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ABSTRACT

The Effects of Becoming a Physician on Prescription Drug Use and Mental Health Treatment*

There is evidence that physicians disproportionately suffer from substance use disorder and mental health problems. It is not clear, however, whether these phenomena are causal. We use data on Dutch medical school applicants to examine the effects of becoming a physician on prescription drug use and the receipt of treatment from a mental health facility. Leveraging variation from lottery outcomes that determine admission into medical schools, we find that becoming a physician increases the use of antidepressants, opioids, anxiolytics, and sedatives, especially for female physicians. Among female applicants towards the bottom of the GPA distribution, becoming a physician increases the likelihood of receiving treatment from a mental health facility.

JEL Classification: I1, I12, I18

Keywords: prescription drug use, opioids, mental health treatment, physicians

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1. INTRODUCTION

Physicians tend to enjoy good physical health. The typical physician exercises more, is less likely to smoke, and is less likely to be obese than his or her non-physician counterpart (Nelson et al. 1994; Frank et al. 1998a; Abramson et al. 2000; John and Hanke 2003; Smith and Leggat 2007; Leuven et al. 2013). In the United States, physicians live an average of two years longer than other professionals, and almost three years longer than members of the general population (Frank et al. 2000).

Although physically healthy, there is evidence that physicians disproportionately suffer from substance use disorder (SUD) and mental health problems. Ten to 15 percent of physicians will misuse alcohol or prescription drugs during their career (Baldisseri 2007; Vayr et al. 2019); more than 20 percent of physicians are depressed or exhibit the symptoms of depression (Mata et al. 2015; Rotenstein et al. 2018, eTable 24); and at least one third of physicians describe themselves as suffering from "job burnout" (Drummond 2015), a syndrome closely linked to SUD and depression (Bianchi et al. 2015; Schonfeld and Bianchi 2016; Wurm et al. 2016; Stageberg et al. 2020). Compounding these problems, physicians are often reluctant to seek psychologic help, perhaps out of shame or fear of losing their license (Shanafelt et al. 2011; Dyrbye et al. 2017; Tay et al. 2018; Weiner 2020).

Several causal explanations have been proposed for why physicians might be especially prone to SUD and mental health problems. Self-medication with prescription drugs is common among physicians (Montgomery et al. 2011), and there is concern that this practice leads to abuse and dependency (Bennett and O'Donovan 2001; Moberly 2014; Khan et al. 2019). During their residency, physicians work long, irregular hours, which can lead to sleep deprivation (Baldwin and Daugherty 2004; Prins et al. 2007) and adversely affect their relationships with friends and family (Raj 2016). Being involved in malpractice litigation is psychologically traumatizing (Lazarus 2014) and strongly associated with burnout and depression (Balch et al. 2011; Chen et al. 2013). More than 60 percent of U.S. physicians express concern about being involved in malpractice litigation "sometime in the next ten years" (Reed et al. 2008; Carrier et al. 2010), and at least one in three physicians have actually had a medical liability lawsuit filed against them (O'Reilly 2018). Finally, physicians are increasingly burdened with administrative tasks. One recent study found that every hour spent in contact with patients leads to two hours of "deskwork" and working with electronic health records (Sinsky et al. 2016); the adoption of electronic health records is predictive of physician burnout (Bianchi et al. 2015; Ehrenfeld and Wanderer 2018).

Using variation from lottery outcomes that determine admission into Dutch medical schools, we estimate the causal effect of becoming a physician on prescription drug use. The number of students admitted to medical school is tightly regulated in the Netherlands: applicants outnumber available slots, and acceptance to one of eight medical schools is determined at random, based on the results of an annual admissions lottery. Following previous researchers (Leuven et al. 2013; Ketel et al. 2016; Artmann et al. 2021), we use the outcomes from these annual admissions lotteries as an instrumental variable (IV), allowing us to estimate the effects of becoming a physician on the use of antidepressants, opioids, anxiolytics (e.g., anti-anxiety benzodiazepines such as Ativan and Xanax), and sedatives (e.g., pentobarbital and benzodiazepines such as Versed).[1] In addition, we leverage the outcomes of admission lotteries to examine the effect of becoming a physician on the likelihood of receiving treatment from a mental health facility.

IV estimates indicate that students induced into becoming physicians by winning the admissions lottery are more likely to use prescription antidepressants than those who lose the lottery and go into a different profession. This effect could reflect their (relatively poor) mental health,

[1] Leuven et al. (2013), Ketel et al. (2016), and Artmann et al. (2021) used the Dutch admissions lottery data to study the effects of becoming a physician on physical health, earnings, and parental health, respectively. In section 2.4, we provide a brief review of these papers.

although IV estimates provide evidence of an across-the-board increase in the use of prescription drugs, including anxiolytics, opioids, and sedatives. We view the increased use of anxiolytics, opioids, and sedatives as particularly worrisome because these drugs are highly addictive and there is descriptive evidence that they are often abused by physicians (Merlo and Gold 2008; Oaklander 2015; Moberly 2014; Khan et al. 2019). Although we cannot distinguish legitimate use from misuse in our data, it is clear that Dutch physicians are especially prone to using prescription drugs and that this phenomenon is entirely explained by their choice of profession.

Female physicians are described in the medical literature as being at risk for SUD and depression, possibly because of on-the-job sex-based harassment or added pressure to balance professional and family responsibilities (Frank et al. 1998b; Merlo and Gold 2008; Wallace et al. 2009; Guille et al. 2017; Jenner et al. 2019; Stageberg et al. 2020).[2] Restricting the sample to female applicants, the IV estimates are generally large, positive, and measured with precision across all prescription drug categories. By contrast, when the sample is restricted to male applicants, the IV estimates for antidepressant and anxiolytic use are small and statistically insignificant at conventional levels. When the sample is restricted to female applicants towards the bottom of the GPA distribution, we find that becoming a physician increases the likelihood of receiving treatment from a mental healthcare facility.

The remainder of the paper is organized as follows. In Section 2, we discuss previous studies in the medical literature and provide institutional details. In Section 3, we describe our data and empirical strategy, and in Section 4 we report our results. Section 5 concludes.

[2] In 1999, there were almost twice as many registered male physicians as female physicians in the Netherlands. By 2018, this gender gap had closed. Male physicians were, however, much more likely than their female counterparts to practice in a specialized field of medicine (Statistics Netherlands 2020).

2. Background

The conventional explanations for why physicians are at risk of developing SUD and depression, described in the introduction, are causal in nature. It is, however, important to recognize that becoming a physician requires intelligence, extraordinary drive, and perseverance. In the United States, the process of becoming a physician begins with gaining acceptance into medical school. Most medical schools are extremely competitive, requiring a high Medical College Admission Test (MCAT) score, a minimum undergraduate GPA of 3.0 in a science-based field, the completion of pre-medical courses, and letters of recommendation (Balan 2021).[3] After graduating from medical school, physicians must complete a three- to seven-year residency program, the length of which depends on the field of specialization.[4] While the path to becoming a physician is not the same in European countries, it involves overcoming substantial hurdles, many of which are similar to those encountered in the United States (Martinho 2012).

Given that occupational choice is not random, could selection explain the relatively high rates of SUD and mental health issues among physicians? There is evidence that intellectually gifted youth are especially susceptible to becoming depressed later in life (Wraw et al. 2016; Karpinski et al. 2018).[5] "Perfectionists," individuals who set unrealistically high standards for themselves, are also predisposed to becoming depressed (Ashby et al. 2006; Lo and Abbott 2013). Perhaps not surprisingly, perfectionism appears to be a common trait among medical students (Enns et al. 2008; Chand et al. 2018; Bußenius and Harendza 2019; Hu et al. 2019; Leung et al. 2019; Eley et al. 2020).

[3] In 2017-2018, successful medical school applicants in the United States scored, on average, in the top 20th percentile on the MCAT and had an undergraduate GPA above 3.7 (*What is a Good MCAT Score?* 2021).

[4] Three-year residency programs include those in family practice, internal medicine, and pediatrics. Neurological surgery is the longest residency and typically lasts 7 years (Murphy 2020).

