I_{ij}, the GP refers the patient to a specialist if:

$$E\{U_{ij}(1) - U_{ij}(0)|I_{ij}\} \geq 0 \Leftrightarrow \tag{3}$$

$$E\{b_i|I_{ij}\} - s_j - \tau \geq 0 \tag{4}$$

, where $b_i = h_i^1 - h_i^0$ measures the true benefit of being referred to a specialist. For simplicity, we normalize $h_i^1 = 0$, such that the benefit of referral depends only on the severity of the illness $b_i = -h_i^0$.

The GP has prior beliefs about patients benefit from referral b_i, $b_i \sim \mathcal{N}(b_j^0, \sigma_j^2)$. We define $B_j = 1/\sigma_j$ as a measure of the strength of the GP's prior belief about whether or not to refer patients to a specialist. After seeing a patient, the GP observes a signal about their true health and, therefore, their benefit from being referred:

$$b_{ij} = b_i + \epsilon_{ij}, \quad \epsilon_{ij} \sim \mathcal{N}(0, \sigma_{D_j}^2) \tag{5}$$

The variance of this signal is inversely related to the diagnostic skill of the physician, $D_j = 1/\sigma_{D_j}$. Intuitively, skilled diagnosticians observe a less noisy signal about patients' true health.

From DeGroot 1972, it follows that:

$$E[b_i|b_{ij}, b_j^0] = \pi b_{ij} + (1 - \pi)b_j^0 \tag{6}$$

, where $\pi = \frac{D_j^2}{D_j^2 + B_j^2}$ denotes the degree to which physicians update their beliefs about patient benefits of referral after observing the signal. This learning rate depends positively on diagnostic skill (D_j) and negatively on the strength of prior beliefs (B_j). Substituting (5) and (6) into (4),

we get:

$$\pi b_{ij} + (1-\pi)b_j^0 - s_j - \tau \geq 0 \Leftrightarrow \tag{7}$$

$$b_{ij} \geq \alpha_j \tag{8}$$

$$b_i - \alpha_j \geq \gamma_{ij} \quad , \quad \gamma_{ij} = -\epsilon_{ij} \tag{9}$$

, where $\alpha_j = \frac{s_j + \tau - (1-\pi)b_j^0}{\pi}$ is a doctor-specific referral threshold. As is evident from (8), doctors refer all patients with an observed severity, b_{ij}, above this threshold. The threshold depends positively on treatment skills of the doctor (s_j), costs of referral (τ), and negatively on the prior belief about the benefits of referring patients.

Since γ_{ij} is normally distributed with mean zero, we calculate the probability of referral as:

$$\rho_{ij} = Prob[b_i - \alpha_j \geq \gamma_{ij}] \tag{10}$$

$$= F(D_j(b_i - \alpha_j)) \tag{11}$$

Effect of the reform on referral decisions

To illustrate the impact of the reform, we study the effect of a marginal decrease in the cost of referring a patient, τ, as GPs are now encouraged to refer more patients to a specialist:

$$-\frac{\partial \rho}{\partial \tau} = f(D_j(b_i - \alpha_j))\frac{D_j}{\pi} > 0 \tag{12}$$

Unsurprisingly, the reform induces GPs to refer more patients to specialists. The increase is larger when physicians have high diagnostic skills. Furthermore, as the density of a normal density function is highest at the mean (in this case zero), the increase in referrals is higher for patients whose severity, b_i, is close to the doctor-specific referral threshold, α_j. Intuitively, if doctors observe diagnoses perfectly, the severity of all marginal patients is equal to the threshold. Since diagnostic skill is inversely related to the standard deviation of the distribution, doctors with high diagnostic skill mainly change referral decisions of patients whose severity is close to the threshold, while doctors with low diagnostic skill change referral decisions for a broader spectrum of patient severity. Hence, for a given referral threshold, α_j, the model predicts that doctors with low diagnostic skill are more likely to refer mild and severe cases as a result of the reform, compared to doctors with high diagnostic skill.

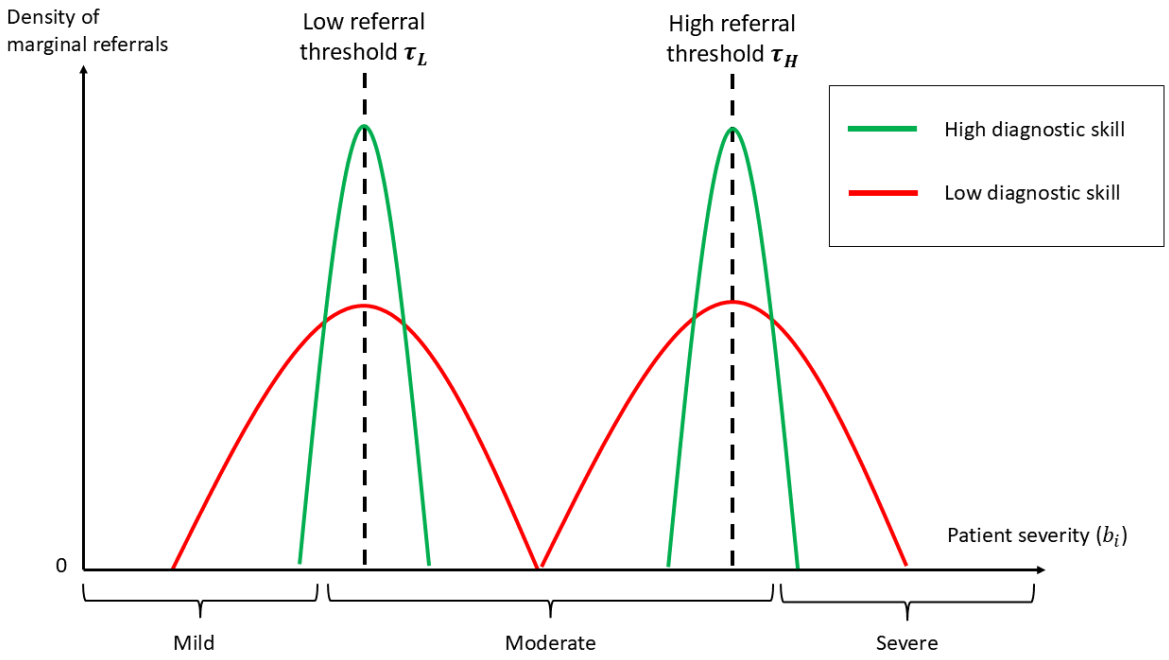


Figure 3: Theoretical Marginal Referrals by Diagnostic Skill and Referral Thresholds

Table 1: Theoretical predictions by severity, threshold and diagnostic skill

	Diagnostic skill	
Referral threshold	Low	High
Low	↑,↑,-	-,↑,-
High	-,↑,↑	-,↑,-

Measuring diagnostic skill and referral thresholds

To obtain a measure of diagnostic skill and referral preferences of GPs, we again follow Currie and MacLeod (2013, 2017). We start by estimating a proxy for patient severity in a sample of individuals not included in our main analysis sample (mainly older individuals or individuals experiencing mental health shocks before our analysis period starts). We estimate the probability of being referred to a specialist within one year of the mental health shock, based on pre-shock characteristics including family history of mental illness, socioeconomic characteristics, and shocks to mental health such as sickness, unemployment, and divorce.

We then run a regression for each GP, using this predicted patient severity as the explanatory variable and a dummy for referring the patient as the outcome. The slope of this regression measures the extent to which a given GP responds to patient severity when deciding who to refer. In other words, the slope is a measure of diagnostic skill of the GP. On the other hand, the intercept measures the doctor's preference for referring a patient with a given severity. Therefore, the intercept is negatively related to the doctor's referral threshold.

4 Method

We combine two empirical strategies to estimate the causal effect of specialized mental health treatment compared to treatment provided by a primary care physician. Our main method combines event study and Difference-in-Differences models (ES-DD). Our approach compares individuals experiencing a mental health shock above and below age 25, before and after the reform and before and after the shock happens. Therefore, the estimation equation is similar to a triple-difference model:

$$\begin{aligned} Y_{it} = \quad & \gamma_0 + \gamma_1 Post_i + \gamma_2 Treat_i + \gamma_3 Treat_i \# Post_i + \\ & \gamma_4 PostShock_{it} + \gamma_5 Post_i \# PostShock_{it} + \gamma_6 Treat_i \# PostShock_{it} + \\ & \gamma_7 Treat_i \# Post_i \# PostShock_{it} + \nu_{it} \end{aligned} \tag{13}$$

Y_{it} is our outcome of interest. $PostShock_{it}$ indicates relative periods after a mental health shock. $Treat_i$ is an indicator that equals one for individuals who experienced a mental health shock between ages 20-24. If the shock occurred between ages 25-29, then $Treat_i = 0$. $Post_i$ indicates if the shock occurred after the change in guidelines; it takes the value 1 if the mental health

shock occurred during 2015-2018 and the value 0 if the shock occured during 2012-2014. ν_{it} is the error term. Since our main analysis is focused on individuals who have all experienced a mental health shock, identified by receiving a psychometric test in primary care, all individuals are observed both before and after the shock.

The parameter of interest, γ_7, captures the reduced form effect of the change in guidelines. The identifying assumption is that the impact of a mental health (pre/post shock change) between treated and control individuals would have remained constant if not for the change in guidelines. Note that, contrary to a normal DD model, this model allows for violations of the standard parallel trends assumptions, as long as these violations are constant relative to the timing of the mental health shock. This is because any pre-shock impacts of the reform are essentially subtracted from the DD estimates. The model relies on the assumption that treatment decisions are determined by the medical guidelines in effect at the time of the mental health shock. Furthermore, it assumes that future changes in guidelines have no impact on treatment decisions and that the change in guidelines affected only those individuals covered by the changes (i.e., individuals above age 25 should not be affected by changes in guidelines intended for those below age 25).

Beyond the added robustness compared to a standard DD model, our ES-DD model allow us to estimate dynamic treatment effects. Therefore, we estimate dynamic versions of (14), which is basically a DD model fully interacted with distance to mental health shock dummies:

$$Y_{it} = \sum_{d=-4}^{4} (\beta_0^d + \beta_1^d Post_i + \beta_2^d Treat_i + \beta_3^d Treat_i \# Post_i) 1\{k_{it} = d\} + \epsilon_{it}, \tag{14}$$

where d represents the relative distance to the mental health shock. To provide a graphical representation of our main results, we construct treated and counterfactual outcomes, based on the coefficients from equation (14):

Counterfactual: $\beta_0^d + \beta_1^d + \beta_2^d$

Treatment group: $\beta_0^d + \beta_1^d + \beta_2^d + \beta_3^d$

The ES-DD estimates capture reduced form average treatment effects on the treated. We assume these estimates are driven by patients who are referred to a specialist as a result of the change in guidelines, i.e., compliers. Therefore, we also estimate instrumental variable (IV) versions of a our ES-DD model, using the change in seeing a specialist as the first stage. Our method follows Hudson et al. (2017) on DD-IV interpretation, with an additional difference.

The first stage equation is:

$$\begin{aligned} Specialist_{it} = \quad & \alpha_0 + \alpha_1 Post_i + \alpha_2 Treat_i + \alpha_3 Treat_i \# Post_i + \\ & \alpha_4 PostShock_{it} + \alpha_5 Post_i \# PostShock_{it} + \alpha_6 Treat_i \# PostShock_{it} + \\ & \alpha_7 Treat_i \# Post_i \# PostShock_{it} + \eta_{it} \end{aligned} \tag{15}$$

$Specialist_{it}$ indicates if individual i is referred to a mental health specialist after a mental health shock. This is our treatment variable. Including the first stage in the reduced-form estimation, we obtain the second-stage equation:

$$\begin{aligned} Y_{it} = \quad & \beta_0 + \beta_1 Post_i + \beta_2 Treat_i + \beta_3 Treat_i \# Post_i + \\ & \beta_4 PostShock_{it} + \beta_5 Post_i \# PostShock_{it} + \beta_6 Treat_i \# PostShock_{it} + \\ & \beta_7 \widehat{Specialist}_i + \epsilon_{it} \end{aligned} \tag{16}$$

The coefficient of interest, β_7 captures the causal Local Average Treatment Effect (LATE) of specialist treatment for compliers. This coefficient can be expressed as the ratio of the reduced form and first-stage parameters (α_7).

