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# When women take over: Physician gender and health care provision *

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## Abstract

The share of female physicians has risen in OECD countries in recent decades, but we know little about the effects of physician gender. We exploit quasi-random assignment of primary care providers (PCPs) to patients and estimate the causal effect of female PCPs on health care provision. Using Austrian register data and a difference-in-differences strategy, we find that female PCPs generate 14% less revenue than male PCPs. This gap is driven by a 6% reduction in the number of patients and a 6.5% decrease in services per patient. Our findings are not consistent with discrimination; instead, female PCPs work fewer hours.

*JEL Classification:* I11, I12, J16, J22
*Keywords:* physician gender, primary care, gender medicine

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# I. Introduction

The medical field has historically been male-dominated. In recent decades, this has started to change, and the share of female physicians has nearly doubled in many developed countries (Hedden et al., 2014). While this is an important step toward gender equality in general, it also has potential implications for patients. On the one hand, female physicians have been found to be more altruistic toward their patients, meaning that they focus more on patient well-being than on maximizing their own income (Andreoni and Vesterlund, 2001; Attema et al., 2023). On the other hand, female physicians have been found to provide fewer services and treat their patients more defensively, leading to worse patient outcomes (Currie et al., 2016; Hedden et al., 2014). Additionally, with women not only underrepresented in the medical profession but also in medical research, the focus of clinical trials has been the male body, while disregarding biological and societal differences between male and female patients (Mauvais-Jarvis et al., 2020). Female physicians might be expected to be more aware of these differences and to treat their patients accordingly. Changes in the gender composition of the medical profession raise questions not only about the patient outcomes, but also about potential changes in the provision of health care and thus the allocation of health care resources.

In this paper, we analyze whether physician gender affects health care provision. To do so, we exploit quasi-random assignment of primary care physicians (PCPs) in Austria to causally estimate the effect of being assigned a female PCP on patient health care utilization.[1] We use a unique physician replacement process that excludes self-selection of patients to physicians where a solo practice is transferred from an exiting PCP to a new PCP (the *successor*). Additionally, we show that PCPs do not systematically self-select into specific positions based on their gender. Thus, the initial assignment of PCPs to patients provides a unique opportunity to causally study the effects of physician gender on health care provision.

Using a difference-in-differences (DID) framework, we compare practices with

[1]PCPs are general practitioners (GPs) who are the first point of contact with the medical system. Patients typically have one main PCP with whom they have repeated interactions and often a long-lasting trusting relationship. For this reason, PCPs are also often called *family doctors*. Importantly, due to the universal public health care system, patients do not pay out of pocket fees for medical care.

assigned female PCPs to those with assigned male PCPs before and after the replacement. We focus on practices with male exiting PCPs because they account for 92% of all replacements we observe. First, we are interested in whether female PCPs themselves behave differently than their male counterparts and analyze the effects on practice revenues and the number of patients seen. Second, we move to the patient level and ask whether patients are more likely to change PCPs when assigned to a female PCP. Finally, we examine the health care outcomes of patients who stay with their assigned PCPs and those who move away from their assigned PCP.

We find that female PCPs generate, on average, 14% less revenue than their male counterparts. Because PCPs are self-employed, their revenues directly correspond to their earnings. This revenue gap is driven by female PCPs *(a)* seeing fewer patients and *(b)* providing fewer services per patient than their male counterparts. On average, practices with female successors see 6% fewer patients per quarter. In addition, patients are 6 percentage points (pp) more likely to switch PCPs after being assigned a female PCP. This effect is particularly pronounced for practices located in urban areas. Crucially, patients do not avoid female PCPs altogether, as they are not more likely to choose a male PCP after leaving their assigned female PCP.

In terms of patient health, we find that patients treated by a female PCP have 6.5% lower PCP fees. At the same time, other outcomes such as specialist fees, drug prescriptions, or hospital expenditures are not affected. The gap in PCP fees is driven by a difference in the number of services provided, in particular health screenings. We decompose the screening gap and find that it is driven by male PCPs having a higher propensity to perform health screenings. Finally, the gender of the successor does not affect the health care utilization of patients who change PCPs. We argue that female PCPs reduce the per-patient costs relative to their male counterparts without leading to higher costs in other areas of medical care.

Our evidence is not consistent with discrimination by patients. If patients were avoiding female PCPs because of their gender, we would expect them to be more likely to choose a male PCP after leaving their assigned female PCP. This is not the case. Instead, it seems like the decrease in patients for female PCPs is driven by a reduction in the PCP working hours. This is particularly pronounced for PCPs with

children.

We contribute to the existing literature in three ways. First, we contribute to the literature on the effects of physician gender on health care provision. A battery of previous medical research has descriptively studied differences between male and female physicians and the implications on patient outcomes. Due to a wide variety of settings and methods, the results are mixed, and the majority of these studies are based on analyses that cannot rule out sorting of patients to physicians.[2] We contribute by employing a causal design that isolates the effect of PCP gender on a comprehensive set of practice and patient outcomes. We show that several effects on health care utilization disappear almost entirely when controlling for physician and patient sorting.