[5] White and Batty (2011) and White et al. (2012) document a positive association between childhood IQ and the likelihood of adult illicit drug use.

For instance, Hu et al. (2019) found that 25 percent of first-year medical students at Saint Louis University School of Medicine met the criteria for "maladaptive perfectionism," which is characterized by an excessive preoccupation with mistakes. Enns et al. (2008) found that maladaptive perfectionism predicted the onset of depression and feelings of hopelessness among medical students.

From a policy perspective, it is crucial to distinguish between selection and the conventional causal explanations for why physicians are at risk of developing SUD and depression. If easy access to prescription drugs or frivolous malpractice claims are disposing physicians to SUD and creating undo psychological stress, then there are concrete steps that can be taken to shield them. For instance, several states, including New Jersey, New York and Pennsylvania, have recently prohibited COVID-19 patients from filing medical malpractice lawsuits against their physicians (Caruso 2020). There is also evidence that the adoption of malpractice reforms, known as communication-and-resolution programs (CRPs), have improved liability outcomes for physicians (LeCraw et al. 2018).[6] Hospital-level policies intended to curb work-related stress include work-hour caps for residents, the provision of mindfulness-based stress reduction programs, offloading non-essential tasks to assistants, and increasing appointment times for primary care visits (Hirsch 2017; Patel et al. 2019).

2.1. Substance use among physicians

Physicians whose substance use causes impairment pose a risk not only to themselves but also to their patients. Qualitative interviews among physicians receiving treatment from an addiction center have identified effects on clinical care (e.g., botched procedures and prescription errors), direct consequences from psychoactive effects of the drug (e.g., physical effects, psychotic

[6] CRPs emphasize transparency and their possible advantages include "increased association between compensation and actual presence of error, improved liability outcomes, decreases in the practice of defensive medicine, greater patient satisfaction, improved quality of care, and decreased stress on healthcare providers" (LeCraw et al. 2018, p. 14).

symptoms, and sedation), and impaired punctuality (Shadakshari et al. 2021). Other common issues associated with physician substance misuse include conflicts with co-workers, social isolation, mood swings, and patient complaints (Dumitrascu et al. 2014).

Two large-scale descriptive studies have attempted to document substance use patterns among U.S. physicians. In 1989, Hughes et al. (1992) surveyed members of the American Medical Association (AMA) about their substance use.[7] Eleven percent reported misusing prescription benzodiazepines in the past year, and 18 percent reported past-year opioid misuse.[8] By comparison, past-year misuse of benzodiazepines is two percent among the general U.S. adult population (Maust et al. 2019) and 5 percent of the general population report opioid abuse (Han et al. 2017). Using data from a 2011 web-based survey of AMA members, Oreskovich et al. (2015) found that 15 percent of U.S. physicians exhibited the symptoms of alcohol abuse or dependence, but only 1.3 percent of respondents reported ever having abused opioids.[9]

2.2. Mental health and burnout among physicians

Less than 5 percent of the general population suffers from major depression, characterized by feelings of hopelessness, loss of energy, and disturbed sleep or appetite (Baxter et al. 2014; Otte et al. 2016). Among medical students and physicians, the prevalence of major depression appears to

[7] Hughes et al. (1992) mailed 9,600 questionnaires to AMA members. The response rate was 59 percent.

[8] Respondents were asked if they used prescription drugs in the past year without obtaining a prescription from "another physician for a legitimate medical or psychiatric condition."

[9] Of the 27,276 physicians who received an invitation, 27 percent completed the web-based survey (Oreskovich et al. 2015, p. 30). See also Pförringer et al. (2018) who conducted a web-based survey of German physicians. Nearly 25 percent of German physicians had problematic alcohol intake, but very few German physicians admitted to regularly taking benzodiazepines, opioids, or amphetamines. Underreporting could explain the low rates of drug abuse found by Oreskovich et al. (2015) and Pförringer et al. (2018). Physicians suffering from SUD may be reluctant to admit to having a problem and fear losing their license (Vayr et al. 2019). Finally, there is evidence that SUDs are increasingly prevalent among residents in anesthesiology (Bryson 2018).

be much higher.[10] According to recent meta-analyses, 27 to 29 percent of medical students and physicians exhibit depressive symptomology (Mata et al. 2015; Puthran et al. 2016; Rotenstein et al. 2016; Rotenstein et al. 2018), and there is evidence that female medical students and physicians are at elevated risk for depression and psychiatric distress. For instance, Guille et al. (2017) found that, after 6 months of residency, female residents experienced greater increases in the symptoms of depression than their male counterparts.[11] Merlo et al. (2017) found that matriculating female medical students had substantially higher levels of stress and were more likely to report that they would benefit from mental health care compared to their male counterparts.

"Job burnout" is a common syndrome characterized by emotional exhaustion and feelings of diminished personal accomplishment (Cordes and Dougherty 1993). Among physicians, burnout, depression, and SUD are closely linked (Worm et al. 2016; Rotenstein et al. 2018; Stageberg et al. 2020), although it is difficult to assess the overall prevalence of burnout among physicians due to fundamental cross-study differences in how it is measured (Rotenstein et al. 2018; Verougstraete and Idrissi 2019).[12] As noted above, the adoption of electronic health records is associated with an increased risk of burnout among physicians (Ehrenfeld and Wanderer 2018). Early-career and primary care physicians may be especially vulnerable to burnout (del Carmen et al. 2019).[13]

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[10] Among medical students, predictors of poor mental and emotional health include adjusting to a demanding medical school environment, ethical conflicts, exposure to death and human suffering, and abuse from faculty (Dyrbye et al. 2005). See Siegrist (1996) for a related discussion on the adverse health effects of working in a high-effort/low-reward environment.

[11] Adjusting for "work-family conflict scores" reduced the size of the male-female depressive symptoms gap, leading the authors to conclude that "explicit consideration of work and family responsibilities may be helpful in constructing a medical education system that allows for rigorous medical training and promotes good mental health." (Guille et al. 2017, p. 1771). See also Voltmer et al. (2010) and Cull et al. (2019).

[12] In general, depression and burnout are so closely linked that, according to Bianchi et al. (2015, p. 28), it is "notably unclear how the state of burnout (i.e., the end stage of the burnout process) is conceived to differ from clinical depression."

[13] There is no credible evidence that burnout is related to physician gender or other personal characteristics such as race and/or ethnicity (Rotenstein et al. 2018; del Carmen et al. 2019; Verougstraete and Idrissi 2019).

2.3. Mental health problems and burnout among Dutch physicians

A handful of studies have examined depression and burnout among Dutch medical students and physicians. For instance, Ruitenburg et al. (2012) surveyed residents and physicians working at an "academic medical center" in the Netherlands. Twenty-nine percent of the 458 respondents exhibited the symptoms of depression, which is comparable to rates of depression among physicians working in other countries and settings (Mata et al. 2015; Puthran et al. 2016; Rotenstein et al. 2018).[14] Prins et al. (2010), who conducted a nation-wide survey of Dutch medical residents, found that 21 percent met the criteria for burnout, while 30 percent reported emotional exhaustion.[15]

Panel A of Figure 1 shows rates of burnout by profession in the Netherlands. It is based on the 2019 National Survey on Labor Conditions (NSLC), which is conducted jointly on an annual basis by Statistics Netherlands, the Dutch Organisation for Applied Scientific Research, and the Ministry of Social Affairs. Burnout is assessed using five items. Specifically, survey respondents are asked whether they agree with the following statements:

1.) I feel emotionally exhausted by my work.
2.) I feel empty at the end of the working day.
3.) I feel tired when I get up in the morning and am confronted with my work.
4.) It is demanding for me to work with other people the whole day long.
5.) I feel completely exhausted from my work.

Agreement is expressed on a scale from 1 ("Never") to 7 ("Every day"). The NSLC reports the share of respondents by occupation who answer 4 ("A few times per month") or higher on each item, which we average across the five items.

[14] Forty-two percent of respondents reported work-related fatigue, but only 6 percent suffered from burnout (Ruitenburg et al. 2012).