4.1 Validation

For the empirical strategy to provide us causal interpretation, we need several key assumptions to be fulfilled. As our method relies both on IV and DiD elements, we need requirements from both methods to be met.

Relevance: To use the change in medical guidelines as an instrument for seeing a specialist, we first need the instrument to be relevant. We show in the Results section, section 5.1, that the change in medical guidelines had meaningful impact on the probability of seeing a specialist.

Exclusion restriction: Second, we need the exclusion restriction to be met. The instrument should only affect outcomes through its impact on treatment. In our setting it means that, this means that the change in medical guidelines affects outcomes like suicide attempts or labor market outcomes solely by influencing treatment by a medical specialist. As we will discuss in the next section, we do see a break of the exclusion restriction, as we have a group of defiers. This group lose access to care because of the change in guidelines. We see this as a short

term drop in Anti-depressant use, that reflect that the change in medical guidelines both had a positive impact of seeing a medical specialist (referral compliers) and a negative effect on receiving anti-depressants (treatment defiers). In the next section we show that our results are driven by people who are being referred (referral compliers) by estimating the joined probability of a particular outcome and being referred to a medical specialist.

Parallel trends: As we use a control group to control for common time trends, our method includes DiD and event study elements. Because of these elements, we additional assumptions. We test if there are differences in the trends of outcomes for people who experienced a shock before the change in guidelines. We show that this does not seem to be the case. The instrument in period 1 should not affect period-0 outcomes or treatment. In other words, the medical guidelines do not affect the treatment group before the change in guidelines, or we do not want any anticipation effect. First, we can test for anticipation in our event study figures, and show that there are no evidence of pre-trends. For the control group to correctly account of time trends, we also need the instrument not to affect the control group, which comprises individuals who experience a mental health shock after age 25.

4.2 Threats to the internal validity

In this section we empirically test threats to the internal validation.

We may worry that the additional treatment of the treatment group by specialists, and the potentially fewer treatments by GPs, could impact the treatment of other groups. For example, if GPs lose revenue because they treat this group less and consequently increase treatment for others, or if the influx of new patients into the psychiatric system worsens the treatment that other groups are receiving. This would be an issue for our empirical design if the reform indirectly impacted the control group. We test for this in different ways, and argue that this is unlikely that there are general equilibrium effects of the reform.

First, the services GPs provided related to mental health treatments were generally low. The share of GPs' reimbursement for mental health services for all patients was 2.8 percent on average over the time period. Where the largest part of this was from mental health consultations, c.f. Appendix Figure 10 panel B. Zooming in on group affected by the reform, the reimbursement from mental health services was on average 0.2% of their total reimbursement (Panel C), amounting to around $75.6 per month (0.07% from psychometric tests and 0.16%

from mental health consultations for this group). While we observe a slight decrease in their total reimbursement from the treatment group following the reform, it is unlikely this would have changed their treatment of other groups, and unlikely that this would in particular have impacted their treatment of the control cohort. Throughout the period, total reimbursement is increasing, and the reform does not alter this trend, see Appendix Figure 10 panel A.

Second, the reform referred patients who were previously treated by their GPs to the specialized system. An inflow of new patients could potentially impact the treatment of unaffected groups by either decreasing the quality of care or increasing the waiting time from referral to first contact with a specialist. In contrast to the treatment provided by GPs, the share of patients aged 20-24 in psychiatric hospitals is non-negligible. On average, individuals aged 20-24 constitute around 12% of contacts with psychiatric hospitals, and individuals aged 25-29 account for around 10% of all contacts, as shown in Appendix Figure 11. The number of contacts in general, and the share of the relevant groups, has been increasing over the time period. However, contacts related to depression and anxiety are a smaller part of these contacts. Panel B of Figure 11 shows the share of contacts due to depression for the relevant age groups. These types of contacts consist of around 1-1.2% of all hospital contacts. The figure does show a small increase in contacts related to depression for ages 20-24 in 2015, but this is relatively small, around 0.1%.

Another way to investigate if the reform could have unintended consequences for other patients is to study if the reform change the waiting time for the control group. The figure shows the decrease in waiting time in 2013 for individuals ages 20-24 and 25-29 at the time of referral. We do not see any differences in the waiting time for treatment and control groups around the change in guidelines in 2015, suggesting that the inflow of patients ages 20-24 did not increase waiting time for other groups of patients. Appendix Figure 12 Panel B shows that individuals in our treatment and control group had similar waiting time before and after the change in medical guidelines. After the change change in guidelines, more than 30 pct. of referred patient was a specialist within the first month, and this is similar for the treatment and control group.

Our main analysis sample consists of individuals who experience a mental health shock, as measured by receiving a psychometric test from their GP. We assume that there is no differential selection into getting the test before and after the change in guidelines. In Appendix Table 14 we show that the share of women, individuals from the ethnic majority, individuals with prior mental health conditions or had parents who previously had a mental health condition, or were employed prior to the mental health shock has evolved similarly between treatment and control

group before and after the change in guidelines.

We also find no evidence of differences in the use of the psychometric test for the treatment group after the change in guidelines. Appendix Figure 13 shows the number of individuals getting the a psychometric test. Panel A illustrates the numbers by age, separately before and after the change in guidelines. The figure show a decrease in the number of tests after the age of 22, but this pattern is similar both before and after the change in guidelines. Importantly, we observe no differences in the number of tests around the age of 25. Panel B illustrates the numbers by year, separately for the treatment and control groups. The figure shows an increase in the use of tests over time, which is the case for both the treatment and control groups. There do not seem to be any changes in the use of tests in 2015, at the time of the change in guidelines. From the figures, we do not find any evidence of manipulation or differential sorting into the sample by age or over time.

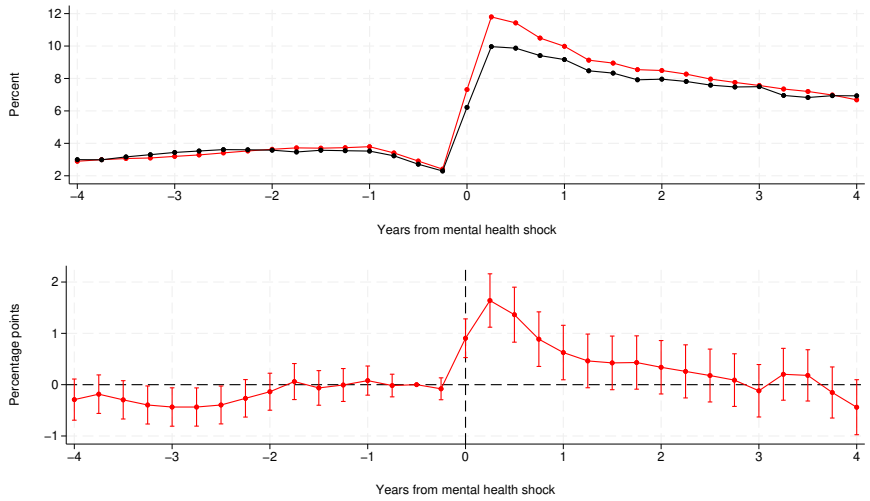
5 Results

In this section, we present our main results. First, we show how the probability of seeing a medical specialist was affected by the change in medical guidelines. This is our first-stage result. Second, we study the effect of seeing a specialist on diagnoses and the medical treatment recieved. Third, we estimate the effect of the changed treatment as a consequence of the change in the medical guidelines on suicide attempts and labor market outcomes.

5.1 Seeing a specialist

Figure 4 shows our first-stage estimate. The upper panel shows the percentage of individuals experiencing a mental health shock who are referred to medical specialists—either a private practice psychiatrist or the psychiatric hospital. The data is shown separately for the treatment group (in red) and the estimated counterfactual (in black). The lower panel of Figure 4 shows the difference between the treatment and the counterfactual with 95 percent confidence intervals. Following a mental health shock, approximately 8 percent of individuals are in contact with a medical specialist one quarter after experiencing the shock. After the change in medical guidelines, this figure rises to around 10 percent of individuals. The figure shows that specialist visits increased by approximately 1.5 percentage points in the first quarter after a mental health shock. This represents an increase of around 19% compared to the counterfactual. Approxi-

Figure 4: Seeing a specialist



Note: The figures show the estimate on the probability of seeing a specialist from the dynamic ES-DD model, equation 14. The upper panel shows the mean outcome for the treatment group and the counterfactual. The bottom panel shows the difference between the treatment and counterfactual along with 95 pct confidence intervals. Standard errors are clustered at the individual level.

mately half of the increase in specialist visits occurred at private practice psychiatrists, while the other half occurred in psychiatric hospitals, see appendix table 15.

First stage estimates by subgroups are shown in Appendix table 16. The table show that females, non-ethnic majority individuals and individuals from low-SES families have a higher increase in specialist visits after the change in guidelines.

Table 11, column 1, shows the reduced-form evidence using all specialist contacts within 12 months of the mental health shock. The result indicates an overall increase in specialist visits by 2.7 percentage points (15% compared to the mean). These 2.7 percent of our sample are the compliers in our analysis - patients who are treated by a specialist instead of their GP, as a result of the change in guidelines.

Other health care use In the absence of the guideline change, patients would have been treated by their GP. We investigate how the new guidelines affected other medical services accessed by patients. Appendix Table 17 shows no change in patients' contact with GPs or psychologists. The only observed effect is a reduced likelihood of patients receiving mental health consultations from their GP and number of mental health consultations with the GP. In addition, we also examine the types of contacts with psychiatric hospitals. The increase in specialist visits is driven by outpatient contacts, with no effect observed on inpatient or

Table 2: Reduced form estimates on seeing a specialist and medication use

	(1) Specialist	(2) Other med	(3) Anti-psychotics	(4) Anti-anxiety and Sleep	(5) Psycho-stimulants
All	2.643***	0.943***	0.702***	0.482	0.232
	(0.411)	(0.362)	(0.242)	(0.299)	(0.158)
Specialist prescribed		0.806***	0.691***	0.438***	0.232
		(0.214)	(0.170)	(0.129)	(0.143)
Mean	20.8	13.2	5.4	8.2	2.5
N	8,693,124	8,693,124	8,693,124	8,693,124	8,693,124

Notes: The table shows reduced form estimates from ES-DD model, equation 14, from four years prior to the mental health shock and one year after. The data are aggregated at the monthly level. Outcome variables include first specialist contact (column 1) and the first prescription (columns 2–5) within a 12-month period. Column 1 represents the first-stage estimate. *Other med* is a summary measure of the medications listed in columns 3-5. *Specialist prescribed* indicates that the medication is prescribed by a specialist. Specialist prescriber indicates that the medication was prescribed by a specialist, determined by the prescriber ID on the prescription. Standard errors are clustered at the individual level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

emergency visits.

5.2 Diagnoses

As the change in medical guidelines should only affect treatment for individuals with moderate depression and anxiety, we would expect the reform to primarily cause more patients with moderate depression and anxiety to see a specialist. For patients in contact with the psychiatric hospital system, we have a diagnosis for the contact. To examine the effect on diagnoses, we construct variables that take the value of one if the individual is in contact with the psychiatric hospital and has received a particular diagnosis. Hence, we do not condition on being in contact with the hospital. Patients who are in contact with a hospital, as opposed to a private practice, have different characteristics, as shown in Table 19.