We are aware of only three design-based papers studying the effects of physician gender on patient health outcomes. Cabral and Dillender (2024) exploit random assignment of patients to physicians and analyze the effect of being assigned to a female physician on the likelihood of being evaluated as disabled and thus receiving disability benefits. The authors find that female patients are more likely to receive disability benefits when they are treated by same-gender physicians, while there is no such pattern for male patients. Greenwood et al. (2018) study the random assignment of patients with heart attack symptoms to emergency room physicians and find that female patients are more likely to survive a heart attack if they are treated by a female doctor. Relatedly, Currie et al. (2016) study physician differences in treatment style of heart attacks using a similar design. They find that female physicians are less likely to choose aggressive treatment styles leading to worse

[2]Contrary to the meta-analysis by Hedden et al. (2014), recent work shows that female GPs provide more testing and examinations than their male counterparts, leading to lower hospitalization rates (Bouissiere et al., 2022; Dahrouge et al., 2016; Krähenmann-Müller et al., 2014). Jackson et al. (2020) find no differences in the provision of preventive care by physician gender. In an experimental setting, Godager et al. (2021) find no difference between male and female physicians in their chosen treatment. While Mishra et al. (2020) show that female physicians prescribe less medication, Orzella et al. (2010) find the opposite. Tsugawa et al. (2017) and Wallis et al. (2017) both study hospital patients and find that patients treated by female physicians are less likely to die or be readmitted to the hospital. Moreover, there is evidence that patients communicate differently with female and male physicians. Female physicians talk more with their patients, which results in patients disclosing more information (Hall and Roter, 2002; Hedden et al., 2014). At the same time, female physicians are more likely to be interrupted by their patients and are perceived as more dominant compared to their male counterparts (Hall and Roter, 2002; Schmid Mast et al., 2011).

patient outcomes. These studies focus on a limited range of outcomes and one-time patient-physician interactions. We contribute to this literature by examining the effect of physician gender on a wide range of health outcomes over an extended time period. Furthermore, due to the repeated interactions in our setting, patients may decide to change their PCP. This decision has not been studied in the literature so far.

Second, we contribute to the literature on earnings gaps, particularly among physicians. Early work by Baker (1996), as well as research by Esteves-Sorenson and Snyder (2012) and Seabury et al. (2013), among others, has established that male physicians earn more than their female counterparts. Possible explanations for the observed revenue gap include childcare obligations (Sasser, 2005), discrimination (Theurl and Winner, 2011), differences in time allocation (Ganguli et al., 2020), and biased professional networks (Zeltzer, 2020). Our results point to the important role of childcare obligations, similar to (Sasser, 2005). In addition, we contribute to a recently emerging literature showing that earnings gaps arise even under gender-blind remuneration schemes (Cook et al., 2021). Despite having the same contract, female PCPs see fewer patients on average than their male counterparts, while male PCPs increase the number of services provided relative to their female counterparts.

Finally, our work fits into a growing strand of the literature focusing on the effects of gender and race matches in a variety of different settings, such as medical care, education, the labor market, and the legal system. Cabral and Dillender (2021) and Mauvais-Jarvis et al. (2020) provide an overview of gender concordance in the medical field; Alsan et al. (2019); Hill et al. (2023) and Walker et al. (2023) provide examples of the effects of nationality and race concordance.[3] Our paper builds on this work by testing whether patients prefer or benefit from same-gender physicians.

[3]Other papers have studied gender and race concordance in academia (e.g., Bagues et al., 2017; Card et al., 2020), education (e.g., Canaan and Mouganie, 2023; Carrell et al., 2010; Gershenson et al., 2022), the labor market (e.g., Bertrand et al., 2019; Cullen and Perez-Truglia, 2023; Weber and Zulehner, 2010), and the legal system (e.g., Anwar et al., 2012, 2019; Hoekstra and Street, 2021).

## II. Institutional setting

Austria's health care system is a Bismarckian social security system with universal access to high-quality medical services for the entire population. Compulsory health insurance covers a wide range of inpatient and outpatient treatments, as well as drugs.[4] Individuals are not free to choose their health insurance provider, instead it is defined by their place of residence and type of occupation. We focus on Upper Austria (UA), one of Austria's nine federal states.[5] The largest health insurance provider in UA is the Upper Austrian Regional Health Insurance Fund (UAHIF), which covers all private sector employees and their dependents, about 1.2 million people in 2018, or roughly 80% of the population (HVB, 2019; Statistics Austria, 2023).[6]

Primary outpatient care is mainly provided by PCPs, who are general practitioners (GPs) in solo practices. They are responsible for acute care, regular check-ups, preventive care, and referrals to specialists and hospitals. In addition, PCPs issue sick notes (Ahammer, 2018). PCPs are usually the first point of contact for patients in need of health care, although there is no strict gatekeeping system (Hofmarcher, 2013).[7] Even though patients are free to choose among available PCPs, they typically consult the PCP in their immediate area of residence (Hackl et al., 2015). PCPs can either be contracted by a health insurance or work privately.[8] If they are contracted, their compensation is centrally negotiated by the UAHIF and the UA Medical Association and is based on a combination of flat-rate and fee-for-service payments, with services being billed directly to the health insurance (Hofmarcher,

[4] Patients have to pay minimal co-payments, e.g. a 6 € fee for drug prescriptions (2018).

[5] UA is the third largest federal state with 20% of the total population, or about 1.5 million inhabitants in 2018. The province consists of 440 municipalities and 18 districts (Statistics Austria, 2023).

[6] Based on own calculation. Other health insurance funds cover, for example, the self-employed, farmers, or civil servants.

[7] Patients can see most specialists and hospital outpatient departments without a referral. Health insurances also cover these services.

[8] We observe both contracted and private PCPs in our data. However, the majority of primary care is provided by contracted PCPs. Only 2% of UAHIF insured regularly see a private PCP. When patients see a private PCP, they have to pay the fee out-of-pocket and are then reimbursed by the health insurance for up to 80% of the costs that would have been incurred with a contracted PCP (Hofmarcher, 2013).

2013). Although the number of PCPs has remained fairly constant over the past twenty years, their composition has changed. The share of female GPs has increased drastically, from about 25% in 2005 to almost 50% in 2018 (Appendix Figure A.1).