[15] Residents who met the criteria for burnout reported making more on-the-job mistakes than those who did not (Prins et al. 2009). Fifty-six percent of residents reported having made a mistake "with a negative consequence" (Prins et al. 2009). See also Prins et al. (2007) and Geuijen et al. (2020). According to Geuijen et al. (2020), one-third of Dutch physicians report interacting with a colleague whom they presumed was using substances at work.

Twenty-three percent of Dutch physicians meet our criterion for burnout (i.e., their average response across the five items is 4 or greater).[16] By comparison, 16 percent of managers, 18 percent of science and engineering professionals, and 19 percent of public servants meet the burnout criterion. Only teachers, social workers, and machine operators exhibit higher rates of burnout than physicians. Dutch physicians also appear to be under more work and emotional pressure than members of other occupations (Panels B and C of Figure 1).[17]

2.4. Becoming a physician in the Netherlands

In the Netherlands, the Minister of Education sets an annual cap on the number of high school graduates allowed to study medicine, dentistry, and veterinary medicine at university. During the period 1973-1993, this annual cap was set at 1,458. Although it was gradually increased to 2,010 during the period 1994-1999, demand far exceeded supply: every year, more than 5,000 high school students competed for the available slots, which were allocated based on the results of a nation-wide lottery. Applicants are divided into 6 weighted lottery categories (A, B, C, D, E, and F) based on their high school ("voortgezet wetenschappenlijk onderwijs") GPA, which determines their probability of "winning" (i.e., being admitted to medical school).[18]

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[16] The physician occupational category includes "therapists."

[17] The NSLC assessed work pressure using three questionnaire items. Respondents were asked whether they have to work quickly, whether they have to work a lot, and whether they have to work overtime at their main job. The NSLC reports the share of respondents who answer 3 or higher on a scale of 1 ("Never") to 4 ("Always"), which we average across the three items. Panel B of Figure 1 shows the percentage of respondents who meet our work pressure criterion (i.e., their average response across the three items is 3 or greater) by occupation. Panel C of Figure 1 is constructed in a similar manner. Respondents were asked whether they face emotionally difficult situations at work, whether their work is emotionally demanding, and whether they get emotionally involved in their work.

[18] Students applying to medical school are also required to have passed high school courses in biology, chemistry, math, and physics. High school GPA ranges from 1 to 10 and is based on school and national exams. Strict guidelines ensure that grading differences across schools are minimized. Applicants with the best GPAs are assigned a weight of 2.00 and placed in the A category. Passing requires scoring at 5.5 or higher. The lottery category weights are as follows:

Category	GPA	Weight
A	GPA $\geq$ 8.5	2.00

There are eight medical schools in the Netherlands, and students typically finish their medical degree in 6 years.[19] Students first complete a three-year bachelor's degree, followed by an equally long master's program.[20] During the master's program, students receive hands-on training through a series of internships at general practices and hospitals. At the end of their 6th year, they take a final medical examination ("artsexamen"). Those who pass receive their medical degree and are officially registered as a medical doctor. Newly minted doctors generally go on to receive specialized postgraduate training and work under the supervision of senior physicians at a teaching hospital or university medical center.[21]

Three previous studies have leveraged Dutch medical school lottery outcomes to identify causal effects (Leuven et al. 2013; Ketel et al. 2016; Artmann et al. 2021). Leuven et al. (2013), estimated the effect of attending medical school on a range of physical health outcomes. These authors found that attending medical school reduces the likelihood of being underweight and has a small, negative effect on the frequency of physical exercise.[22] Ketel et al. (2016) found that Dutch physicians earned at least 20-50 percent more than their counterparts who chose a different occupation. The labor market returns to becoming a physician increased with experience and only a

B	$8.0 \leq GPA < 8.5$	1.50
C	$7.5 \leq GPA < 8.0$	1.25
D	$7.0 \leq GPA < 7.5$	1.00
E	$6.5 \leq GPA < 7.0$	0.80
F	$GPA < 6.5$	0.67

19 There are only small differences in the quality of instruction and content of courses across these eight schools (Ten Cate 2007; Ketel et al. 2016).

20 The bachelor's degree primarily focuses on basic theory, while the master's degree focuses on application.

21 Students can choose between 33 medical specialties. The specialization track for a general practitioner is the shortest, taking three additional years. The most advanced specializations (e.g., neurology or cardiology) require an additional four to six years of training. Only 0.3 percent of students choose to not receive specialized training (Vergouw 2015).

22 There was also evidence of reductions in self-reported alcohol consumption, but going to medical school had little effect on cigarette smoking (Leuven et al. 2013).

small portion of these returns could be attributed to differences in working hours or human capital investments.[23] Artmann et al. (2021) estimated the effect of becoming a physician on parental health. Their results suggest that having informal access to the services of a physician does not lead to substantial differences in health or healthcare utilization.[24]

3. Data and Empirical Strategy

3.1. Medical school lottery data

Register data on medical school lottery outcomes were obtained from the Dienst Uitvoering Onderwijs (DUO), which is a Dutch governmental organization under the Ministry of Education. We observe the outcomes of all medical school lotteries conducted between 1987 and 1999. After 1999, the national lottery was replaced with a decentralized selection system that gave medical schools more control over the admissions process.

Appendix Table 1 reports the share of medical school applications and admission probabilities by lottery category during the period 1987-1999.[25] Of the 42,445 applications, over 80 percent were assigned to lottery categories F (GPA < 6.5), E (6.5 ≤ GPA < 7.0) and D (7.0 ≤ GPA < 7.5). Ten percent were assigned to category C (7.5 ≤ GPA < 8.0), 6 percent to category B (8.0 ≤ GPA < 8.5), and only 2 percent to category A (GPA ≥ 8.5).[26] On average, 46 percent of applicants

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[23] Using administrative data from Norway and an IV strategy that exploits admission cutoffs into different fields of study, Kirkeboen et al. (2016) estimate the labor market payoffs to completing one type of postsecondary education relative to a next-best alternative.

[24] Artmann et al. (2021) considered a range of health outcomes such as mortality, hospitalizations, any medication use, visits to specialists, and total healthcare costs.

[25] Note this table refers to "applications" and not "applicants," because rejected students who reapply contribute multiple observations to the sample.

[26] For 7 of the 13 years in our data, all applicants assigned to category A were admitted to medical school. The very few applicants from this category who lost their first lottery generally gained acceptance upon reapplying. After 1999, all students with a GPA of 8.0 or higher (i.e., students in categories A and B) were automatically admitted to medical school.

were eventually admitted (either when they first applied or in a subsequent application round). Seventy-one percent of applicants who lost their first lottery reapplied at least once.

During this period, 33,229 students participated in the medical school lottery for the *first time*. Our focus is on 27,464 of these first-time applicants. Those who completed their high school exams in 1986 or earlier are excluded from the analysis to ensure that we have complete lottery histories (N = 1,468). Likewise, students for whom we could not determine the year in which they took their high school exam are dropped from the sample (N = 1,014).[27] Applicants belonging to lottery category A (N = 692) are excluded because they were all but guaranteed eventual admittance, and applicants from the lottery category "other" (N = 2,377) are excluded because they were admitted without having to take the Dutch high school exam (e.g., foreign students). Finally, we dropped 64 students with missing social security numbers, 142 students from the former colony of the Dutch Antilles (who were assigned a slot in medical school through a separate process), and 8 students who died. Conditional on lottery category and lottery year, the excluded students were evenly distributed between lottery winners and lottery losers (p=0.486).

3.2. Outcomes

Information on prescription drug use for the period 2006-2018 comes from the Dutch prescription reimbursement database, provided by Statistics Netherlands.[28] These data contain information on all persons who received a prescription drug the costs of which were reimbursed

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[27] Students with missing information on exam year who are too young to have taken it in 1986 or earlier are included in the analysis.