We further categorize contacts for depression based on severity. Consistent with the change in medical guidelines, we find that the majority of the increase in depression-related contacts at psychiatric hospitals is due to moderate depression, as shown in Table 4. However, we also observe statistically significant effects for severe depression. For every 10 compliers, more than 1–2 are diagnosed with severe depression. Patients with severe depression should not be affected by the change in medical guidelines. This finding could thereby suggest that GPs either lack sufficient skills to accurately diagnose patients or apply excessively high thresholds for referrals. We study this potential mechanism in section 5.4.1.

Table 3: IV estimates - Diagnoses

	(1) Depression	(2) Anxiety	(3) Schizophrenia	(4) Bi-polar	(5) Eating dis.	(6) ADHD
	0.695***	0.463***	-0.008	-0.019	-0.032	0.030
	(0.145)	(0.128)	(0.068)	(0.048)	(0.051)	(0.077)
Mean	0.004	0.006	0.001	0.001	0.001	0.001
N	8,693,124	8,693,124	8,693,124	8,693,124	8,693,124	8,693,124

Notes: The table presents IV estimates from Equation 17, using data from four years prior to the mental health shock and one year after. The data are aggregated at the monthly level. Diagnoses are recorded only when a patient has contact with a psychiatric hospital. The outcome variables represent the joined probability of having first-time contact with a psychiatric hospital due to a specific diagnosis within a 12-month period. Importantly, we do not condition on prior contact with a psychiatric hospital. Since we only observe diagnoses when a patient is in contact with a psychiatric hospital, we replace the endogenous variable in the first-stage equation with psychiatric hospital contacts instead of contacts with any specialists. Standard errors are clustered at the individual level. *** p <0.01, ** p <0.05, * p <0.1.

Table 4: IV estimates - Depression Severity

	(1) Mild	(2) Moderate	(3) Severe
	0.084	0.466***	0.165***
	(0.052)	(0.114)	(0.060)
Mean	0.001	0.002	0.001
N	8,693,124	8,693,124	8,693,124

Notes: The table presents IV estimates from Equation 17, using data from four years prior to the mental health shock and one year after. The data are aggregated at the monthly level. Depression severity is recorded as different diagnosis codes. Column 3 includes both the diagnosis codes severe depression and severe depression with and without psychotic symptoms. Diagnoses are recorded only when a patient has contact with a psychiatric hospital. The outcome variables represent the joined probability of having first-time contact with a psychiatric hospital due to a specific diagnosis within a 12-month period. Importantly, we do not condition on prior contact with a psychiatric hospital. Since we only observe diagnoses when a patient is in contact with a psychiatric hospital, we replace the endogenous variable in the first-stage equation with psychiatric hospital contacts instead of contacts with any specialists. Standard errors are clustered at the individual level. *** p <0.01, ** p <0.05, * p <0.1.

5.3 Drug use

Next, we investigate how the provider impacts the medical treatment received. By comparing changes in the medical treatment received, we examine the GP's role as a mental health care provider. The change in medical guidelines directly targeted antidepressant prescriptions, particularly those initiated by GPs. However, as access to medical specialists could lead to alternative medical assessments of the patient, and given that some compliers were in contact with psychiatric hospitals for severe depression — which could involve other medical treatments — we also consider other psychotropic drugs.

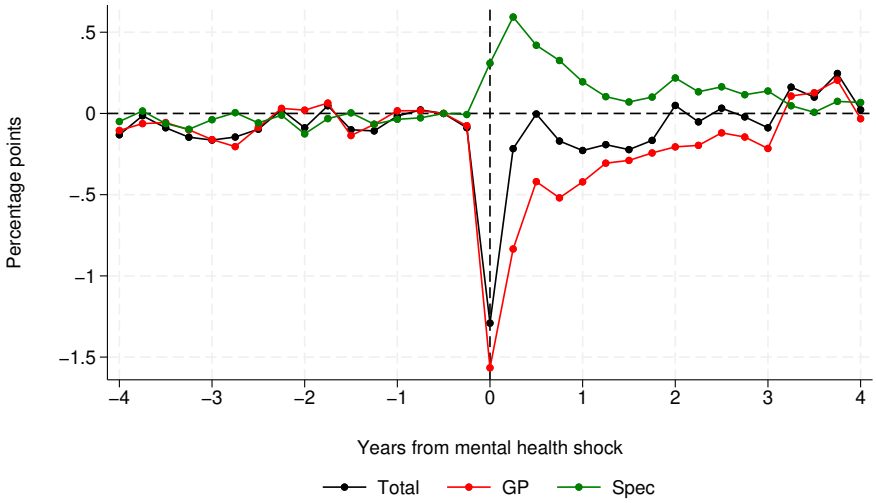
Anti-depresants Figure 5 shows the effect on antidepressant prescriptions by the type of prescriber. The figure shows a significant drop in antidepressant prescriptions in the quarter of the mental health shock of around 1.5 percentage points. This decline is driven by fewer prescriptions from GPs after the change in guidelines.

Appendix Figure 14 panel b shows that the decrease in prescriptions is short-term, and already one quarter after the mental health shock, the drop is statistically insignificant. The short-term decline in antidepressants seems to be caused by two underlying mechanisms: 1) a delay in prescriptions when referred to a specialist, and 2) a permanent drop in prescriptions for patients who would otherwise stay on antidepressants for a very short period of time. In Appendix Table 18 we show that only short term AD use is declining, while we find no effect on long term use. According to medical guidelines, patients are supposed to stay on antidepressants for at least 6 month after remission is achieved. This suggests that the patients no longer receiving antidepressants as a result of the reform, were never supposed to receive these in the first place, and that the drop in antidepressant use is a result in a decrease in inappropriate usage.

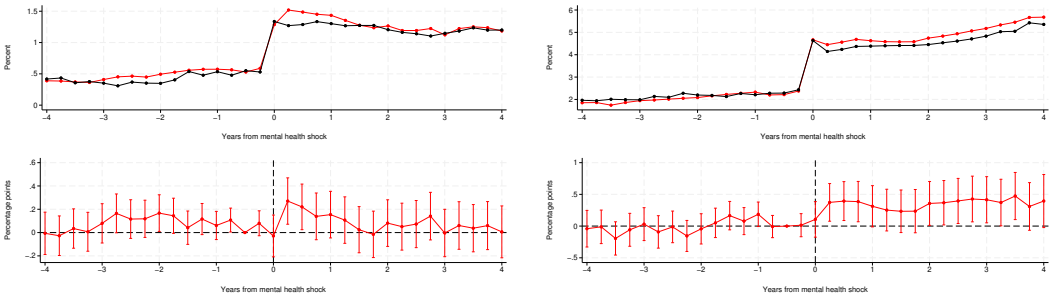
Specialists and generalists may prescribe different variations of the same drug. Specialists, with their greater knowledge and experience, may prescribe more tailored drugs to patients (Currie and MacLeod, 2020). Additionally, GPs are advised to prescribe particular types of drugs when initiating treatment, for example, Sertralin or Citalopram. Figure 6, panel A, shows that patients seeing a specialist are more likely to be prescribed "non-standard" antidepressants, in line with the conjecture that specialists use a broader range of drugs. This is also seen in Appendix Table 18 column 4.[25]

[25]Non-standard anti-depressants is defined as not receiving the drug that is among the 5 most common in the

Figure 5: Anti-depressant use by prescriber



Note: The figures show the estimate on antidepressant prescriptions by the type of prescriber from the dynamic ES-DD model, equation 14. The prescriber is identified by the the prescriber ID on each prescription. Standard errors are clustered at the individual level.



A: Specialized AD **B:** Other psychotropic drugs

Figure 6: Reduced form evidence on non-standard anti-depressants and other psychotropic drugs

Note: The figures show the estimate on medication use from the dynamic ES-DD model, equation 14. Specialized anti-depressants is defined as not receiving the drug that is among the 5 most common in the year and for people in the same age group. Other psychotropic drugs include antipsychotics, psycho-stimulants, medications for anxiety, and sleeping medication. The upper panel shows the mean outcome for the treatment group and the counterfactual. The bottom panel shows the difference between the treatment and counterfactual along with 95 pct confidence intervals. Standard errors are clustered at the individual level.

Table 5: IV estimates

	(1) Other med	(2) Anti-psychotics	(3) Anti-anxiety and Sleep	(4) Psycho-stimulants
All	0.357***	0.266***	0.182	0.088
	(0.132)	(0.090)	(0.113)	(0.058)
Mean	0.011	0.004	0.007	0.002
N	8,693,124	8,693,124	8,693,124	8,693,124

Notes: The table shows IV from equation 17, from four years prior to the mental health shock and one year after. The data are aggregated at the monthly level. The outcomes are first prescription with a given medication within 12 months. *Other med* is a summary measure of the medications listed in columns 2-4. Standard errors are clustered at the individual level. *** p <0.01, ** p <0.05, * p <0.1.

Other psychotropic drugs Figure 6, panel B, shows the effect on use of other psychotropic drugs than anti-depressants, defined as anti-psychotics medication, psycho-stimulants, anti-anxiety, and sleep medication. The figure shows an increase use of other type of drugs in all subsequent periods after the mental health shock for the treatment group compared to the counterfactual.

Table 11 shows that in the first 12 months after the mental health shock, the use of other psychotropic drugs increase by 0.8 percentage points (8 %) on average. The second row of Table 11 demonstrates that the increase in the use of other types of psychotropic drugs is driven by specialists. This suggests that the reform did not make GPs substitute to other drugs, but the reform increased treatment conducted by specialists, consequently leading to higher utilization of other drugs. The increase in utilization of other drugs is driven by anti-psychotic medication. Furthermore, we find suggestive evidence of increased use of sleep medication, anti-anxiety drugs, and psychostimulants. Table 5 shows the IV results, where the reduced form estimates are rescaled by the share of compliers. Column 1 shows that for every 10 complier, 3 additional individuals received other types of psychotropic drugs, which is largely driven by a large increase in anti-psychotic medication.

The results show that there are dramatic differences in the type of medical treatment compliers receive when they are treated by their GP compared to a medical specialist. Not only do they receive other types of antidepressants, but they are receive other types of medication, not typical for moderate depression or anxiety. The large treatment differences is especially driven by girls, ethnic minorities and individuals of parents with a short education, as shown in

year and for people in the same age group.

Appendix Table 20.

5.4 Mechanisms

The change in medical guidelines affected only young individuals with moderate depression and anxiety. If GPs could correctly diagnose and refer the right patients to medical specialists, we would not expect to see an increase in the use of antipsychotic medication or contacts due to severe depression. In this section, we investigate the underlying mechanisms behind our main results. First, we examine the role of GPs' diagnostic skills and their preferences for referring patients to specialists. Second, we explore whether an increase in wait time from the shock to treatment could be a driving mechanism. Lastly, we assess non-compliance with the revised guidelines and the role of the supply of medical specialists.