When a PCP wishes to leave their contracted position (henceforth referred to as *exit*), the UAHIF and the UA Medical Association seek to replace the exiting PCP. In our analysis, we exploit this physician replacement process, in which a medical practice is taken over by a new physician. The exiting PCP is required to notify the UAHIF at least one quarter prior to termination. The most common reasons for an exit are either retirement or relocation.[9] When a contract position is to be filled, the UA Medical Association advertises the position on its website. Potential PCPs can then submit their applications and are ranked according to their qualifications (*score*), which is calculated based on previous experience and additional training.[10] The applicant with the highest score is offered the position, and neither the exiting PCP nor the patients have any influence on who becomes the successor. Therefore, the gender of the successor can be considered exogenous to the patients and the exiting PCP. The exiting PCP can only determine how the patients are transferred and whether the new PCP can become active in the premises of the successor's practice.

There are two types of replacement: In a *soft transition*, the exiting and new PCP work together for at least one quarter, while in a *hard transition*, the exiting PCP stops working when the successor starts working.[11] We exclude positions with a transition period of more than one quarter from our analysis, because we want to measure the effect of the successor working alone and avoid picking up on collaboration effects between exiting and incoming PCP.

[9]Roughly 85% of exiting PCPs retire, 4% relocate within UA, and 10% either relocate to a hospital, a different federal state or country, or stop working for other reasons (Zocher, 2024).

[10]Previous medical practice accounts for an average of 56-61% of this score, additional training for an average of 19-23%, and the time since obtaining the license to practice general medicine for an average of 16-18% of the points (R. Hechenberger, UA Medical Association, personal communication, June 2023).

[11]Exiting PCPs autonomously choose the transfer type, which is advertised with the position. Overall, soft transitions are more common than hard transitions. Other differences between positions with soft or hard transitions (e.g., number of patients) are minor and mostly insignificant. For more details on the exit and transition process, see Zocher (2024).

# III. Data

## III.A. Patients' health care utilization

We use administrative data from the UAHIF from 2005 to 2018 to analyze practice-level outcomes and individual health care utilization. These data contain detailed quarterly information on individual outpatient and inpatient health care expenditures, such as provided treatments, drug prescriptions (including ATC classification), and diagnoses of inpatient hospital stays (ICD-10 classification). Importantly, these fees are billed directly to the health insurance and are not paid out-of-pocket by patients. Additionally, the data provide information on the providing, referring, and prescribing physicians for each service received by a patient.

For the practice-level outcomes, we aggregate all services provided and all patients seen for each PCP in our sample. We use the term *revenue* to refer to the sum of all fees that the PCP bills directly to the health insurance. For the analysis of patient health outcomes, we focus our analysis on PCP fees as this represents health care provision by the PCP.[12] We further look at additional health care expenditures, such specialist fees, drug prescriptions, and hospital expenditures. To study preventive care provision, one of the main functions of PCPs, we also examine participation in general health screenings, diabetes care, and referrals for laboratory and radiology services at the extensive margin.

## III.B. Patient-PCP Link

To identify the PCP for each patient, the related literature often counts the number of PCP visits within a given time period when official registries are not available (Fadlon and Van Parys, 2020; Sabety, 2023). Due to data limitations, we are not able to determine the exact number of visits per quarter prior to 2013. Therefore, to identify the primary PCP for each patient in a given quarter, we instead calculate total fees incurred by a patient with a PCP on a quarterly basis. We then define the PCP for each patient and quarter as the PCP with whom the patient had the highest

[12] This corresponds to the revenue at the PCP level as described above. To calculate PCP revenue, we aggregate the PCP fees of all patients a PCP sees per quarter.

spending in at least two of the previous three quarters. In cases where a patient does not see a PCP for an extended period of time, resulting in the unavailability of an identifiable PCP for a given quarter, information from previous quarters is used. This methodology allows us to assign patients' PCPs for each quarter from 2005 to 2018. Importantly, it mitigates the disruption caused by patients temporarily switching to a different PCP, e.g., when their usual PCP is unavailable.[13]

### III.C. PCP and position characteristics

Additionally, we use data on replacements from the UA Medical Association from 2005 to 2018. We restrict the sample of replacements to the years 2007–2016 so that we can observe patients for at least 2 years before and after the replacement. We only include successful replacements where a contracted position is transferred from the exiting PCP to the succeeding PCP. Therefore, we exclude newly created, merged, expanded, and shared contracted positions.[14] To avoid picking up the effects of prior replacements, we only consider practices that experience a single replacement. The UA Medical Association additionally provides information on the exact replacement date, the type of transition (soft or hard), and the birth year, graduation year, and gender of the exiting and new PCPs.

We supplement this data with web-scraped vacancy data from the UA Medical Association website, covering the period from April 2008 to December 2017, which provides further information on the number and scores of applicants. In addition, we collect the number of vacancies before the position was successfully filled. In our analysis sample, we are able to match occupation and vacancy data through the location of the position, the transition model, the gender of the successor, and the timing of the transfer for almost all replacements from 2008 to 2017. About 10% of the replacements in the final sample cannot be successfully matched (for detailed

[13]The majority of patients typically see only one PCP per quarter. As a result, the assignment approach yields PCP-patient matches that closely resemble those from using the visit frequencies. We test the overlap by determining the PCP based on visits for the available time period from 2013 to 2018. These two different methods yield the same match in 94.1% of the cases.

[14]In the case of such vacancies, the senior partners of the position being filled have the right to participate in the selection of the junior partners. To ensure a quasi-random assignment of successors to positions, we exclude these types of transfers. We also exclude newly created positions because we cannot rule out patient selection to PCPs.

information, see Appendix C).