[28] Approximately 91 percent of lottery winners from 1999 (i.e., the last year before the lottery was replaced with a decentralized selection system) were registered as doctors by 2006. The results presented below are similar if we exclude the most recent cohorts of graduating physicians from the analysis. Likewise, we obtained qualitatively similar results to those reported below when we focused on the 5 most recent years of data, 2014-2018.

under the statutory basic medical insurance.[29] Based on the information available in the prescription drug reimbursement database, we construct the following 5 outcomes:

- *Total Prescriptions*, equal to the total number of drug prescriptions for individual *i* during the period 2006-2018.
- *AD Use*, equal to one if individual *i* was prescribed antidepressants during the period 2006-2018, and equal to zero otherwise.[30]
- *Anxiolytic Use*, equal to one if individual *i* was prescribed an anxiolytic (i.e., an anti-anxiety drug) during the period 2006-2018, and equal to zero otherwise.
- *Opioid Use*, equal to one if individual *i* was prescribed an opioid during the period 2006-2018, and equal to zero otherwise.
- *Sedative Use*, equal to one if individual *i* was prescribed a sedative during the period 2006-2018, and equal to zero otherwise.[31]

Table 1 presents outcome means separately for the physicians and non-physicians in our sample. While physicians appear no more likely to have used antidepressants than their non-physician counterparts during the period 2006-2018, they used anxiolytics, opioids, and sedatives at higher rates, all of which come with risks of abuse and addiction (Oaklander 2015; American Addiction Centers 2021). The gap in sedative use is particularly striking. Physicians were more than twice as likely as non-physicians to have used sedatives, such as the highly addictive Versed.

Information on receipt of treatment for a mental health issue during the period 2012-2016 comes from a national register database on mental health facilities, provided by Statistics

[29] The database includes everyone in the municipal population register at any point during a specified year. Exceptions include persons who received a prescription drug while hospitalized and individuals in nursing homes.

[30] Antidepressants are defined as drugs falling under the Anatomical Therapeutic Chemical (ATC) codes of N06A (antidepressant drugs) and N06B (psychostimulants). Examples include selective serotonin reuptake inhibitors (e.g., sertraline, brand name Zoloft) and non-selective monoamine reuptake inhibitors (e.g., desipramine, brand name Norpramin). The patterns of results presented below were similar if we excluded psychostimulants from our definition of antidepressants.

[31] The "anxiolytic" category includes a number of benzodiazepines (aka "benzos"), buspirone, and hydroxyzine. The "sedative" category, which also includes hypnotics, consists of pentobarbital (a barbiturate) and a range of benzodiazepines and benzodiazepine-related drugs used to treat insomnia.

Netherlands.[32] These data cover all treatments for severe or complex mental health problems the costs of which were reimbursed by the statutory basic medical insurance. The majority of patients at these facilities are treated by specialized healthcare providers (e.g., psychiatrists and psychotherapists) for mood and anxiety disorders. We define the variable *Mental Health Treatment* as equal to one if individual *i* ever received treatment for a mental health issue during the period 2012-2016 (and equal to zero otherwise). Non-physicians are 3.1 percentage points (34 percent) more likely than physicians to have received treatment from a mental health facility (Table 1).

3.3. Empirical strategy

Our empirical strategy leverages the fact that medical school admissions in the Netherlands are determined by a lottery. Let the outcome of individual i, y_i, be a linear function of whether he or she becomes a physician, a vector of controls ($\boldsymbol{X}_i$), and an error term (ε_i):

$$(1) \qquad y_i = \beta_0 + \beta_1 Physician_i + \boldsymbol{X}_i\boldsymbol{\beta}_2 + v_c + \varepsilon_{it}.$$

Our independent variable of interest, $Physician_i$, is equal to one if individual *i* went to medical school in the Netherlands and became a registered medical doctor (and is equal to zero otherwise).[33] The vector $\boldsymbol{X}_i$ includes age at first lottery, age squared, gender, ethnicity, *i's* lottery category, the year in which he or she first participated in the admissions lottery, and interactions between lottery category and year of first lottery.

[32] These data are only available for the years 2012-2016.

[33] The indicator *Physician* is equal to zero for licensed physicians in the Netherlands who were educated abroad.

The effect of becoming a physician on y_i is β_1. If profession were randomly assigned, ordinary least squares (OLS) estimates of equation (1) would reflect the true relationship between becoming a physician and the outcomes under study. However, because the process of becoming a physician is highly selective, OLS estimates are likely to be biased. The direction of the bias is difficult to predict and depends on unobserved applicant characteristics such as ability, personality, motivation, temperament, and background.

To obtain an unbiased estimate of β_1, we compare the outcomes of applicants who won their first lottery to the outcomes of those who lost. Because we focus solely on the outcome of the first lottery, we avoid sample selection concerns. If winning the lottery is random and only affects y_i through the process of becoming a physician, the average treatment effect for applicants induced into the profession by winning the lottery can be estimated using two-stage least squares (2SLS). The first-stage equation takes the following form:

$$Physician_i = a_0 + a_1 Lottery\ Win_i + \boldsymbol{X}_i\boldsymbol{\alpha}_2 + u_i, \qquad (2)$$

where *Lottery Win*$_i$ is the outcome of *i* 's first lottery. It is equal to one if *i* won his or her first lottery, and is equal to zero if *i* lost. Note that winning the lottery does not perfectly predict becoming a physician for the following reasons:

1.) If a student lost the lottery the first time he or she applied, they could reenter the following year. During the period 1987-1998, there was no limit on how many times students could reenter the lottery. After 1998, students could take the lottery up to two additional times if they failed to win the first time. Forty-four percent of students who lost their first lottery eventually enrolled in medical school.

2.) Not all lottery winners enrolled in medical school. Every year, between 4 and 8 percent of lottery winners opted to pursue a different major (on average, 6.4 percent across all years in our data).

3.) Not all enrollees graduated from medical school and not all medical school graduates became licensed physicians in the Netherlands. On average, 15 percent of Dutch medical enrollees in our data were not practicing medicine during the period 2006-2018, when our outcomes are measured.[34]

Table 2 shows balancing tests by lottery category for first-lottery winners and losers. The results of these tests support the independence assumption necessary for instrumental variable estimates. With only one exception, lottery winners and losers appear statistically similar on the observational characteristics included in $\boldsymbol{X}_i$.[35] We begin the next section by discussing the estimates of a_1. Next, we provide OLS and 2SLS estimates of β_1, the parameter in which we are most interested.

4. RESULTS

Table 3 presents first-stage results for the full sample and by gender. The estimates of a_1 are consistently positive, large, and measured with precision. With F-statistics well over 2,000, we clearly meet the Staiger and Stock (1997) criterion.

Full-sample estimates of the effect of becoming a physician on drug prescriptions are reported in the top panel (Panel A) of Table 4. The OLS estimate is statistically significant and positive. On average, physicians were prescribed 4.25 more drugs during the period 2006-2018 than their non-physician counterparts, or 22 percent of the sample mean. The 2SLS estimate, which accounts for the endogenous process of becoming a physician, is not qualitatively different from the naïve OLS estimate.[36]

[34] While we do not observe the percentage of graduates who did not become licensed, we expect this phenomenon to be extremely rare.

[35] Appendix Table 2 shows physician characteristics for the full sample and provides variable definitions.

[36] We also experimented with using an indicator for having been prescribed more drugs than the average resident of the Netherlands in *i*'s age group. Specifically, we found that becoming a physician is associated with a 20 percent increase in the likelihood of being prescribed more drugs than the average. These results were similar if we used the 75th percentile, as opposed to the average.

We examine the effect of becoming a physician on prescription drug use by gender in Panels B and C of Table 4. Restricting the sample to female applicants and accounting for selection, becoming a physician is associated with 4.67 additional drug prescriptions, which represents 20 percent of the mean (Panel B). Among male applicants, becoming a physician is associated with 2.66 additional drug prescriptions, which represents 19 percent of the mean (Panel C).