5.4.1 GP diagnostic skill and referral preferences

To separate these effects, we use our estimated measures of GP diagnostic skill and referral preferences. We run our ES-DD regressions using equation (16), fully interacted with ranks of GP diagnostics skill and referral preferences, normalized to be between -0.5 and 0.5 such that the baseline effect measures the reform-effect of a GP with median diagnostic skill and preferences, while the interactions measure the difference between top and bottom GPs in terms of diagnostic skill and referral preferences. For simplicity, we report reduced form estimates. Table 6 shows the results. From this, it follows that the change in severe diagnoses is driven by GPs with low diagnostic skills and a high referral threshold (low referral preferences). This fits the predictions of the theoretical model, in that GPs with low diagnostic skills, for given referral threshold, are more likely to refer severe cases after the change in guidelines. Furthermore, intuitively, GPs with low diagnostic skills, but low referral thresholds are unlikely to refer severe cases as a result of the reform, because the severity of these patients is too far above the referral threshold to be on the margin. We find analogous results on mild diagnoses. These are caused by GPs with low diagnostic skills and low referral thresholds (high referral preferences). Again, this is in line with theory. The marginal referral of a GP with low diagnostic skill is more spread out across severities, but mild cases are unlikely to be on the margin of referral, unless the GPs referral threshold is fairly low.

Together, these results suggest that a key issue in despecialization policies is to ensure that GPs have sufficient diagnostic skills. This also suggests that policies aimed at improving

Table 6: Severity results by diagnostic skill and referral preferences (reduced form estimates)

	Mild	Moderate	Severe	Severe, psychotic
Base	0.134	0.811***	0.232**	0.015
	(0.097)	(0.175)	(0.095)	(0.037)
# Diag. skill	-0.075	0.527	-0.517	0.136
	(0.351)	(0.633)	(0.327)	(0.129)
# Referral Pref.	0.280	0.753	-0.823	0.228
	(0.363)	(0.654)	(0.341)	(0.141)
# D. Skill # Ref. Pref.	-0.103	1.248	-0.117	-0.856
	(1.100)	(1.879)	(0.985)	(0.421)

Notes: xxx

diagnostic skill, including providing better diagnostic tools and additional training, could have a large impact on patient outcomes without the need to increase the supply of specialists.

5.4.2 Waiting time

An alternative explanation for the increase in severe diagnoses is that the delay in treatment due to the reform causes moderate depression to worsen into severe depression while waiting to see a specialist. Figure 4 suggests that individuals affected by the reform may have experienced a longer waiting time from the health shock to the time of treatment. Assuming no waiting days from the time of the mental health shock to the time of antidepressant prescription, the reform and the referral to a specialist could, in some cases, considerably delay the time of treatment. Assuming that psychiatric hospital contacts within one year of the psychometric test is caused by the mental health shock, the median waiting time was 30 days for the first contact with a specialist, and the waiting time from a health shock to the first prescription increased by 2 weeks on average for the treatment group before and after the change in guidelines. The hypothesis that the increase in severe depression is caused by a delay in treatment seems unlikely.

While we cannot completely rule out that treatment delay causes moderate depression to develop into severe depression before contact with the psychiatric hospital, we test if the individuals who wait longer are also the ones diagnosed with severe depression at the hospital.

We group waiting time into tertiles and assume that all contacts within the first 6 months are referrals from the initial shock and estimate the effect of being in a certain waiting time tertile on being diagnosed with the four different types of depression severity simultaneously.[26]

[26] Assuming that all contacts within the first 6 months are referrals from the initial shock is likely to be a

Appendix 21 shows that the increased contacts with severe depression are driven by individuals with the shortest waiting time, who are waiting for a maximum of one month from the time of the health shock to the first contact with the psychiatric hospital. We can redo the analysis with waiting time from the mental health shock to the first prescription, using the same method as above.

5.4.3 Compliance

We can characterize the compliers using the method by Angrist and Pischke (2009). While individual compliers cannot be identified, we can characterize the composition of the group with respect to observable characteristics. By dividing the first-stage estimate for a particular group of individuals, such as women, by the full-population first-stage estimate, we can calculate the share of this particular group among the total group of compliers. From Table 7, we see that compliers are slightly more likely to be female and from the ethnic majority. Individuals with parents with a short education have a much higher probability of being compliers compared to the general sample. The compliers are also more likely to have experienced a mental health condition in the past, and to have parents who have been prescribed a psychotropic drug.[27]

Patient characteristics Appendix Table 10 characterizes non-compliant patients when additional control variables are included. The table shows that patients who were marginally unaffected by the change in guidelines were more likely to be non-compliers. For instance, a 24-year-old patient was 3.4 percentage points more likely to be non-compliant compared to a 20-year-old patient. The table also shows that women and patients from high SES families are more likely to be non-compliers. The table also provides suggestive evidence that an increase in the length of the patient-GP relationship decreases the compliance rate. This may suggest that when the GP has more knowledge about the patient, they are more likely to treat them according to medical guidelines.

conservative measure. During the analysis period, there was a guaranteed maximum waiting time of 30 days from the time of referral to the first contact. Using a shorter period to estimate the waiting time length will reduce the average waiting time and not change the results.

[27] Comparing compliers referred to a private practice psychiatrist to those referred to a psychiatric hospital, we find few differences. However, compliers who are referred to the psychiatric hospital are more likely to have had a previous mental health shock, see appendix Table 19.

Table 7: Characteristics of Compliers, Always takers, Never Takers

	(1) Sample mean	(2) Compliers	(3) Always takers	(4) Never taker
Female	63.6	68.1	64.2	63.4
Ethnic majority	92.7	89.5	95.3	92.5
Low-SES	25.5	33.3	26.2	25.3
Previous mental illness	29.7	34.5	51.9	27.4
Parental MH issues	72.2	76.3	75.5	71.8
Municipality supply above median	51.3	35.4	58.8	50.8
GP Solo	27.7	24.4	27.0	27.8
GP Younger	62.0	56.2	64.2	61.9
GP Female	39.9	51.1	39.4	39.8
GP Majority	90.1	91.3	90.5	90.1

Notes: The table reports average characteristics of compliers, always takers, and never takers. The estimates are based on the ratio of the subgroup-specific first stage estimate to the overall first-stage estimate following Angrist and Pischke (2009). Average characteristics of the population is reported in Appendix Table 9. Low-SES is defined as having either a mother or father with primary school as their highest level of completed education. Previous mental illness is defined as either being prescribed a psychotropic drug or being in contact with a specialist in the past. Parental mental health is defined as having either a mother or father who have been prescribed a psychotropic drug in the past (measured after 1995 and the year before the mental health shock). GP solo indicates that there is only one physician in the GP clinic. GP younger refers to clinics where the GP is under the age of 54, which is the median age of GPs in the sample. GP female is defined as clinics where more than 50% of the physicians are female. GP majority refers to clinics where more than 50% of the physicians belong to the ethnic majority. All characteristics are measured one year before the mental health shock.

GP characteristics GPs in solo clinics are more likely to be non-compliers.[28] Older GPs are more likely to be non-complient. GPs who had a higher pre-reform prescription rate are also more likely to keep prescribing after the change in guidelines.

Supply of medical specialists A significant portion of geographical differences in medical care is driven by supply-side factors (see, e.g., Finkelstein et al. (2016)). To study the impact of supply side factors on non-compliance, we create two measures of the supply of medical specialists in an area.

First, we create a measure of area-specific supply of mental health specialists following a similar approach to Cuddy and Currie (2020). For each municipality, we calculate the percentage of the population that, after undergoing a psychometric test performed by their GP, saw a psychiatrist within 12 months. This measure is created for all patients, not just those in our analysis sample, to capture a broader area supply measure and focuses on the period before the change in medical guidelines.[29] As in many other medical contexts, we observe disparities in the availability of medical specialists across different geographical areas. The share of people who see a specialist within 12 months of a psychometric test ranges from 10.5% in the municipality at the 10^{th} percentile to 16.0% in the 90^{th} percentile.[30] Table 10 shows that patients living in an area with above-median specialist provision are more likely to comply with the changed medical guidelines. This suggests that part of the non-compliance rate could be caused by too few specialists in an area.

Second, we create a measure of waiting time to see a medical specialist. As the waiting time may differ for young individuals compared to adults, and by diagnosis, we calculate the average waiting time from the referral to the psychiatric hospital to the time of contact for individuals aged 20-24 in the period 2013-2014 with a depression or anxiety diagnosis. We use the period 2013-2014, as there was a large shift in the average waiting time for young individuals with depression and anxiety around 2013. Similar to the first measure, there is significant variation in the average waiting time for people across different municipalities. The waiting time ranges from 7.7 days in the municipality at the 10^{th} percentile to 31.5 days in the 90^{th} percentile. Table 10, column 5, shows that patients living in an area with above-median waiting time in

[28] Could this be driven by fewer patient observations and more extreme values because of this?

[29] We do not create a leave-out-mean measure as supply is measured in the period 2010-2014, and the analysis focusing on non-compliance covers the period 2015-2019.

[30] The correlation between the municipality-level specialist visits, unconditional on a psychometric test, and specialist visits following a psychometric test is 0.7086.

the pre-period are less likely to comply with the changed medical guidelines. This suggests that part of the non-compliance rate could be caused by GPs assessing that the waiting time to see a medical specialist is too long and deciding to treat the patient themselves.

5.5 Robustness of main results

In this section, we test the robustness of our main results, before we move on to estimate the effect on suicide attempts and labor market outcomes.

Adding controls In our main analysis, we did not include control variables. However, in Appendix Table 22, we added controls and fixed effects to demonstrate the robustness of our results. The table illustrates that our estimates remain unaffected by the inclusion of individual fixed effects, year fixed effects, and individual and year fixed effects.

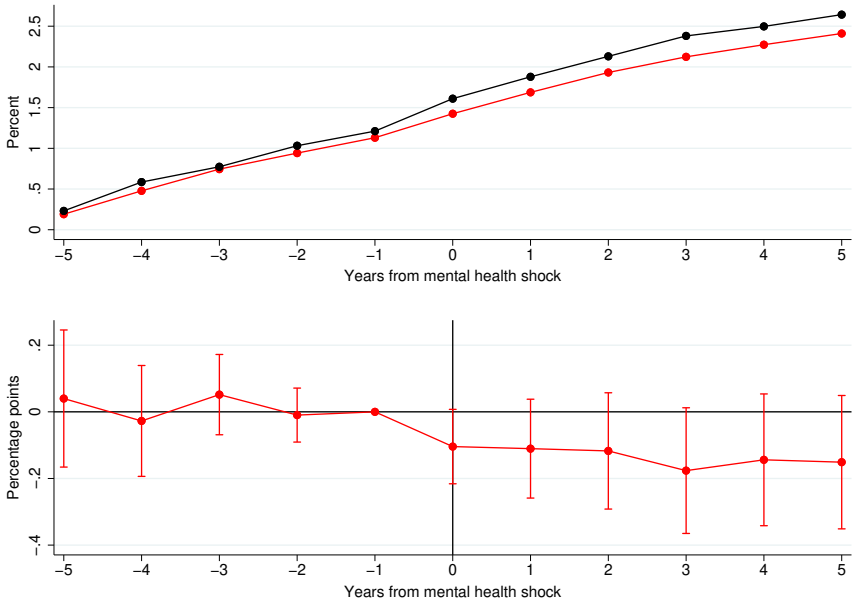
First shock Appendix Table 22 column 5 shows our main results restricted to only the first mental health shock. The results shows that our main results, execpt the effect on other medication, are robust to using cases of only the first mental health shock.

Exclude double treated Part of the treatment group may have already been treated by the changes implemented in 2011 regarding individuals below age 18, as mentioned in footnote 18. As a robustness check, we consider individuals who received treatment under both the 2011 and 2015 changes. In Appendix Table 22 column 6, we demonstrate that excluding this group does not alter our main results.

Alternative methods In our main analysis, we employed an ES-DD model and used the change in medical guidelines as an instrument for receiving treatment from a medical specialist. Alternative we could employ other types of empirical strategies. For example, we could do a more standard difference-in-difference method.