### III.D. Descriptives

We descriptively compare male and female successors in Appendix Table B.1. We observe 131 replacements in our final sample, of which 40% involve female successors. Generally, male and female successors are very similar. The raw differences in personal and replacement characteristics are small and insignificant and do not indicate differential selection.

We also observe only small differences between patients with either a male or female successor, which are not quantitatively significant. Table B.2 shows socioeconomic characteristics and health care utilization of patients. We observe approximately 41,500 patients with an assigned male successor and 24,500 patients with a female successor.[15] The mean age of patients in the pre-period is 52.3 years and the share of female patients is approximately 52 percent.[16] The average patient visits their PCP 0.7 times per quarter in the pre-period and generates fees of 33 € with their PCP.

## IV. Empirical methodology

To identify the causal effect of PCP gender on practice and patient outcomes, we exploit the quasi-random assignment of successors after a PCP decides to exit their contracted position.[17] We first discuss the quasi-random assignment of PCPs to patients before describing our identification strategy in more detail.

[15] These numbers represent patients who stay with the PCP practice for the entire observation period.

[16] The average age is higher than the average age of the total population in UA of 42.4 years (Statistics Austria, 2022). The difference occurs because we require patients to stay with the same PCP practice for at least four years. Younger people are more likely to change PCPs.

[17] Similarly, recent work has studied the implications of practice takeovers (e.g., Sabety, 2023; Simonsen et al., 2021; Zhang, 2022; Zocher, 2024). However, these papers focus on the disruption of continuity of care.

### IV.A. Random assignment of successors

Since neither the exiting PCP nor the patients can influence who becomes the successor, the gender of the successor can be assumed to be exogenous to the exiting PCP and the patients. However, if female and male successors were to apply to different positions, this self-selection could pose a threat to our identification strategy. Consequently, the gender of the successor may not be randomly distributed across all open positions, but may be correlated with observed and unobserved characteristics.

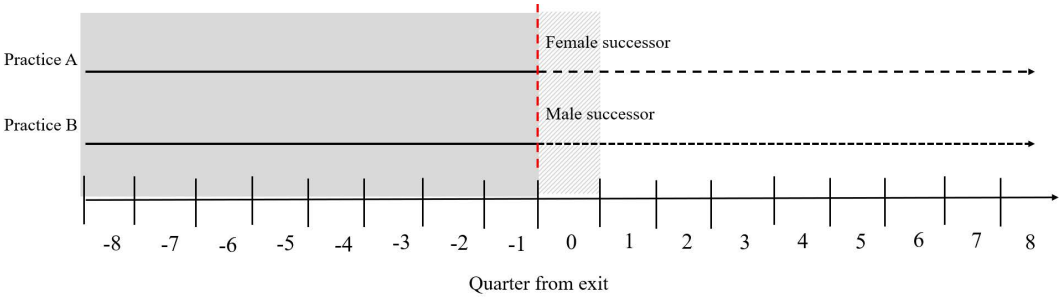
Above we show descriptively that female and male successors do not differ systematically. Furthermore, we provide evidence that the successor's gender is not correlated with several practice and patient characteristics of the position. To test for a correlation between practice characteristics and the gender of the succeeding PCP, we estimate the following model:

$$Y_j = \beta FS_j + \boldsymbol{\delta}\mathbf{X}_j + \varepsilon_j, \tag{1}$$

where $Y_j$ denotes the characteristics of the position taken over by successor $j$, measured in the two years prior to the successful replacement. $FS$ is an indicator equal to one if successor $j$ is female, and zero otherwise. Thus, $\beta$ estimates the correlation between the gender of the successor and the position characteristics. $\mathbf{X}$ includes the successor's age and years of experience, and calendar year fixed effects.

We present results for four different types of outcomes: *(i) potential income:* average quarterly revenue, in-house pharmacy, practice location (urban or rural); *(ii) practice attractiveness:* transition model (soft or hard), number of postings until successful replacement, number of applicants; *(iii) patient types:* share of female patients, patients aged over 65, patients with comorbidities; and *(iv) average fees:* for PCPs, specialists, and drug prescriptions. The estimation results are summarized in Appendix Table B.3. Notably, the coefficients associated with the successor's gender do not show statistical significance in any of the estimates. Given the lack of significant correlation with position characteristics, we suggest that PCPs do not systematically choose specific positions based on their gender.

Figure 1: Identification method




*Notes:* This figure illustrates the identification method. The gray area indicates the period in which the exiting PCP works alone. The shaded area shows the quarter in which the exiting and the incoming PCP work together in case of a soft transition.

## IV.B. Identification strategy

We argue that the assignment of female and male PCPs is as good as random for both exiting PCPs and patients. Therefore, we compare practices A and B during the two years before and after the exit, as shown in Figure 1. Both practices were run by a male PCP before the exit.[18] The exiting PCP of practice A is replaced by a female PCP, while practice B is taken over by a male PCP. In the case of a hard transition, the exiting PCP leaves at the end of the relative quarter $q = -1$ and the successor starts in the relative quarter $q = 0$. In the case of a soft transition, the exiting PCP leaves at the end of relative quarter $q = 0$ and the exiting PCP and successor work together in relative quarter $q = 0$. The majority of the observed successors have not previously worked in the outpatient sector in UA. Consequently, we examine the effect of PCP gender in a context where patients have no prior contact with the succeeding PCP.

For our patient-level analysis, we require that patients be consistently insured over the entire observation period ($q = -8$ to $q = 8$) to ensure that we can observe their health care utilization. Additionally, all patients have stayed with the same PCP practice for at least two years before the replacement ($q = -8$ to $q = 1$).[19] In the

[18] In 131 of the replacements in our sample, the exiting PCP was male, while in 12 cases the exiting PCP was female. We focus on the male exiting PCPs, because the exiting female PCPs represent a much smaller share of the sample.