In Table 5, we turn our focus to the use of antidepressants. The full-sample OLS estimate is negative, but small and statistically indistinguishable from zero (Panel A). When we instrument using *i*'s first lottery outcome, the estimated effect flips sign and becomes statistically significant. Becoming a physician is associated with a 0.029 increase in the probability of having been prescribed an antidepressant during the period 2006-2018, which represents 23 percent increase relative to the sample mean. After accounting for selection, becoming a physician is associated with a 0.042 increase in the probability of having been prescribed an antidepressant for female applicants (Panel B). Although also positive, the corresponding 2SLS estimate for male applicants is much smaller and is nowhere near statistically significant (Panel C).[37]

Previous studies have found that lower-performing medical students are at elevated risk for burnout, stress, depression, and anxiety (Stewart et al. 1997; Shadid et al. 2020). In Table 6, we split the sample by gender and ability. High-ability applicants are defined as those in lottery categories B, C, and D, while low-ability applicants are defined as those in categories E and F.[38] For both female

[37] Examining the effect of becoming a physician on the probability of using antidepressants in at least two of the 13 years under study produces qualitatively similar results (Appendix Table 3). Other studies on prescription drug use have taken a similar approach to measure potentially problematic use when information on abuse was unavailable (Baker et al. 2020; Sacks et al. 2021).

[38] Appendix Table 4 shows the corresponding first-stage estimates by gender and ability.

and male applicants, there is little evidence that the estimated effect of becoming a physician on antidepressant use differs across the ability threshold.[39]

In Table 7, we report 2SLS estimates for prescription anxiolytics, opioids, and sedatives.[40] Anxiolytics and sedatives include a range of benzodiazepines (e.g., Xanax and Versed), which are popular drugs among physicians seeking self-treatment (Moberly 2014; Khan et al. 2019). Similar to opioids, benzodiazepines are addictive and come with an extremely high potential for abuse (American Addiction Centers 2021).

In the full sample, there is strong evidence that becoming a physician increases the use of anxiolytics, opioids, and sedatives. Specifically, becoming a physician is associated with a 0.021 increase in the probability of having been prescribed an anxiolytic. This estimate is 20 percent of the sample mean and is, in fact, more than large enough to explain the unadjusted gap between physicians and non-physicians in our sample (Table 1). Becoming a physician is also associated with a 0.044 increase in the probability of having been prescribed an opioid (which is 25 percent of the sample mean), and a 0.070 increase in the probability of having been prescribed a sedative (which is 61 percent of the sample mean). Again, these 2SLS estimates can explain the entire unadjusted gaps between physicians and non-physicians.

Among female applicants, becoming a physician is associated with a 0.031 increase in the probability of having been prescribed an anxiolytic (or 27 percent of the mean), a 0.043 increase in the probability of having been prescribed an opioid (or 24 percent of the mean), and a 0.093 increase in the probability of being prescribed a sedative (or 72 percent of the mean). Restricting the sample to male applicants produces positive, but considerably smaller, 2SLS estimates for anxiolytics and

[39] Appendix Table 5 shows estimates of effect of becoming a physician on the probability of using antidepressants in at least two of the 13 years under study produces by gender and ability.

[40] The corresponding OLS estimates are reported in Appendix Table 6.

sedatives.[41] Table 8 shows corresponding estimates by ability group.[42] The estimated effects of becoming a physician on having used anxiolytics, opioids, and sedatives are roughly similar across the ability threshold.

Finally, we explore the effects of becoming a physician on receiving treatment from a mental healthcare facility. Naïve OLS estimates, reported in Tables 9 and 10, are negative, large, and statistically significant. These estimates confirm that physicians are, on average, less likely to have received mental healthcare treatment than their non-physician counterparts during the period under study. However, the 2SLS estimates are generally smaller than the corresponding OLS estimates and are not statistically significant at conventional levels.[43]

There are two important exceptions to this basic pattern of results. Among low-ability female applicants, the 2SLS estimate is positive and statistically significant: becoming a physician is associated with a 0.037 increase (31 percent of the mean) in the probability of having received treatment from a mental health facility (Panel B, Table 10). The OLS and 2SLS estimates for receipt of treatment from a mental health facility are similar in magnitude and precision for high-ability men (Panel C, Table 10). Becoming a physician is associated with a 0.045 reduction (52 percent of the mean) in the probability of having received treatment from a mental health facility for high-ability male applicants.

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[41] In Appendix Table 7, we introduce alternative measures of anxiolytic, opioid, and sedative use based on two-year thresholds (i.e., having been prescribed an anxiolytic, opioid, or sedative in at least two years during the period 2006-2018). The estimated effects are of similar magnitude to those reported in Table 7, although several are less precise. The two-year thresholds roughly correspond to average levels of use among applicants who have been prescribed an anxiolytic, opioid, or sedative. Alternative thresholds (e.g., at least 4 years of use during the period 2006-2018) produced qualitatively similar results.

[42] Appendix Table 8 shows estimates by gender and ability of the effect of becoming a physician on whether individual i used the specified drug in at least two of the 13 years under study.

[43] When interpreting these results, it is important to keep in mind that surveys of physicians suggest that those who are suffering from mental health problems are particularly reluctant to seek psychiatric or psychologic help, often out of fear of stigma or losing their license (Shanafelt et al. 2011; Dyrbye et al. 2017; Tay et al. 2018; Weiner 2020). This issue has recently received more attention from specialists and the media as physicians struggle with pandemic-related mental health issues (Weiner 2020).

5. CONCLUSION

While the high risk of suicide, abuse of substances, and general "silent suffering" among physicians has been well documented (Feist 2021; Kaliszewski 2021), we do not know whether becoming a physician has a causal effect on substance use and mental health. This study uses data on Dutch medical school applicants to explore the effects of becoming a physician on prescription drug use and receipt of treatment from a mental health facility. One of the advantages of focusing on the Netherlands is that admission to medical school was determined by a national lottery, allowing us to isolate exogenous variation in occupation uncorrelated with intelligence or personality. There is strong evidence that medical school students and physicians are "perfectionists," who often set unrealistically high standards for themselves and are especially prone to becoming depressed (Ashby et al. 2006; Lo and Abbott 2013; Chand et al. 2018; Hu et al. 2019; Leung et al. 2019), which may explain their relatively high rates of substance use disorder (SUD) and even suicide (Schernhammer and Colditz 2004; Duarte et al. 2020).

Instrumental variable estimates, which correct for selection into the profession, show that physicians are more likely to use prescription drugs, including antidepressants, opioids, anxiolytics (i.e., anti-anxiety medications), and sedatives than their non-physician counterparts. Although we do not directly observe abuse, these estimates are particularly worrisome for two reasons. First, many prescription opioids, anxiolytics, and sedatives are highly addictive (Longo and Johnson 2000; National Institute on Drug Abuse 2021). Second, our estimated effects tend to be quite large. For instance, becoming a physician is associated with a 20 percent increase in the likelihood of having been prescribed an anxiolytic (e.g., Xanax), a 25 percent increase in the likelihood of having been prescribed an opioid (e.g., Oxycodone), and a 61 increase in the likelihood have having been prescribed a sedative (e.g., Versed).

The medical literature describes female physicians as being at risk for substance use disorder and depression (Oreskovich et al. 2015; Guille et al. 2017). Estimates from meta-analyses show that female physicians commit suicide at much higher rates than male physicians (Schernhammer and Colditz 2004; Duarte et al. 2020). In our sample, female physicians use prescription drugs at higher rates than their male counterparts. This pattern is, in fact, exhibited across each of the prescription drug categories under consideration (i.e., antidepressants, opioids, anxiolytics, and sedatives). Instrumental variable estimates provide strong evidence of pronounced gender-based differences. Specifically, the estimated effects of becoming a physician on antidepressant, anxiolytic, and sedative use are all much larger for female, as opposed to male, medical school applicants. This pattern of results is consistent with descriptions of female physicians being at elevated risk for depression and SUD because they are being exposed to on-the-job sex-based harassment and are under added pressure to balance professional and family responsibilities (Frank et al. 1998b; Merlo and Gold 2008; Wallace et al. 2009; Jenner et al. 2019; Stageberg et al. 2020). Prior research suggests that systemic modifications to alleviate work-life conflict may disproportionally benefit female physicians (Guille et al. 2017).

Finally, we estimate the effect of becoming a physician on having received treatment from a mental health facility. We find that "low-ability" female applicants, defined as those with GPAs placing them in lottery categories E and F, are 30 percent more likely to have received mental health treatment. This estimate is consistent with descriptive evidence showing that lower-performing medical students are at elevated risk for subsequent burnout, stress, depression, and anxiety (Steward et al. 1997; Shadid et al. 2020).