Appendix Figure 15 panel A plots the probability of having a specialist contact within one year of a mental health shock, by the year of the shock and the age at the time of the shock. The figure shows that the treatment and control group were on parallel trends in the 3 years before the change in guidelines. In 2015, where the guidelines changed for the 20-24 year olds, we see an immediate increase in the probability of a specialist contacts after a mental health

Figure 7: Suicide attempts (any so far)



Note:

shock. The control group seem unaffected by the change in guidelines. Appendix Figure 15 panel B plots the differences between the two lines in panel A.

5.6 Health Consequences

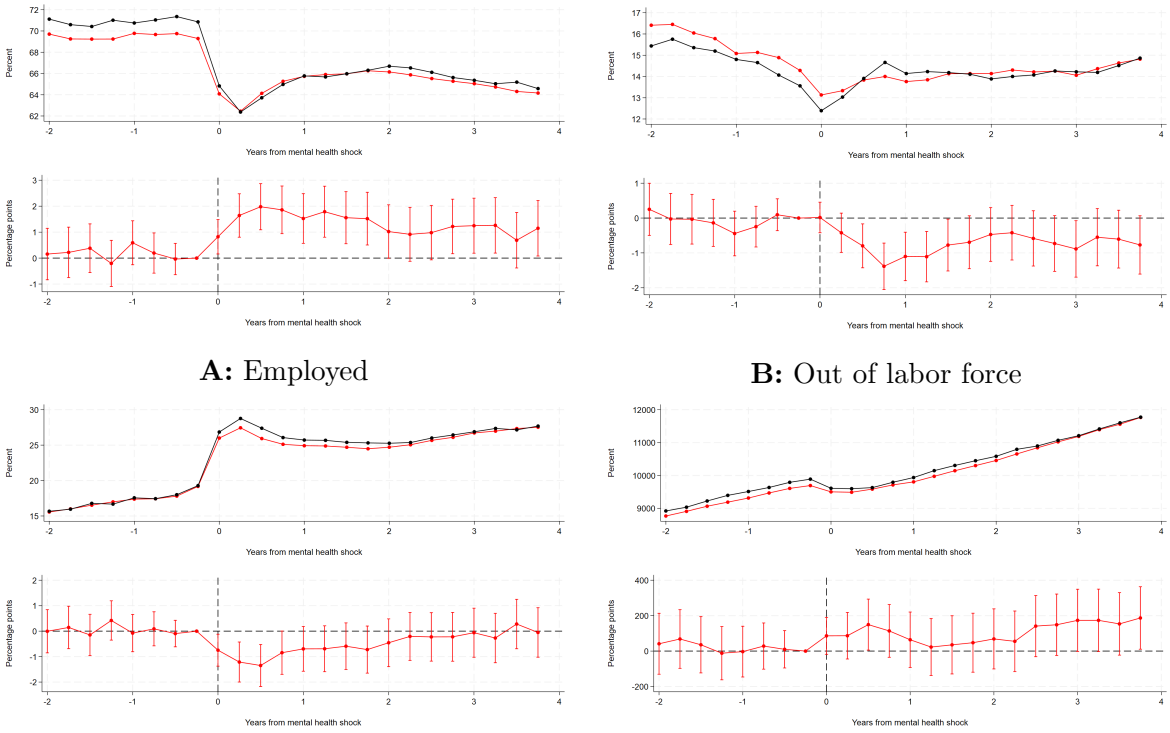
By now, we have demonstrated that the change in medical guidelines for depression and anxiety had a significant impact on the type of medical treatment patients received. Next, we ask: Does the specialized treatment and the changes in treatment improve the patients' mental health?

To answer this question we follow the literature and use suicide attempts to measure mental health. As suicide attempts are relatively rare, we estimate the effect on the yearly level, and calculate the effect on the on having any suicide attempts so far. That is, once an individual have attempted suicide variable will take the value one for all subsequent periods.

The lower panel of Figure 7 shows that before the time of the mental health shock the treatment group and the counterfactual ran parallel. At the time of the mental health shock, we find a decrease in suicide attempts for the treatment group compared to the counterfactual.[31]

[31]The effect is not caused by a jump in the control group, but the absence of a jump for the treatment group compared to the counterfactual scenario.

Figure 8: Labor market outcomes



A: Employed

B: Out of labor force

C: Temporary transfers

D: Hours worked, conditional on employment

Note: Employment is full time employment and studying.

As an alternative measure of mental health, we also use psychiatric hospital contacts related to eating disorders. The medical literature suggests that eating disorders can develop following untreated depression or anxiety (Godart et al., 2007). Appendix Figure 16 illustrates the effect of the change in medical guidelines on psychiatric hospital contacts for eating disorders. The figure shows a decrease in contacts, with a slight delay compared to the mental health shock, suggesting that the change in medical guidelines improved treatment for depression and anxiety, which could potentially reduce the risk of developing an eating disorder.

5.7 Labor market

Figure 8 panel A shows the reduced form effect on the probability of being employed in the years following a mental health shock. The upper panel of the figure illustrates that the employment rate following a mental health shock is declining; however, this decline is smaller for the treatment group, suggesting that specialized care at the time of a mental health shock has a mediating impact on employment status. The lower panel of panel A in Figure 8 displays the

difference between the treatment group and the counterfactual, along with 95 percent confidence intervals. The figure indicates that while there are no differences in employment rates prior to the shock, the treatment group has a 1.5-2 percentage point higher probability of being employed in the subsequent years. The effect appears to be persistent, as it slightly increases over time.

Figure 8 panel B shows that following a mental health shock the probability of being outside the labor force increases. Consistently with the effect on employment, the figure shows that specialized care reduces the probability of leaving the labor force, e.g. being on sick leave or other type of public assistance.

6 Conclusion

This paper studies the consequences of despecialization in the context of treatment for depression and anxiety. Using a change in guidelines in Denmark in 2015 and a combination of event study and Difference-in-Differences models, we find large differences in the treatments prescribed to identical patients when treated by a specialist rather than a GP. Patients treated by a specialist receive more atypical antidepressants, as well as other medications, including anti-psychotic drugs. As a consequence, these patients face lower risks of suicide attempts and achieve better labor market outcomes. This suggests that despecialization policies should be implemented with caution, and that additional policies to improve treatment and diagnostic skills among GPs could be optimal.

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7 Appendix

7.1 Joint Probabilities and Mechanisms

Table 8 reports estimates on joint probabilities of using various drugs and seeing a specialist. We can use these estimates to understand the mechanisms behind the results on psychiatric drugs.[32] To see this, we start by writing the probability of using a given drug as the sum of the joint probability of using the drug (D) and seeing a specialist (S) and using the drug without seeing a specialist:

$$P(D) = P(D \cap S) + P(D \cap not\ S)$$

Table 8 reports results on these two joint probabilities. Consider the results on antidepressants. The use of antidepressants decreases as a result of the change in guidelines. This decrease is driven exclusively by the joint probability of using the drug and not seeing a specialist:

$$\Delta P(D) \approx \Delta P(D \cap not\ S) < 0$$

There are three ways in which the number of patients receiving antidepressants and not seeing a specialist ($D = 1, S = 0$) can decrease: (i) they may start seeing a specialist without changing antidepressant use ($D = 1, S = 1$). However, this would violate the finding that antidepressant use decreases. (ii) they may stop using antidepressants and still not see a specialist ($D = 0, S = 0$). However, this would violate the finding that the use of specialists increases. (iii) they may stop using antidepressants and start seeing a specialist at the same time ($D = 0, S = 1$). This is the only movement that doesn't violate the change in the use of antidepressants or specialists. Therefore, we can conclude that this movement must be driving the change in the joint probability, and, therefore, the total effect on antidepressants. Note that this is an argument about net effects. There may be some (i) and (ii) types, but they would have to be offset by even more (iii) types.

The results suggest that the decrease in antidepressants is driven by patients who would normally see a GP, but now see a specialist. In other words, the reduction in antidepressants is driven by compliers of the reform and not by patients who no longer receive antidepressants from their GP and don't get to see a specialist. Therefore, these results support the exclusion restriction.

[32] This analysis is inspired by Bhuller et al. (2020), Table B15 and footnote 41.

Table 8: Joint probabilities: Drug use and seeing a specialist

	Not t4 AD	Other	Anti-psych.	Sleep	Anxiety	Psycho-stim.
All	0.609**	1.261***	0.674**	0.773**	0.301	0.329
	(0.287)	(0.455)	(0.305)	(0.330)	(0.242)	(0.204)
Joint prob.	0.875***	1.487***	0.836***	0.777***	0.329*	0.316*
	(0.206)	(0.338)	(0.262)	(0.218)	(0.172)	(0.188)
Mean	6.1	18.8	8.0	9.0	4.1	3.8
N	885,780	885,780	885,780	885,780	885,780	885,780

For the remaining outcomes in Table 8, drug use increases and this increase is entirely driven by the joint probability of using the drug and seeing a specialist:

$$\Delta P(D) \approx \Delta P(D \cap S) > 0$$

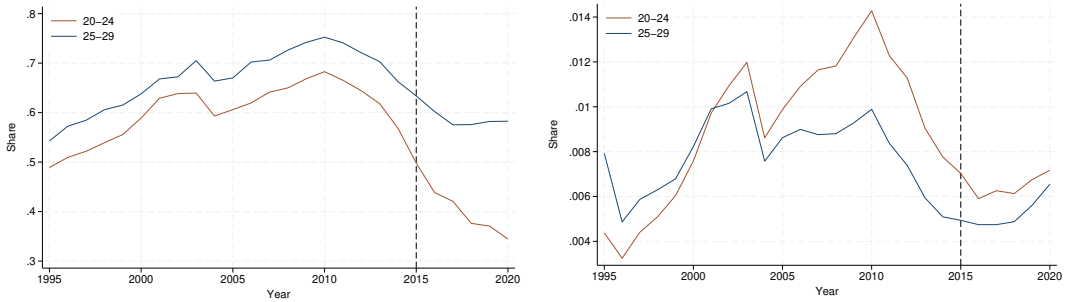
Again, the increase in the number of people using the drug and seeing a specialist ($D = 1, S = 1$) may come from three different groups: (*ii*) people who used the drug already, but didn't see a specialist ($D = 1, S = 0$). However, this would violate the finding that drug use increases. (*ii*) people who didn't use the drug initially, but did see a specialist ($D = 0, S = 1$). However, this would violate the finding that the use of specialists increases. (*iii*) people who didn't receive the drug and didn't see a specialist before ($D = 0, S = 0$). This is the only movement that doesn't violate changes in the use of the drug or specialists. Therefore, we can conclude that this movement must be driving the change in the joint probability, and, therefore, the increase in drug use.

Hence, the results are driven by patients seeing a specialist rather than GPs substituting towards other drugs than antidepressants.

Table 9: Summary Statistics

	(1) Full pop	(2) Analysis sample	(3) Treat	(4) Contr
Age	24.406	24.447	23.212	26.185
Female	0.490	0.590	0.604	0.569
Ethnic majority	0.812	0.909	0.920	0.892
Low SES	0.270	0.303	0.284	0.331
Any mental health services	0.101	0.263	0.279	0.240
Enrolled in education	0.439	0.458	0.502	0.397
No high school	0.288	0.340	0.392	0.268
Parent previous mental health condition	0.586	0.712	0.720	0.701
Number of individuals	1,172,235	90,324	50,944	39,380

Notes: The table shows summary statistics for all individuals of the relevant ages and the analysis sample measured one month before the mental health shock. Low-SES is defined as having either a mother or father with primary school as their highest level of completed education. Previous mental illness is defined as either being prescribed a psychotropic drug or being in contact with a specialist in the past. Parental mental health is defined as having either a mother or father who have been prescribed a psychotropic drug in the past (measured after 1995 and the year before the mental health shock).