[19] We require patients to stay until $q = 1$ to ensure that they actually experience the replacement also in the case of a soft transition.

analysis of practice-level outcomes, patient movement, and health care utilization among moving patients, individuals are allowed to change PCPs after the replacement. In the analysis of health care utilization among staying patients, patients are required to maintain their association with the specific PCP pair (the exiting and the new PCP) for the entire observation period ($q = -8$ to $q = 8$). The chosen time window implies that we capture the early stages of patients and successors establishing a new relationship and getting to know each other. If patients experience multiple PCP replacements during our sample period, we only keep the first one in the sample to avoid any learning effects.

### IV.C. Estimation

To estimate the effect of PCP gender on practice and patient outcomes, we estimate the following two-way fixed effects model:

$$Y_{iq} = \alpha_i + \theta_q + \beta(\mathbb{I}\{q > 0\}_q \times FS_i) + \boldsymbol{\gamma}\mathbf{X} + \varepsilon_{iq}, \tag{2}$$

where $Y_{iq}$ is the outcome of interest for practice or individual $i$ in relative quarter $q$. $\alpha_i$ are practice or patient fixed effects, $\theta_q$ are relative quarter fixed effects. $\mathbb{I}\{q > 0\}$ is an indicator equal to one if the replacement has already taken place, and zero otherwise. $FS_i$ is an indicator equal to one if practice or person $i$ is assigned to a female successor, and zero otherwise. $\beta$ is the coefficient of interest and represents the effect of a female PCP on the outcome of interest compared to a male successor. $\mathbf{X}$ includes additional control variables such as calendar year fixed effects and the successor's experience as a physician in years. For the analysis of patient outcomes, we also control for patient age. Standard errors are clustered at the practice level.[20] To examine the dynamic effects of PCP gender on practice and patient outcomes, we estimate the following event study:

$$Y_{iq} = \alpha_i + \theta_q + \sum_{k=-8 \mid k \neq -2}^{8} \beta_k(\mathbb{I}\{q = k\}_q \times FS_i) + \boldsymbol{\gamma}\mathbf{X} + \varepsilon_{iq}, \tag{3}$$

[20] We follow Abadie et al. (2022) and define standard error clusters at the level at which the treatment is assigned, in our case the practice where an exiting doctor is replaced by a successor. If we instead define the cluster at the patient level, standard errors become much smaller.

where $\mathbb{I}\{q = k\}$ indicates the relative time period $k$.

The identifying assumption of any TWFE estimation is that practice-level outcomes as well as the health care utilization of patients assigned to female PCP relative to a male PCP would have continued on a parallel trend in the absence of the change in PCP gender. We provide evidence in support of this assumption by showing that the outcomes of interest do not systematically diverge before the change in PCP.[21] The reference quarter in the dynamic estimation is the relative quarter $q = -2$. As discussed in section II, while exiting PCPs do not directly influence the selection of successors, they could potentially adjust their behavior once they become aware of who the successor is. Moving the reference quarter to $q = -2$ provides an opportunity to study the effect of the successor's gender on the exiting PCP in the relative quarter $q = -1$ (and $q = 0$ in the case of a soft transition).

## V. Practice level results and patient movement

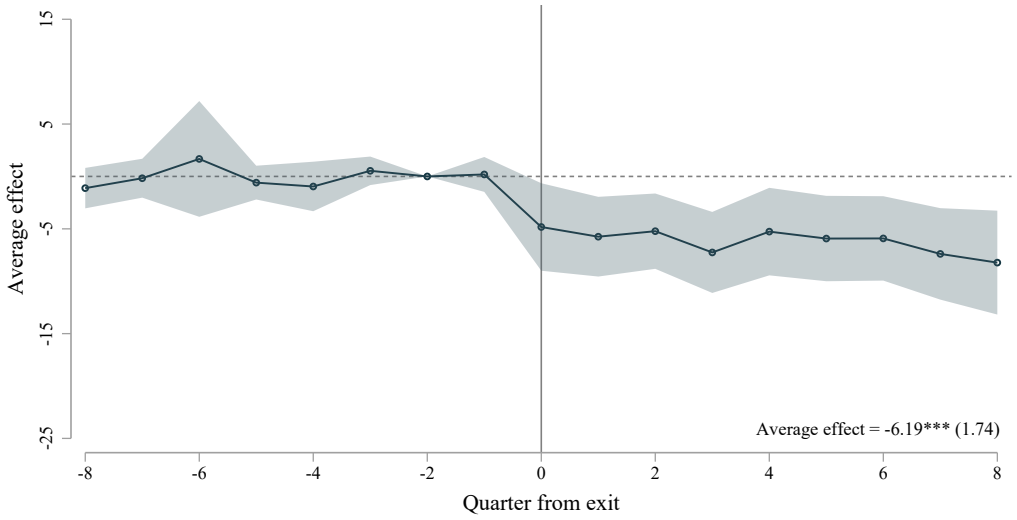
We start our analysis by studying the PCPs themselves. Both male and female successors arrive at their new practice and are faced with a multitude of questions. Crucially, they have to decide how many patients to see and how many services to provide which directly affects their income. Therefore, we begin this chapter by analyzing revenue and patient volume at the PCP level. We then shift the focus to the patient level, where we analyze patient movement. We end the chapter by exploring potential mechanisms.