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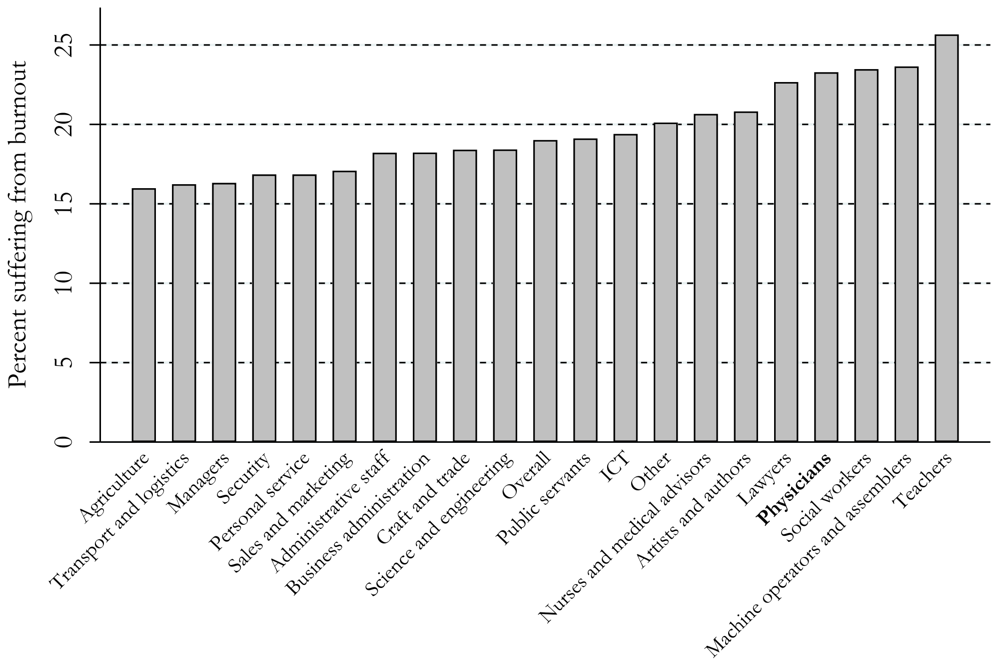
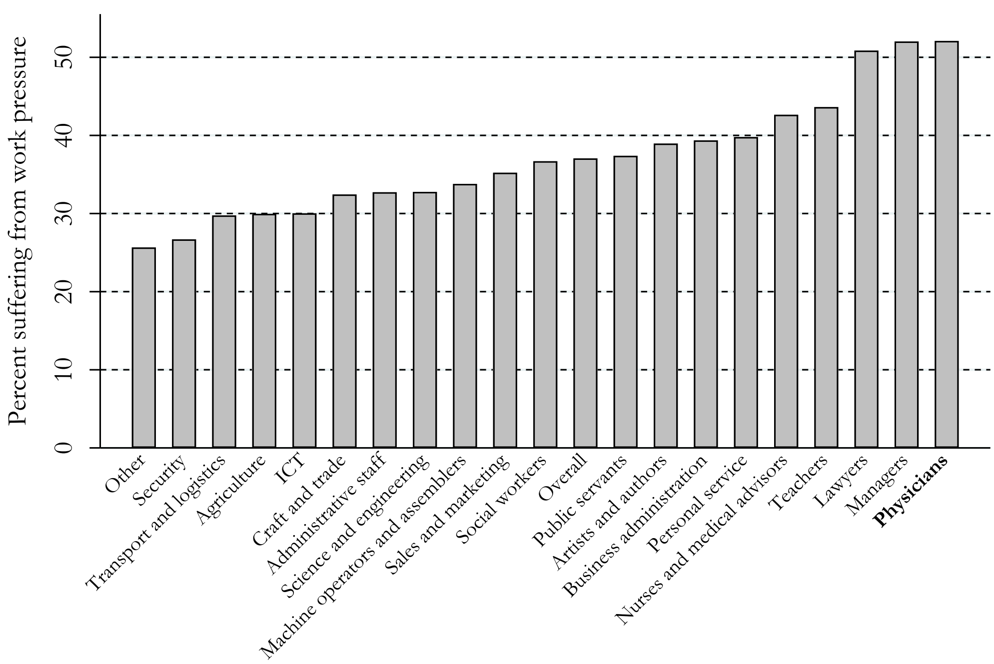
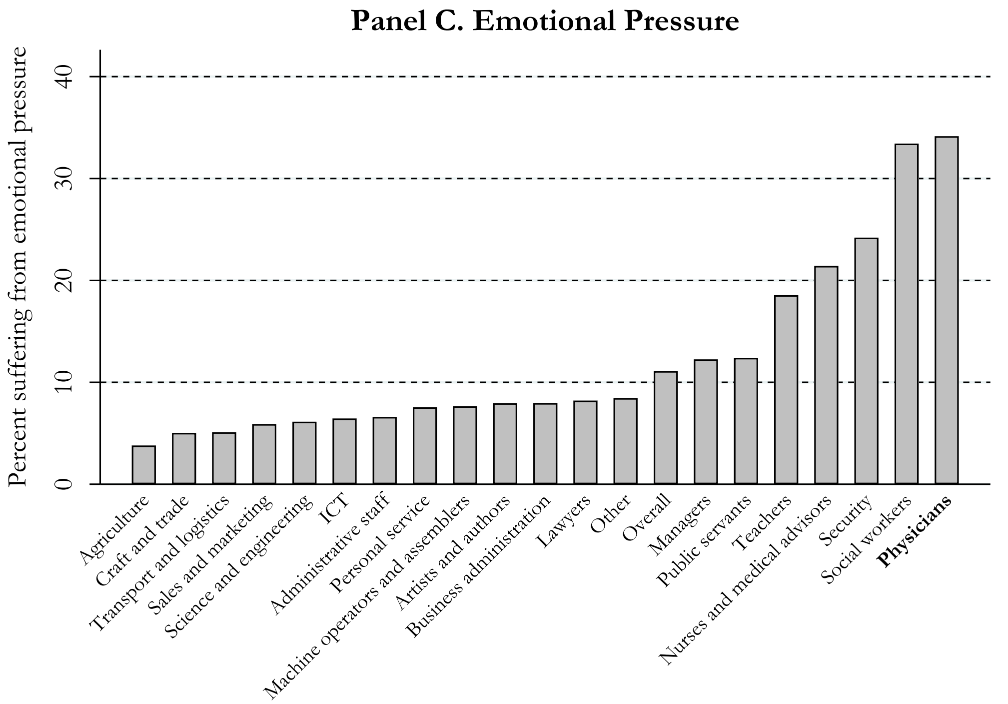
Figure 1. Burnout, Work Pressure, and Emotional Pressure by Occupation in the Netherlands

Panel A. Burnout



Panel B. Work Pressure





Notes: Based on data from the 2019 National Survey on Labor Conditions.

Table 1. Means of Outcomes for Physicians vs. Non-Physicians

	Physicians	Non-Physicians	Statistically different at 5% level?
Total Prescriptions	21.0	17.0	Yes
AD Use	0.125	0.131	No
Anxiolytic Use	0.109	0.096	Yes
Opioid Use	0.185	0.159	Yes
Sedative Use	0.146	0.072	Yes
Mental Health Treatment	0.092	0.123	Yes
N	15,869	11,595	

Table 2. Balancing Tests by First-Lottery Outcome

	(1)	(2)	(3)
	First-lottery winners	First-lottery losers	Statistically different at 5% level?
Lottery category B			
Female	0.601	0.602	No
Age at first lottery	18.1	18.1	No
Non-Western migrant	0.047	0.038	No
N	1,467	475	
Lottery category C			
Female	0.621	0.626	No
Age at first lottery	18.2	18.2	No
Non-Western migrant	0.041	0.039	No
N	1,801	1,108	
Lottery category D			
Female	0.585	0.594	No
Age at first lottery	18.3	18.3	No
Non-Western migrant	0.054	0.053	No
N	3,395	3,132	
Lottery category E			
Female	0.570	0.581	No
Age at first lottery	18.5	18.5	No
Non-Western migrant	0.077	0.072	No
N	2,887	4,058	
Lottery category F			
Female	0.552	0.556	No
Age at first lottery	18.8	18.7	Yes
Non-Western migrant	0.113	0.107	No
N	3,368	5,773	

Notes: Weighted means are shown. Tests of equality were performed by separately regressing *First Lottery* on each physician characteristic, where regressions were weighted by yearly admittance probabilities.