A: Share of first time AD prescribed by GP Robustness

B: Share of first time AD without a psychometric test

Figure 9: Antidepressants (AD) prescriptions and GP prescription share

Note: Panel A shows the share of new antidepressant prescriptions initiated by general practitioners (GPs). Compared to the definition in Figure 1 Panel B, this measure is redefined to include patients whose first antidepressant (AD) prescription was issued by a GP, as identified by the prescriber ID, *and* who had no contact with a psychiatrist within three months of the initial prescription. Panel B shows the share of patients prescribed ADs for the first time and did not get a psychometric test by their GP before the prescription was filled.

Table 10: Non-compliance - patient level

	(1)	(2)	(3)	(4)	(5)
Female	0.016	0.026**	0.026**	0.028**	0.029**
	(0.010)	(0.011)	(0.011)	(0.012)	(0.012)
Age 21	-0.024	-0.025	-0.025	-0.021	-0.020
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Age 22	-0.039*	-0.031	-0.031	-0.030	-0.030
	(0.023)	(0.025)	(0.025)	(0.025)	(0.025)
Age 23	-0.012	-0.014	-0.014	-0.015	-0.015
	(0.022)	(0.023)	(0.023)	(0.025)	(0.024)
Age 24	0.034*	0.036*	0.036*	0.036*	0.036*
	(0.020)	(0.021)	(0.021)	(0.020)	(0.020)
Ethnic majority	-0.048*	-0.049	-0.049	-0.045	-0.044
	(0.025)	(0.033)	(0.033)	(0.037)	(0.036)
Low SES	-0.011	-0.019*	-0.019*	-0.020**	-0.018*
	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)
Parental mental health	0.010	0.004	0.004	0.008	0.008
	(0.014)	(0.013)	(0.013)	(0.014)	(0.013)
GP Patient relationship	-0.001	-0.002*	-0.002*	-0.003**	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GP Solo		0.023**	0.023**	0.022*	0.023*
		(0.011)	(0.011)	(0.012)	(0.012)
GP age		0.004***	0.004***	0.003**	0.003**
		(0.001)	(0.001)	(0.001)	(0.001)
GP female		-0.002	-0.002	-0.018	-0.018
		(0.018)	(0.018)	(0.017)	(0.017)
GP Ethnic majority		-0.054*	-0.054*	-0.047	-0.050
		(0.029)	(0.029)	(0.032)	(0.031)
GP pre-reform prescription rate			0.168***	0.201***	0.199***
			(0.039)	(0.034)	(0.034)
Municipality specialist supply above median				-0.082***	-0.068***
				(0.023)	(0.017)
Municipality specialist waiting time above median					0.040**
					(0.018)
N	9,237	8,116	8,116	8,116	8,116
Mean	0.664	0.667	0.667	0.667	0.667
SD	0.473	0.471	0.471	0.471	0.471

Notes: The table presents the characteristics of non-compliant patient, controlling for GP characteristics, municipality effects, and the area-specific supply of specialists. Non-compliance is defined being prescribed AD from a GP and being between 20-24 during the period 2015-2017. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 11: Non-compliance - GP level

	(1)	(2)	(3)	(4)	(5)
GP Solo	0.000	0.017	0.016	0.010	0.010
	(0.018)	(0.020)	(0.020)	(0.019)	(0.019)
GP age	0.004***	0.004***	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GP female	-0.026	-0.013	-0.010	-0.026	-0.027
	(0.023)	(0.025)	(0.026)	(0.025)	(0.025)
GP Ethnic majority	0.021	0.031	0.046	0.060	0.058
	(0.035)	(0.037)	(0.038)	(0.039)	(0.039)
GP pre-reform prescription rate		0.153***	0.148***	0.175***	0.172***
		(0.046)	(0.046)	(0.044)	(0.044)
Patient Female share			-0.013	0.005	0.012
			(0.075)	(0.072)	(0.072)
Patient average age			0.024	0.020	0.027
			(0.048)	(0.041)	(0.042)
Patient ethnic majority share			-0.199	-0.124	-0.121
			(0.128)	(0.115)	(0.114)
Patient Low-SES share			-0.063	-0.013	0.008
			(0.091)	(0.076)	(0.077)
Patient parental MH share			0.107	0.104	0.103
			(0.110)	(0.105)	(0.105)
Patient-GP relationship mean			0.001	-0.000	-0.000
			(0.002)	(0.002)	(0.002)
Municipality specialist supply above median				-0.085***	-0.074***
				(0.017)	(0.018)
Municipality waiting time above median					0.041**
					(0.018)
N	1,522	1,293	1,293	1,293	1,293
Mean	0.641	0.646	0.646	0.646	0.646
SD	0.315	0.307	0.307	0.307	0.307

Notes: The table presents the characteristics of non-compliant GPs, controlling for patient characteristics, municipality effects, and the area-specific supply of specialists. Non-compliance is defined as GPs prescribing antidepressants to patients aged 20-24 during the period 2015-2017. Only GPs with at least 2 patients getting AD in the period is included. The table looks similar if increase the minimum number of patients. *** p <0.01, ** p <0.05, * p <0.1.

Table 12: Summary Statistics on GPs provision of mental health related services

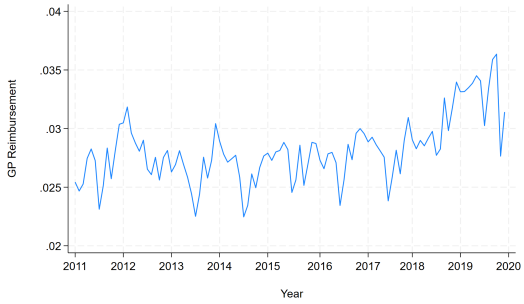
	(1) Treatment pre	(2) Treatment post	(3) Control pre	(4) Control Post
Any mental health consultations	0.331	0.348	0.343	0.373
	(0.471)	(0.480)	(0.475)	(0.486)
Any psychometric tests	0.078	0.098	0.078	0.089
	(0.269)	(0.297)	(0.268)	(0.285)
Any contact with psychologist	0.291	0.241	0.317	0.254
	(0.456)	(0.428)	(0.468)	(0.437)
Number of mental health consultations	0.842	0.854	0.918	0.977
	(1.550)	(1.514)	(1.638)	(1.654)
Number of psychometric tests	0.579	0.556	0.625	0.591
	(1.214)	(1.136)	(1.329)	(1.227)
Contacts with psychologist	2.070	1.603	2.349	1.776
	(4.234)	(3.730)	(4.529)	(3.919)
Number of observations	25,446	25,355	20,328	19,624

Notes: The table shows summary statistics on services provided by GPs to the treatment and control groups during the pre- and post-treatment periods. The outcomes are measures within the first year a mental health shock. The treatment group consists of individuals who experienced a mental health shock between the ages of 20 and 24, while the control group includes those who experienced a mental health shock between the ages of 25 and 29. The pre-period is defined as shocks occurring between 2012 and 2014, and the post-period as shocks occurring between 2015 and 2017.

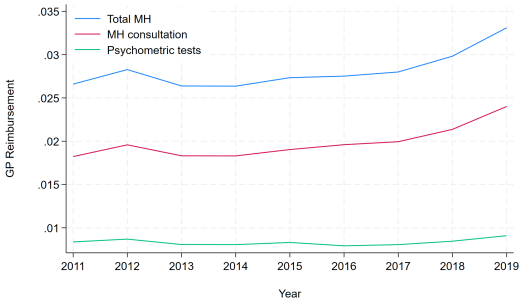
Table 13: Summary Statistics on GPs provision of mental health related services

	(1) Mean	(2) SD	(3) P10	(4) P90	(5) Observations
Any mental health consultations	0.338	0.224	0.038	0.654	18,631
Any psychometric tests	0.082	0.126	0.000	0.214	18,631
Any contact with psychologist	0.290	0.118	0.143	0.438	18,631
Number of mental health consultations	0.867	0.638	0.056	1.732	18,631
Number of psychometric tests	0.602	0.427	0.204	1.089	18,631
Contacts with psychologist	2.078	1.054	0.788	3.400	18,631

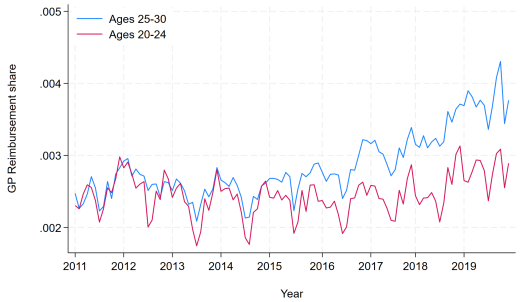
Notes: The table shows summary statistics on services provided by GPs within the first year of a mental health shock. The table shows summary statistics only for the treatment group in the pre-period. P10 and P90 are pseudo percentiles and are calculated over 5 observations.



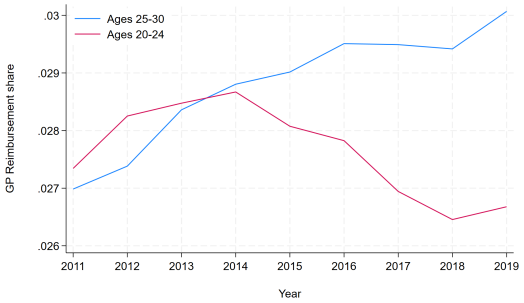
A: GP reimbursement from mental health services



B: GP reimbursement from mental health services by type



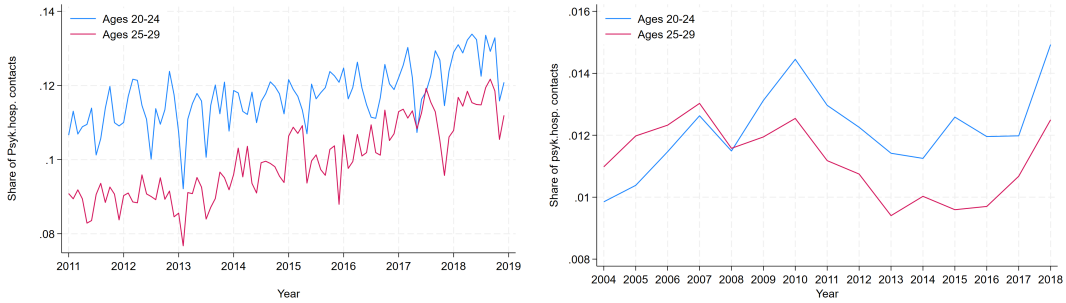
C: GP reimbursement from mental health services for the treatment and control group



D: Total reimbursement from visits for the treatment and control group

Figure 10: GP reimbursement

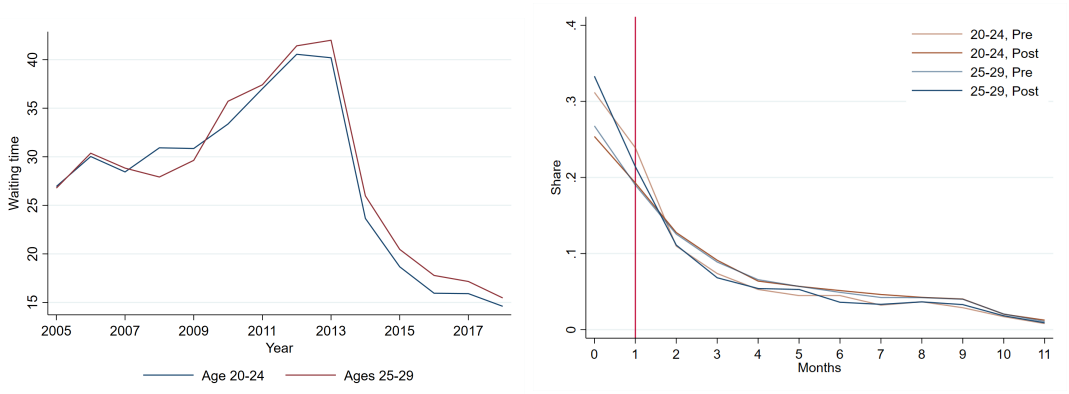
Note: The figure shows the GPs reimbursement from different services and for different age groups. Panel A shows the share of GPs' reimbursements attributed to mental health services over time. This measure includes patients of all ages, not just those in the analysis (ages 20–29). Panel B breaks down GPs' reimbursements from mental health services into two categories: mental health consultations and psychometric tests, for patients of all ages. Panel C shows reimbursements from mental health services specifically for the groups included in our analysis, separated into treatment and control groups. Panel D showsthe average GP reimbursement from all visits for the treatment and control groups.