### V.A. Practice level results

We estimate a TWFE model following equation (3), in which we compare practices that are assigned a female successor to practices with a male successor. In Figure 2, we show event study coefficients for the average revenue. We find that female successors have statistically and economically significant negative effects on revenue per quarter, with a decrease in revenue of 6,190 € per quarter, or about

[21] In light of recent research on TWFE estimation, we also provide estimation results using the method proposed by Sun and Abraham (2021) to address the potential threat of heterogeneous treatment effects related to differential timing of the replacement.

Figure 2: Dynamic effects on PCP revenue




*Notes:* This figure provides event study estimates for the differential impact of a female successor on PCP revenue (in 1,000 €) following equation (3). The shaded band represents the 95% confidence intervals with standard errors clustered at the practice level. The average effect stems from estimations following equation (2). In Appendix Figure A.2, we additionally show event studies using the Sun & Abraham estimator.

15% compared to the pre-mean. In Appendix Figure A.2, we further show the event study for the effect of a female successor on the number of patients treated per quarter. We find a decrease of about 72 individual patients, or 6%, which is statistically significant at the 10% level. Additionally, we provide coefficients using the estimator proposed by Sun and Abraham (2021), which are remarkably similar to the TWFE coefficients.

To learn more about what drives these results, we calculate the average differences between practices with female and male successors before and after the replacement and show results in Table 1. While the difference in the average number of patients before and after the replacement is statistically and economically insignificant for practices with a male successor, this is not the case for practices with a female successor. Female successors see fewer patients per quarter compared to the exiting PCPs in the same practice before the replacement. The opposite is true for average revenue. Here, the difference between the pre- and post-period is

Table 1: Differences in revenue and number of patients

| | *Gender Successor* | | |
|---|---|---|---|
| | Male | Female | Differences |
| | (1) | (2) | (3) |
| *Panel (a): Revenue (in 1,000 €)* | | | |
| Pre-period | 41.14 | 42.20 | 1.06 |
| | (1.54) | (2.33) | (2.78) |
| Post-period | 48.47 | 42.05 | −6.42** |
| | (1.52) | (1.80) | (2.35) |
| Difference over time | 7.33*** | −0.14 | DD = −7.48*** |
| | (1.22) | (1.50) | (1.92) |
| *Panel (b): Patients* | | | |
| Pre-period | 1,041.59 | 1,064.10 | 22.51 |
| | (36.78) | (57.31) | (67.79) |
| Post-period | 1,079.30 | 997.12 | −82.17 |
| | (29.19) | (48.62) | (56.45) |
| Difference over time | 37.70 | −66.98** | DD = −104.68** |
| | (24.45) | (32.30) | (40.33) |
| Number of practices | 79 | 52 | |

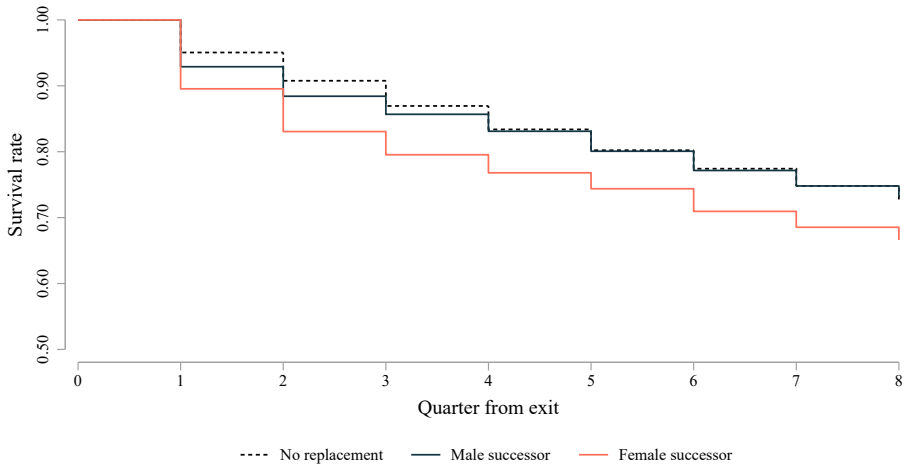
*Notes:* This table shows differences between practices with female and male successors before and after the replacement. These numbers differ from our estimation results as they represent purely averages and do not include fixed effects or controls. In Panel *(a)*, we focus on the revenue per practice and in Panel *(b)* on the quarterly average number of unique patients. Standard errors are clustered at the practice level and reported in parentheses. Asterisks indicate significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

small and insignificant for practices with female successors, but large and significant for practices with male successors. Thus, the negative DID result is due to male successors increasing their revenue while female successors, on average, do not experience a large change.

### V.B. Patient movement

Above, we showed a gap in the number of patients seen by male and female successors. This could occur either because female PCPs choose to see fewer patients than their male counterparts, or because patients choose to change their assigned female

Figure 3: Kaplan-Meier survival function




*Notes:* This graph compares the likelihood of patients to stay with their assigned PCP in the two years following a replacement. All patients are insured for the entire period of interest and have stayed with the same PCP for the last two years before the replacement. The survival function plots patients' probability to change their PCP after the replacement. The "no replacement" group, shown by the black dashed line, is all patients in our data who fulfill these conditions without experiencing a replacement. The black solid line and the red solid line plot survival functions of patients whose PCP is replaced by either a male or a female successor.

PCP at higher rates. Because patients are essentially free to choose their PCP, some patients may decide to move to a different practice after the replacement. Therefore, we use patient-level data to analyze the differential moving behavior of patients with male and female successors. Additionally, we describe patient, physician, and practice characteristics that may be associated with a greater propensity to change the assigned PCP after the replacement. To do so, we focus only on patients who have been with the exiting PCP for at least two years before the replacement.[22]

We first analyze the probability of patients changing their assigned PCP after the exit of their previous PCP in a Kaplan-Meier survival analysis framework. We define survival as staying with the assigned PCP in the post-period, and show Kaplan-Meier survival functions for patients with a female successor (red solid line) and a male successor (black solid line) in Figure 3.[23] Because patients are free to change PCPs

[22] We do not include patients who join the new PCP for the first time after the replacement. These self-selecting patients account for only 3% of all patients a PCP sees each quarter.