Table 3. The Effect of Winning Medical School Lottery on Becoming a Physician

	(1)	(2)	(3)
	Physician (Full sample)	*Physician* (Men)	*Physician* (Women)
First Lottery	0.401***	0.417***	0.389***
	(0.006)	(0.009)	(0.007)
Mean of dependent variable	0.578	0.547	0.600
N	27,464	11,568	15,896

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each column represents the results from a separate regression based on information from the Dienst Uitvoering Onderwijs, a Dutch organization under the Ministry of Education. *Physician* is equal to one if individual *i* is a licensed physician, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Table 4. The Effect of Becoming a Physician on Prescription Drug Use, 2006-2018

	Total Prescriptions (OLS)	*Total Prescriptions* (2SLS)
Panel A. Full sample (N = 27,464)		
Physician	4.245***	3.813***
	(0.245)	(0.628)
Mean of dependent variable	19.31	19.31
F-test of instrument		5,053.8
Panel B. Females (N = 15,896)		
Physician	5.003***	4.666***
	(0.347)	(0.918)
Mean of dependent variable	23.11	23.11
F-test of instrument		2,774.0
Panel C. Males (N = 11,568)		
Physician	3.145***	2.663***
	(0.333)	(0.819)
Mean of dependent variable	14.10	14.10
F-test of instrument		2,267.7

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate regression based on information from the prescription reimbursement database for the population of the Netherlands. *Total Prescriptions* is equal to the total number of prescription drugs individual *i* used during the period 2006-2018. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Table 5. The Effect of Becoming a Physician on Antidepressant (AD) Use, 2006-2018

	AD Use (OLS)	*AD Use* (2SLS)
Panel A. Full sample (N = 27,464)		
Physician	-0.004	0.029***
	(0.004)	(0.011)
Mean of dependent variable	0.128	0.128
F-test of instrument		5,053.8
Panel B. Females (N = 15,896)		
Physician	-0.004	0.042***
	(0.006)	(0.015)
Mean of dependent variable	0.140	0.140
F-test of instrument		2,774.0
Panel C. Males (N = 11,568)		
Physician	-0.002	0.013
	(0.006)	(0.015)
Mean of dependent variable	0.111	0.111
F-test of instrument		2,267.7

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate regression based on information from the prescription reimbursement database for the population of the Netherlands. *AD Use* is equal to one if individual *i* ever used antidepressants during the period 2006-2018, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Table 6. The Effect of Becoming a Physician on Antidepressant Use by Gender and Ability, 2006-2018

	AD Use (OLS)	*AD Use* (2SLS)
Panel A. High-ability females (N = 6,820)		
Physician	-0.020**	0.048*
	(0.010)	(0.025)
Mean of dependent variable	0.136	0.136
F-test of instrument		973.0
Panel B. Low-ability females (N = 9,076)		
Physician	0.005	0.038**
	(0.007)	(0.019)
Mean of dependent variable	0.142	0.142
F-test of instrument		1,812.9
Panel C. High-ability males (N = 4,558)		
Physician	-0.002	-0.004
	(0.010)	(0.025)
Mean of dependent variable	0.101	0.101
F-test of instrument		738.8
Panel C. Low-ability males (N = 7,010)		
Physician	-0.002	0.022
	(0.008)	(0.019)
Mean of dependent variable	0.118	0.118
F-test of instrument		1,527.4

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate regression based on information from the prescription reimbursement database for the population of the Netherlands. *AD Use* is equal to one if individual *i* ever used antidepressants during the period 2006-2018, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Table 7. The Effect of Becoming a Physician on Anxiolytic, Opioid, and Sedative Use, 2006-2018 (2SLS Estimates)

	Anxiolytic Use	*Opioid Use*	*Sedative Use*
Panel A. Full sample (N = 27,464)			
Physician	0.021**	0.044***	0.070***
	(0.010)	(0.012)	(0.010)
Mean of dependent variable	0.103	0.174	0.115
Panel B. Females (N = 15,896)			
Physician	0.031**	0.043**	0.093***
	(0.014)	(0.017)	(0.015)
Mean of dependent variable	0.113	0.180	0.129
Panel C. Males (N = 11,568)			
Physician	0.009	0.047***	0.042***
	(0.014)	(0.018)	(0.014)
Mean of dependent variable	0.091	0.166	0.094

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate 2SLS regression based on information from the prescription reimbursement database for the population of the Netherlands. Each outcome is equal to one if individual *i* ever used the specified drug during the period 2006-2018, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Table 8. The Effect of Becoming a Physician on Opioid, Anxiolytic, and Sedative Use by Gender and Ability, 2006-2018 (2SLS Estimates)

	Anxiolytic Use	*Opioid Use*	*Sedative Use*
Panel A. High-ability females (N = 6,820)			
Physician	0.049**	0.043	0.092***
	(0.023)	(0.028)	(0.026)
Mean of dependent variable	0.108	0.167	0.143
Panel B. Low-ability females (N = 9,076)			
Physician	0.020	0.042**	0.093***
	(0.017)	(0.021)	(0.018)
Mean of dependent variable	0.117	0.189	0.119
Panel C. High-ability males (N = 4,558)			
Physician	-0.001	0.031	0.030
	(0.023)	(0.030)	(0.025)
Mean of dependent variable	0.084	0.148	0.103
Panel D. Low-ability males (N = 7,010)			
Physician	0.015	0.055**	0.050***
	(0.017)	(0.022)	(0.017)
Mean of dependent variable	0.094	0.177	0.089

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate 2SLS regression based on information from the prescription reimbursement database for the population of the Netherlands. Each outcome is equal to one if individual *i* ever used the specified drug during the period 2006-2018, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Table 9. The Effect of Becoming a Physician on Treatment for a Mental Health Issue, 2012-2016

	Mental Health Treatment (OLS)	*Mental Health Treatment* (2SLS)
Panel A. Full sample (N = 27,464)		
Physician	-0.030***	0.002
	(0.004)	(0.010)
Mean of dependent variable	0.105	0.105
F-test of instrument		5,053.8
Panel B. Females (N = 15,896)		
Physician	-0.026***	0.020
	(0.006)	(0.014)
Mean of dependent variable	0.118	0.118
F-test of instrument		2,774.0
Panel C. Males (N = 11,568)		
Physician	-0.035***	-0.021
	(0.006)	(0.014)
Mean of dependent variable	0.088	0.088
F-test of instrument		2,267.7

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate regression based on information from the treatment database of all mental healthcare facilities in the Netherlands. *Mental Health Treatment* is equal to one if individual *i* ever received treatment for a mental health issue during the period 2012-2016, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Table 10. The Effect of Becoming a Physician on Treatment for a Mental Health Issue by Gender and Ability, 2012-2016

	Mental Health Treatment (OLS)	*Mental Health Treatment* (2SLS)
Panel A. High-ability females (N = 6,820)		
Physician	-0.033***	-0.007
	(0.009)	(0.024)
Mean of dependent variable	0.115	0.115
F-test of instrument		937.0
Panel B. Low-ability females (N = 9,076)		
Physician	-0.022***	0.037**
	(0.007)	(0.018)
Mean of dependent variable	0.120	0.120
F-test of instrument		1,812.9
Panel C. High-ability males (N = 4,558)		
Physician	-0.043***	-0.045*
	(0.010)	(0.024)
Mean of dependent variable	0.086	0.086
F-test of instrument		738.8
Panel D. Low-ability males (N = 7,010)		
Physician	-0.030***	-0.008
	(0.007)	(0.017)
Mean of dependent variable	0.090	0.090
F-test of instrument		1527.4

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate regression based on information from the treatment database of all mental healthcare facilities in the Netherlands. *Mental Health Treatment* is equal to one if individual *i* ever received treatment for a mental health issue during the period 2012-2016, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Appendix

For Online Publication

Appendix Table 1. Share of Medical School Applications and Probabilities of Admittance by Lottery Categories A through F, 1987-1999

Lottery category	GPA on final exams in high school	Share of applications	Number of applications	Average probability of admittance
A	GPA ≥ 8.5	0.02	815	0.86
B	8.0 ≤ GPA < 8.5	0.06	2,568	0.75
C	7.5 ≤ GPA < 8.0	0.10	4,118	0.60
D	7.0 ≤ GPA < 7.5	0.24	10,033	0.50
E	6.5 ≤ GPA < 7.0	0.25	10,660	0.42
F	GPA < 6.5	0.34	14,521	0.36

Notes: Based on administrative data from the Dienst Uitvoering Onderwijs, a Dutch organization under the Ministry of Education. GPA ranges from 1 to 10, where a score of 10 is perfect and scores below 5.5 are considered "insufficient." Applicants from the "A" (GPA ≥ 8.5) category are excluded from our sample because nearly all of them were eventually admitted to medical school. Applicants who did not take the nationwide high school exam (e.g., foreign students) are also excluded from the sample.