A: All diagnoses **B:** cond. depression and anxiety

Figure 11: Share of psychiatric hospital contacts for patients in given age range out of all contacts

Note: The figure shows the treatment and control groups contact with the psychiatric hospital. Panel A shows the proportion of total psychiatric hospital contacts accounted for by individuals aged 20–24 and 25–29. This measure includes all reasons for contact, not limited to depression and anxiety. Panel B shows the proportion of total psychiatric hospital contacts for individuals aged 20–24 and 25–29 specifically related to depression and anxiety.

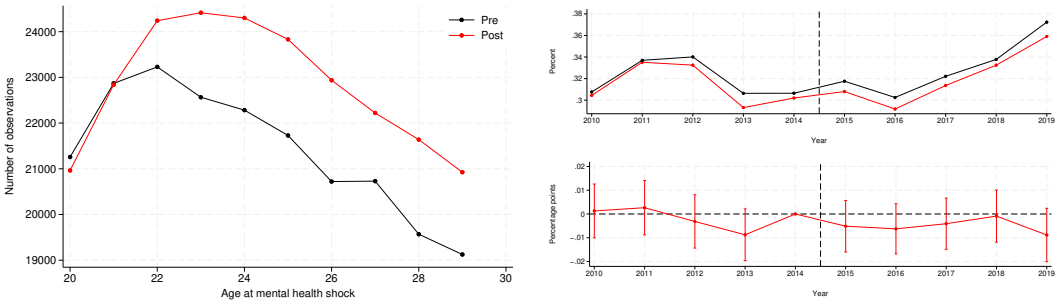


A: by year

B: Months from MH shock to specialist contact

Figure 12: Waiting time by time period and by group

Note: Panel A



A: By age

B: By year

Figure 13: Number of mental health shock (psyc. tests) by age and year

Note: The figure shows the number of individuals getting the a psychometric test. Panel A shows the numbers by age, separately before and after the change in guidelines. Panel B shows the numbers by year, separately for the treatment and control groups.

Table 14: Manipulation test

	(1) Female	(2) Ethnic majority	(3) Previous MH	(4) Parental MH	(5) Primary School	(6) Employed
Treat × Post	0.009	-0.000	0.005	-0.004	-0.002	0.002
	(0.005)	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)
Mean	0.636	0.927	0.262	0.722	0.384	0.708
N	442,392.0	442,392.0	442,392.0	442,392.0	442,392.0	442,392.0

Notes: The table shows xxx

Table 15: First Stage by type of specialist

	Any specialist	PPP	Psyc. Hosp.
All	2.643***	1.865***	1.661***
	(0.411)	(0.256)	(0.370)
Mean	22.885	9.160	16.932
N	8,693,124	8,693,124	8,693,124

Notes: The table shows first stage estimates from equation 16 by the type of specialists. PPP stands for private practice psychiatrists.

Table 16: First Stage by type of specialist

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All	Boys	Girls	DK	Non DK	Low SES	High SES
Specialist	2.6426***	2.0805***	2.9756***	2.5195***	3.9471***	3.5630***	2.2472***
	(0.3156)	(0.5400)	(0.3882)	(0.3316)	(1.0276)	(0.6031)	(0.3888)
F-test	70.1134	14.8419	58.7468	57.7294	14.7540	34.9026	33.4072
Mean	20.7598	22.7979	19.5804	21.0836	16.9053	22.4193	20.1942
N	8,693,124	3,188,895	5,504,229	7,979,768	713,356	2,666,018	5,514,958

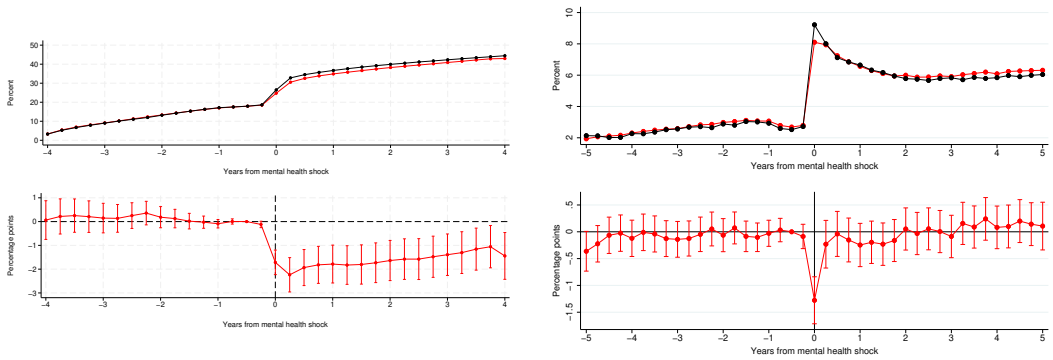
Notes: The table shows first stage estimates from equation 16 by the type of specialists. PPP stands for private practice psychiatrists.

Table 17: IV estimates - Health care utilization

	(1) Any GP visit	(2) Any psych. test	(3) Any GP therapy	(4) Any therapy	(5) N GP visits	(5) N psych. tests	(6) N GP therapy	(7) N therapy	(8) Phyc hosp - Outpatient	(9) Phyc hosp - ER	(10) Phyc hosp - Inpatient
All	0.188	-0.337	-1.804***	0.934	-0.408	0.033	-2.419***	1.570	6.268***	0.027	-0.084
	(0.828)	(0.338)	(0.599)	(0.868)	(1.569)	(0.498)	(0.774)	(1.592)	(1.149)	(0.222)	(0.141)
Mean	0.330	0.110	0.065	0.071	0.477	0.131	0.080	0.121	0.064	0.006	0.002
N	8,693,124	8,693,124	8,693,124	8,693,124	8,693,124	8,693,124	8,693,124	8,693,124	8,693,124	8,693,124	8,693,124

Notes: The table shows IV from equation 17, from four years prior to the mental health shock and one year after. The data are aggregated at the monthly level. *** p <0.01, ** p <0.05, * p <0.1.

Figure 14: Reduced form evidence on antidepressants use



A: Ever recieved AD

B: Antidepressants

Note: The figures show the estimate on AD use from the dynamic ES-DD model, equation 14. The upper panel shows the mean outcome for the treatment group and the counterfactual. The bottom panel shows the difference between the treatment and counterfactual along with 95 pct confidence intervals. Standard errors are clustered at the individual level.

Table 18: IV estimates - Anti-depressant use

	(1) AD	(2) Short term AD use	(3) Long term AD use	(4) Specialized AD
All	-0.740***	-0.616***	-0.124	0.259***
	(0.224)	(0.158)	(0.142)	(0.088)
Mean	0.018	0.008	0.010	0.003
N	8,693,124	8,693,124	8,693,124	8,693,124

Notes: The table shows IV from equation 17, from four years prior to the mental health shock and one year after. The data are aggregated at the monthly level. Short term AD use is defined as use for less than 6 months. Long term AD use is defined as use for more than 6 months. Use is defined from filled prescriptions. Specialized AD is defined as not receiving the drug that is among the 5 most common in the year and for people in the same age group. Standard errors are clustered at the individual level. *** p <0.01, ** p <0.05, * p <0.1.

Table 19: Complier characteristics by type of specialist

	(1) Any specialist	(2) Psychiatrist	(3) Psyc. Hospital	(4) Difference
Female	67.6781	66.7595	68.7894	-2.1480
				(1.4929)
DK	89.5051	88.1968	90.3247	-1.8031**
				(0.8528)
Low-SES	33.6487	33.9589	33.7540	0.1384
				(1.2848)
Previous mental illness	34.6275	26.9821	38.8568	-10.7475***
				(1.6541)
Parental MH issues	71.8088	73.2998	70.8879	1.1424
				(1.5234)
High Supply	35.3860	50.0459	27.2017	24.1545***
				(1.5300)
GP Solo	25.1488	31.6116	21.3269	10.6306***
				(1.1796)
GP Younger	40.1144	56.3739	30.9595	28.0556***
				(1.8422)
GP Female	51.7672	58.1309	46.8034	11.3545***
				(1.4997)
GP Majority	92.9463	91.6520	93.8952	-2.3596***
				(0.7567)

Notes: The table reports the average characteristics of compliers for any specialist visit, as well as by type of specialist. Column 4 shows the difference in characteristics between compliers who visit private practice psychiatrists (column 2) and those who visit psychiatric hospitals (column 3). Asterisks indicate that the share of compliers with a given characteristic is significantly different between the two types of specialists. Hypothesis tests are based on bootstrapped standard errors with 100 repetitions and clustered sampling at the individual level. The estimates are based on the ratio of the subgroup-specific first stage estimate to the overall first-stage estimate following Angrist and Pischke (2009). Average characteristics of the population is reported 9. Low-SES is defined as having either a mother or father with primary school as their highest level of completed education. Previous mental illness is defined as either being prescribed a psychotropic drug or being in contact with a specialist in the past. Parental mental health is defined as having either a mother or father who have been prescribed a psychotropic drug in the past.

Table 20: Heterogeneous Effects

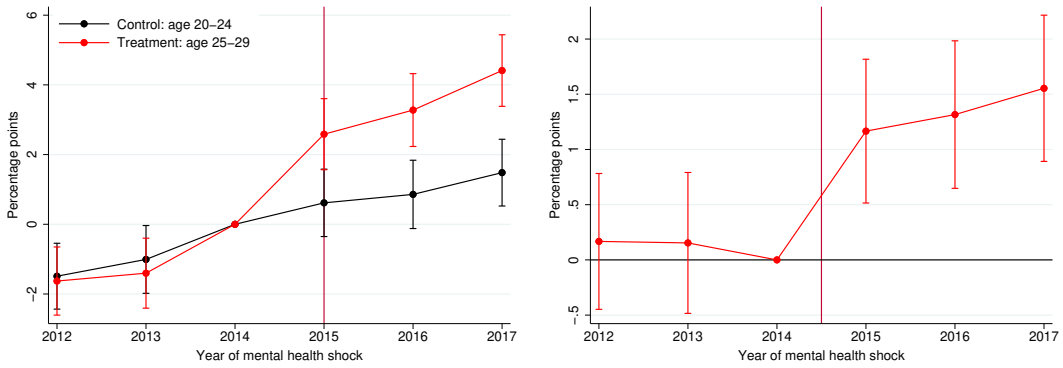
	(1) Specialized AD	(2) Other med	(3) Anti-psychotics	(4) Anti-Anxiety and sleep med.	(5) Psycho-stimulants
All	0.2586***	0.3567***	0.2658***	0.1822	0.0879
	(0.0884)	(0.1325)	(0.0904)	(0.1127)	(0.0584)
Mean	0.0031	0.0110	0.0045	0.0068	0.0021
N	8,693,124	8,693,124	8,693,124	8,693,124	8,693,124
Boys	0.2136	0.4107	0.2497	-0.0540	0.2527
	(0.1815)	(0.2957)	(0.2112)	(0.2431)	(0.1595)
Mean	0.0033	0.0128	0.0058	0.0074	0.0030
N	3,188,895	3,188,895	3,188,895	3,188,895	3,188,895
Girls	0.2802***	0.3478**	0.2793***	0.2823**	0.0251
	(0.0995)	(0.1426)	(0.0938)	(0.1274)	(0.0538)
Mean	0.0030	0.0099	0.0037	0.0065	0.0015
N	5,504,229	5,504,229	5,504,229	5,504,229	5,504,229
DK	0.2837***	0.3375**	0.2179**	0.2312*	0.0804
	(0.0983)	(0.1447)	(0.0978)	(0.1246)	(0.0653)
Mean	0.0031	0.0112	0.0047	0.0069	0.0022
N	7,979,768	7,979,768	7,979,768	7,979,768	7,979,768
Non DK	0.1253	0.4604	0.5537**	-0.1791	0.1480
	(0.1927)	(0.3159)	(0.2494)	(0.2748)	(0.1051)
Mean	0.0027	0.0087	0.0026	0.0067	0.0009
N	713,356	713,356	713,356	713,356	713,356
Low SES	0.2202*	0.0799	0.2830**	-0.1184	0.0421
	(0.1195)	(0.1885)	(0.1344)	(0.1585)	(0.0881)
Mean	0.0033	0.0122	0.0053	0.0072	0.0025
N	2,666,018	2,666,018	2,666,018	2,666,018	2,666,018
High SES	0.3046**	0.3955**	0.1161	0.3869**	0.1020
	(0.1329)	(0.1935)	(0.1234)	(0.1770)	(0.0822)
Mean	0.0030	0.0108	0.0044	0.0067	0.0020
N	5,514,958	5,514,958	5,514,958	5,514,958	5,514,958