[23] We consider a patient's change of PCP as an absorbing state. Hypothetically, patients could

in any case, e.g., due to moving, we also plot a "no replacement" survival function (black dashed line) for insured individuals who do not experience a replacement.

We note that even without a replacement, about 25% of patients change PCPs within two years. For patients with a male assigned PCP, this share is very similar, while for patients with a female assigned PCP, it rises to 31 percent. The difference in survival rates between patients with male and female assigned PCPs persists for the full two year period after the replacement. We test the difference between patients assigned either a male or a female successor using a log-rank test. Patients with assigned female PCPs are more likely to change PCP than patients with assigned male PCPs ($\chi^2 = 289.28$, $p = 0.0000$). The exit rates are stable, with patients with female PCPs being more likely to change PCP after the first and second quarters, but then continuing along a parallel trend to patients of male PCPs. The difference in exit rates between patients with female and male successors is stable at 6 pp.[24]

### V.C. Who leaves whom?

In this section, we further analyze the types of patients who are more likely to change PCPs and the role of replacement characteristics. To determine which patients move away from which PCPs, we regress the probability of leaving the assigned PCP on an indicator of the successor's gender as well as patient, successor, and replacement characteristics. Table 2 shows the corresponding estimation results.

Consistent with Figure 3, we find that patients with a female successor are 6 pp more likely to change their PCP, even after including a variety of control variables, with the coefficient being statistically significant at the 10% level. The probability of changing PCPs is higher for female patients, younger patients, patients with higher wages, and patients who move to a different district.

While correlations between personal characteristics and the probability of chang-

change their PCP multiple times in the post period, but we are only interested in the first time that a patient decides to change their PCP. On average, 19% of patients who change their PCP return again within the two-year post period. For patients with an assigned male PCP, this share is about 21 percent, while for patients with an assigned female PCP, it is 16 percent.

[24] In relative quarter four, the exit rate is 14% for patients with a male successor and 20% for patients with a female successor. In relative quarter eight, the exit rate is 25% for patients with male successors and 31% for patients with female successors.

Table 2: Effect of practice and doctor characteristics on patient move

| | | *Gender Successor* | | New |
|---|---|---|---|---|
| | Baseline | Male | Female | female PCP |
| | (1) | (2) | (3) | (4) |
| Female successor | 0.060* | | | 0.058 |
| | (0.033) | | | (0.037) |
| *Patient characteristics* | | | | |
| Female patient | 0.015*** | 0.014*** | 0.017*** | 0.034*** |
| | (0.003) | (0.004) | (0.005) | (0.006) |
| Age | −0.003*** | −0.003*** | −0.003*** | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Migrant | −0.009 | −0.008 | −0.006 | −0.008 |
| | (0.008) | (0.009) | (0.011) | (0.011) |
| Wage | 0.000*** | 0.000*** | 0.000*** | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Move district | 0.141*** | 0.145*** | 0.141*** | 0.011 |
| | (0.014) | (0.017) | (0.024) | (0.018) |
| Prior comorbidity† | 0.012** | 0.008 | 0.018** | −0.005 |
| | (0.005) | (0.006) | (0.008) | (0.010) |
| *PCP characteristics* | | | | |
| Experience (years) | 0.000 | 0.004 | −0.006 | 0.004 |
| | (0.003) | (0.003) | (0.009) | (0.003) |
| Foreign education | −0.042 | 0.080 | 0.002 | −0.263*** |
| | (0.084) | (0.102) | (0.133) | (0.081) |
| *Practice characteristics* | | | | |
| Urban | 0.144*** | 0.104** | 0.202** | 0.118** |
| | (0.045) | (0.046) | (0.080) | (0.047) |
| In-house pharmacy | 0.028 | −0.010 | 0.100 | 0.061 |
| | (0.048) | (0.034) | (0.117) | (0.046) |
| Soft transition | −0.126*** | −0.129*** | −0.166** | −0.095** |
| | (0.040) | (0.034) | (0.080) | (0.047) |
| Number of patients‡ | | | | |
| Ref: < 1000 patients | | | | |
| 1000-1300 patients | −0.007 | −0.016 | −0.045 | −0.025 |
| | (0.033) | (0.037) | (0.071) | (0.041) |
| > 1300 patients | 0.093* | −0.015 | 0.152 | 0.013 |
| | (0.053) | (0.042) | (0.092) | (0.062) |
| Many patients with comorbidity† | −0.012 | 0.021 | −0.132 | −0.004 |
| | (0.036) | (0.031) | (0.096) | (0.037) |
| Mean | 0.292 | 0.263 | 0.337 | 0.292 |
| $R^2$ | 0.082 | 0.075 | 0.115 | 0.081 |
| $N$ | 84,843 | 51,117 | 33,726 | 19,591 |

*Notes:* This table shows the effect of patient, successor, and practice characteristics on whether patients change their PCP. The outcome variable equals 1 if the patient changes the PCP's practice after the replacement, and 0 otherwise. Column (1) reports OLS results for the full sample, Column (2) shows correlations for patients assigned a male PCP, and Column (3) for patients assigned a female PCP. In Column (4), we additionally regress the probability that patients choose a new female PCP after leaving their assigned PCP on the same covariates. In this analysis, we only consider patients who change their PCP and the outcome equals 1 if the new PCP is female and 0 if the new PCP is male. Standard errors are clustered at the practice level and reported in parentheses. Asterisks indicate significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

‡ The number of patients represents the quarterly average of patients treated in the two years before the replacement. The grouping roughly corresponds to tertiles of the distribution of the average number of patients across practices in our sample.