Appendix Table 2. Descriptive Statistics

	Full sample	Lottery winners	Lottery losers	Description
Female	0.579	0.580	0.578	= 1 if physician is female, = 0 otherwise
	(0.494)	(0.494)	(0.494)	
Age at first lottery	18.5	18.4	18.5	Age at which physician participated in first medical school lottery
	(1.19)	(1.18)	(1.21)	
Non-Western migrant	0.077	0.073	0.081	= 1 if physician or one of the physician's parents was born in a non-Western country, = 0 otherwise
	(0.267)	(0.260)	(0.273)	
N	27,464	12,918	14,546	

Notes: Means with standard deviations in parentheses.

Appendix Table 3. The Effect of Becoming a Physician on Antidepressant (AD) Use for Two or More Years, 2006-2018

	AD Use 2+ Years (OLS)	*AD Use 2+ Years* (2SLS)
Panel A. Full sample (N = 27,464)		
Physician	-0.010***	0.019**
	(0.004)	(0.011)
Mean of dependent variable	0.088	0.088
F-test of instrument		5,053.8
Panel B. Females (N = 15,896)		
Physician	-0.007	0.028**
	(0.005)	(0.013)
Mean of dependent variable	0.098	0.098
F-test of instrument		2,774.0
Panel C. Males (N = 11,568)		
Physician	-0.013**	0.009
	(0.005)	(0.013)
Mean of dependent variable	0.074	0.074
F-test of instrument		2,267.7

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate regression based on information from the prescription reimbursement database for the population of the Netherlands. *AD Use 2+ Years* is equal to one if individual *i* ever used antidepressants in two or more years during the period 2006-2018, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Appendix Table 4. The Effect of Winning Medical School Lottery on Becoming a Physician by Gender and Ability

	(1)	(2)	(3)	(4)
	Physician (High-ability men)	*Physician* (Low-ability men)	*Physician* (High-ability women)	*Physician* (Low-ability women)
First Lottery	0.388***	0.434***	0.352***	0.414***
	(0.014)	(0.011)	(0.011)	(0.010)
Mean of dependent variable	0.672	0.466	0.711	0.517
N	4,558	7,010	6,820	9,076

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each column represents the results from a separate regression based on information from the Dienst Uitvoering Onderwijs, a Dutch organization under the Ministry of Education. *Physician* is equal to one if individual *i* is a licensed physician, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Appendix Table 5. The Effect of Becoming a Physician on Antidepressant Use for Two or More Years by Gender and Ability, 2006-2018

	AD Use 2+ Years (OLS)	*AD Use 2+ Years* (2SLS)
Panel A. High-ability females (N = 6,820)		
Physician	-0.019**	0.021
	(0.008)	(0.022)
Mean of dependent variable	0.100	0.100
F-test of instrument		973.0
Panel B. Low-ability females (N = 9,076)		
Physician	0.001	0.032**
	(0.006)	(0.016)
Mean of dependent variable	0.096	0.096
F-test of instrument		1,812.9
Panel C. High-ability males (N = 4,558)		
Physician	-0.008	-0.010
	(0.008)	(0.021)
Mean of dependent variable	0.068	0.068
F-test of instrument		738.8
Panel C. Low-ability males (N = 7,010)		
Physician	-0.015**	0.020
	(0.006)	(0.016)
Mean of dependent variable	0.078	0.078
F-test of instrument		1,527.4

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate regression based on information from the prescription reimbursement database for the population of the Netherlands. *AD Use 2+ Years* is equal to one if individual *i* ever used antidepressants in two or more years during the period 2006-2018, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Appendix Table 6. The Effect of Becoming a Physician on Anxiolytic, Opioid, and Sedative Use, 2006-2018 (OLS Estimates)

	Anxiolytic Use	*Opioid Use*	*Sedative Use*
Panel A. Full sample (N = 27,464)			
Physician	0.016***	0.035***	0.074***
	(0.004)	(0.005)	(0.004)
Mean of dependent variable	0.103	0.174	0.115
Panel B. Females (N = 15,896)			
Physician	0.019***	0.024***	0.082***
	(0.005)	(0.006)	(0.005)
Mean of dependent variable	0.113	0.180	0.129
Panel C. Males (N = 11,568)			
Physician	0.011**	0.049***	0.064***
	(0.006)	(0.007)	(0.005)
Mean of dependent variable	0.091	0.166	0.094

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate OLS regression based on information from the prescription reimbursement database for the population of the Netherlands. Each outcome is equal to one if individual *i* ever used the specified drug during the period 2006-2018, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Appendix Table 7. The Effect of Becoming a Physician on Anxiolytic, Opioid, and Sedative Use for Two or More Years, 2006-2018 (2SLS Estimates)

	Anxiolytic Use 2+ Years	*Opioid Use 2+ Years*	*Sedative Use 2+ Years*
Panel A. Full sample (N = 27,464)			
Physician	0.006	0.017**	0.023***
	(0.006)	(0.007)	(0.007)
Mean of dependent variable	0.035	0.045	0.045
Panel B. Females (N = 15,896)			
Physician	0.006	0.019**	0.032***
	(0.009)	(0.010)	(0.010)
Mean of dependent variable	0.039	0.048	0.052
Panel C. Males (N = 11,568)			
Physician	0.006	0.015	0.013
	(0.008)	(0.010)	(0.009)
Mean of dependent variable	0.030	0.041	0.036

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate 2SLS regression based on information from the prescription reimbursement database for the population of the Netherlands. Each outcome is equal to one if individual *i* ever used the specified drug in two or more years during the period 2006-2018, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.

Appendix Table 8. The Effect of Becoming a Physician on Opioid, Anxiolytic, and Sedative Use for Two or More Years by Gender and Ability, 2006-2018 (2SLS Estimates)

	Anxiolytic Use 2+ Years	*Opioid Use 2+ Years*	*Sedative Use 2+ Years*
Panel A. High-ability females (N = 6,820)			
Physician	0.005	0.026*	0.036**
	(0.014)	(0.015)	(0.017)
Mean of dependent variable	0.035	0.039	0.055
Panel B. Low-ability females (N = 9,076)			
Physician	0.007	0.014	0.029**
	(0.011)	(0.012)	(0.012)
Mean of dependent variable	0.041	0.055	0.049
Panel C. High-ability males (N = 4,558)			
Physician	-0.014	0.009	0.008
	(0.014)	(0.015)	(0.016)
Mean of dependent variable	0.028	0.032	0.039
Panel D. Low-ability males (N = 7,010)			
Physician	0.017*	0.018	0.015
	(0.010)	(0.012)	(0.011)
Mean of dependent variable	0.031	0.047	0.033

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each cell represents the results from a separate 2SLS regression based on information from the prescription reimbursement database for the population of the Netherlands. Each outcome is equal to one if individual *i* ever used the specified drug in two or more years during the period 2006-2018, and equal to zero otherwise. All models control for the covariates listed in Appendix Table 2, lottery category fixed effects, year-of-first-lottery fixed effects, and lottery category by year-of-first-lottery fixed effects. Robust standard errors are in parentheses.