Notes: The table shows IV from equation 17, from four years prior to the mental health shock and one year after. The data are aggregated at the monthly level. The outcomes are first prescription with a given medication within 12 months. Specialized anti-depressants is defined as not receiving the drug that is among the 5 most common in the year and for people in the same age group. *Other med* is a summary measure of the medications listed in columns 2-4. Low-SES is defined as having either a mother or father with primary school as their highest level of completed education. High-SES is defined as having both a mother or father with above primary school as their highest level of completed education. Standard errors are clustered at the individual level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 21: IV estimates - Depression Severity and Waiting time

	(1) Mild	(2) Moderate	(3) Severe	(4) Severe, psychotic
Short wait	0.0147	0.1973***	0.0702**	0.0053
	(0.0296)	(0.0584)	(0.0315)	(0.0113)
Midt wait	0.0825***	0.1114**	0.0123	0.0147
	(0.0304)	(0.0506)	(0.0252)	(0.0116)
Long wait	0.0087	0.0623*	0.0300	0.0062
	(0.0191)	(0.0352)	(0.0200)	(0.0088)
Missing wait	0.0081	0.0107	0.0080	0.0020
	(0.0097)	(0.0154)	(0.0076)	(0.0026)
N	8,250,732	8,250,732	8,250,732	8,250,732

Notes: Waiting time is grouped into tertiles (assuming that all contacts within the first 6 months are referrals from the initial shock) and we estimate the effect of being in a certain waiting time tertile on being diagnosed with the four different types of depression severity simultaneously. Short waiting time is one month or less, midl. waiting time is between 1 and 3 months, and long waiting time is more than 3 months



A: By age group **B:** Difference between age groups

Figure 15: Difference-in-Difference on specialist contacts

Note: Panel A plots the probability of having a specialist contact within one year of a mental health shock, by the year of the shock and the age at the time of the shock including 95 pct confidence intervals. Panel B shows the differences between the two lines in panel A including 95 pct confidence intervals. Standard errors are clustered at the individual level.

Table 22: Robustness Check: Adding Fixed effects

	(1) Baseline	(2) Year FE	(3) + Ind. FE	(4) Pre. treatment ctr.	(5) First Shock	(6) Excl. double treated
Specialist	2.64***	2.62***	2.62***	2.69***	3.01***	2.54***
	(0.41)	(0.41)	(0.41)	(0.42)	(0.49)	(0.41)
Anti-depressants	-0.74***	-0.75***	-0.76***	-0.78***	-0.58***	-0.76***
	(0.22)	(0.23)	(0.23)	(0.23)	(0.23)	(0.24)
Not top 5 antidep	0.26***	0.26***	0.26***	0.24***	0.18**	0.26***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Other med	0.36***	0.36***	0.35***	0.32**	0.12	0.36***
	(0.13)	(0.13)	(0.13)	(0.13)	(0.14)	(0.14)
Anti-psychotics	0.27***	0.27***	0.27***	0.23***	0.20**	0.25***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Anti-anxiety and Sleep	0.18	0.18	0.18	0.16	-0.02	0.17
	(0.11)	(0.11)	(0.11)	(0.11)	(0.12)	(0.12)
Psycho-stimulants	0.09	0.09	0.09	0.08	0.02	0.09
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
	8,693,124.00	8,693,124.00	8,693,124.00	8,693,124.00	5,364,270.00	8,551,874.00

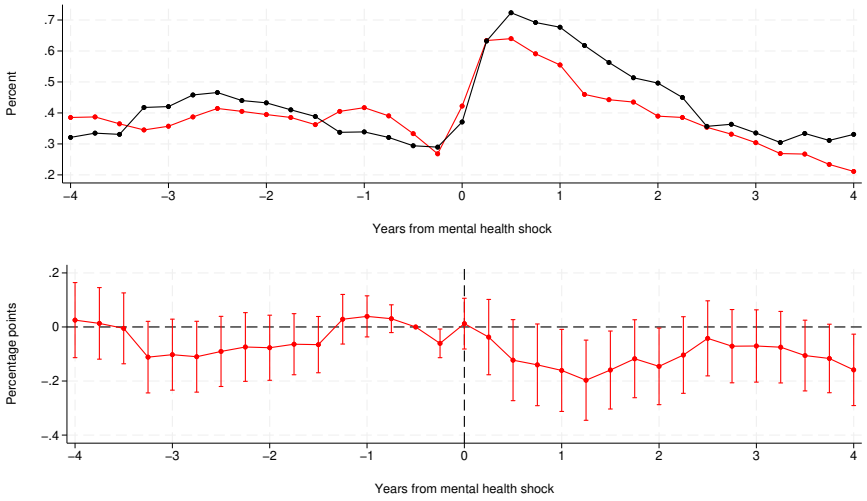
Notes: The table shows our first stage estimates from equation 16 (row 1) and IV estimates from equation 17 (row 2-6), from four years prior to the mental health shock and one year after adding additional control variables. The data are aggregated at the monthly level. Column 1 is our baseline results. Column 2 adds xx xx The outcomes in rows 2-6 are first prescription with a given medication within 12 months. textitSpecialized AD is defined as not receiving the drug that is among the 5 most common in the year and for people in the same age group. *Other med* is a summary measure of the medications listed in rows 3-6. Standard errors are clustered at the individual level. *** p <0.01, ** p <0.05, * p <0.1.

Table 23: Joined Probability

	Not top 4 antidep	Other med	Anti-psychotics	Sleep	Anxiety	Psycho-stimulants
All	0.609**	1.261***	0.674**	0.773**	0.301	0.329
	(0.287)	(0.455)	(0.305)	(0.330)	(0.242)	(0.204)
See specialist joint Prob.	0.875***	1.487***	0.836***	0.777***	0.329*	0.316*
	(0.206)	(0.338)	(0.262)	(0.218)	(0.172)	(0.188)
Mean	6.1	18.8	8.0	9.0	4.1	3.8
N	885,780	885,780	885,780	885,780	885,780	885,780

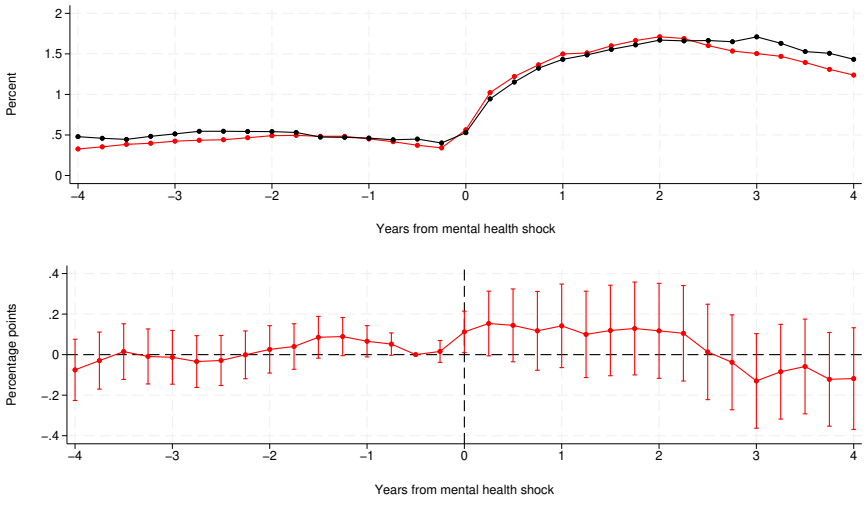
Notes:

Figure 16: Eating Disorders



Note:

Figure 17: Schizophrenia



Note:

Table 24: Multinominal logit - Different types of AD

	Min	Mean	Max	Mean	One	Mean
No AD	0.00	93.45	0.00	93.45	0.00	93.74
	(0.00)		(0.00)		(0.00)	
Infrequent AD	-0.17	0.13	-0.14	0.09	-0.13	0.09
	(0.17)		(0.18)		(0.18)	
Amitriptylin	0.05	0.09	0.06	0.09	0.08	0.08
	(0.16)		(0.16)		(0.16)	
Nortriptylin	0.13	0.14	0.10	0.12	0.10	0.12
	(0.17)		(0.18)		(0.18)	
Fluoxetin	0.28	0.16	0.25	0.16	0.25	0.16
	(0.15)*		(0.15)*		(0.15)*	
Citalopram	-0.05	1.36	-0.05	1.41	-0.05	1.35
	(0.05)		(0.05)		(0.05)	
Paroxetin	0.15	0.14	0.10	0.13	0.09	0.13
	(0.17)		(0.18)		(0.18)	
Sertralin	0.02	1.94	0.01	2.04	0.02	1.94
	(0.03)		(0.03)		(0.03)	
Escitalopram	0.04	0.24	0.04	0.24	0.02	0.23
	(0.10)		(0.10)		(0.10)	
Mirtazapin	-0.10	0.48	-0.09	0.39	-0.10	0.36
	(0.07)		(0.08)		(0.08)	
Venlafaxin	-0.12	1.17	-0.11	1.22	-0.12	1.15
	(0.06)*		(0.06)*		(0.06)**	
Duloxetin	0.03	0.46	0.05	0.46	0.04	0.44
	(0.08)		(0.08)		(0.08)	
Agomelatin	-0.07	0.15	-0.08	0.13	-0.08	0.13
	(0.16)		(0.17)		(0.17)	
Vortiozetin	-0.16	0.08	-0.12	0.07	-0.13	0.07
	(0.16)		(0.17)		(0.17)	

Notes: Multinominal logit. Infrequent AD is all types with less than 1 percent of the total use. Some individuals uses several ADs in one month. In the Min specification, we use the least typical type of AD in the estimation. In the Max specification, we use the most common type. The the specification One, we only include cases where the patient is consuming only one type of AD in a month, such that we do not have to choose between the different types. The estimation is a modified version of 14, where we only include post periods, and exclude the first two quarters where we saw a decrease in use of AD. The estimation is therefor more similar to a DiD than a DDD. *** p <0.01, ** p <0.05, * p <0.1.