† Prior comorbidity is equal to 1 if the patient was diagnosed with one or more of the following conditions in the two years prior to the replacement: Alzheimer's disease, cancer, depression, type-2 diabetes, influenza or pneumonia, heart, kidney, liver, or pulmonary disease, or a stroke. The share of patients with comorbidities is calculated as the practice-level leave-one-out mean averaged over the two years prior to the replacement, and we split the sample at the median.

ing PCPs are similar for patients of male and female successors, practice characteristics appear to be more relevant for female successors than for male successors (Columns (2) and (3) in Table 2). Patients in urban areas are more likely to change PCPs, presumably due to the greater number of alternative PCP practices. This pattern is more pronounced for patients of female successors, with a difference of 20.2 pp between living in an urban area and a rural area, compared to 10.4 pp for patients of male successors. Patients who experience a *soft transition* are overall less likely to change PCPs. For patients of female successors, the coefficient is greater at 16.6 pp compared to 12.9 pp for male successors.

### V.D. Gender discrimination

To test whether patients change their female PCP at higher rates due to a general dislike of female physicians, we focus on patients who change PCP and regress their probability of choosing a new female PCP on patient, successor, and replacement characteristics. We show results in Table 2, Column (4). Patients who are assigned a female successor and decide to move away from their assigned PCP are not more likely to choose a new male PCP rather than a new female PCP. Thus, although patients move away from female PCPs at higher rates, this is not driven by preferences for male physicians.

If it is not patient preferences that drive patients away from female PCPs, we argue that it is instead the female PCPs who choose to see fewer patients. There may be several motives for wanting to see fewer patients. For example, female physicians may prefer to spend more time with each patient, or they may choose to work fewer hours overall. While we cannot observe how much time PCPs spend with each patient, we dive deeper into PCP working hours.

### V.E. Working hours

Since our evidence is not consistent with patients discriminating against female PCPs, we investigate supply-side mechanisms that may explain the gap in the numbers of patients between female and male PCPs. One explanation for our findings may be that female PCPs choose to work fewer hours relative to their male counter-

parts and thus, seeing fewer patients. While contracted PCPs are required by law to open their practices for at least 20 hours per week, they have the flexibility to schedule patient appointments beyond these hours.[25] The UAHIF data do not allow us to observe actual working hours, so we make use of an additional data source, the Austrian Microcensus, a labor force and housing survey (Statistics Austria, 2024).[26]

We select all self-employed physicians in Austria from 2011 to 2018.[27] To compare working hours between female and male physicians, we estimate a model, similar to equation (1), where we regress average weekly working hours on an indicator variable, equal to one if the physician is female, and zero otherwise, as well as experience (in years) and calendar year and state fixed effects.

Table 3 shows the results of this estimation. We find that, on average, female physicians work 7.5 hours less per week than their male counterparts, a gap of 17% relative to the mean. However, parenthood plays a crucial role. Among physicians without children, there is no significant gender gap, while among physicians with children, the gap in working hours between male and female physicians widens to 13.3 hours, about 30% relative to the mean. This result is in line with earlier research showing that female physicians with children reduce their working hours (Sasser, 2005) and complements a previous study showing that mothers in Austria bear the majority of childcare responsibilities (Danzer et al., 2022).

The UA Medical Association data provides some additional information about PCPs for the first quarter of 2009, including the number of children. According to this data, by early 2009, every PCP who took over a practice in the previous two years had at least one child. In the beginning of 2009, we also find a gender gap in patient volume among these PCPs, with female PCPs seeing 101 fewer patients on average.[28]

In summary, we find that female successors generate lower revenues compared

[25] These 20 hours per week must spread over at least five days between Monday and Saturday, and must cover at least two afternoons (§14, Ärzte-Gesamtvertrag, 2020).

[26] The Microcensus is a rotating panel that interviews approximately 22,500 randomly selected households per quarter. Each household participates a maximum of 5 times.

[27] By sampling only self-employed physicians, we exclude those who work in hospitals or companies. Note, that the Microcensus does not allow us to distinguish between PCPs and specialists, or between solo practices and group practices.

[28] Overall, 90% of all PCPs we observe in the first quarter of 2009 had at least one child.

Table 3: Working hours of self-employed physicians

| | | *Children* | |
|---|---|---|---|
| | Baseline | No | Yes |
| Female physician | −7.5*** | 0.6 | −13.3*** |
| | (1.5) | (2.5) | (1.7) |
| $t$-test for effect homogeneity | | −4.67 ($p$ = 0.000) | |
| Mean | 44.5 | 43.5 | 45.2 |
| Mean men | 47.8 | 43.8 | 51.4 |
| Mean women | 39.1 | 43.0 | 36.9 |
| Number of physicians | 548 | 230 | 340 |
| $N$ | 1,799 | 743 | 1,056 |

*Notes:* This table shows the difference in weekly working hours between male and female physicians and depending on whether they have children or not. The results stem from an OLS estimation, similar to equation (1), regressing weekly working hours on an indicator variable, equal to 1 if the physician is female, and 0 otherwise, controlling for experience, calendar year fixed effects, and state fixed effects. To show whether estimates are different from each other, we estimate an additional model where we fully interact our baseline estimation with an indicator variable, equal to 1 if the person has children, and 0 otherwise, and provide the $t$- and $p$-values. Standard errors are clustered at the individual level and shown in parentheses. Stars indicate significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

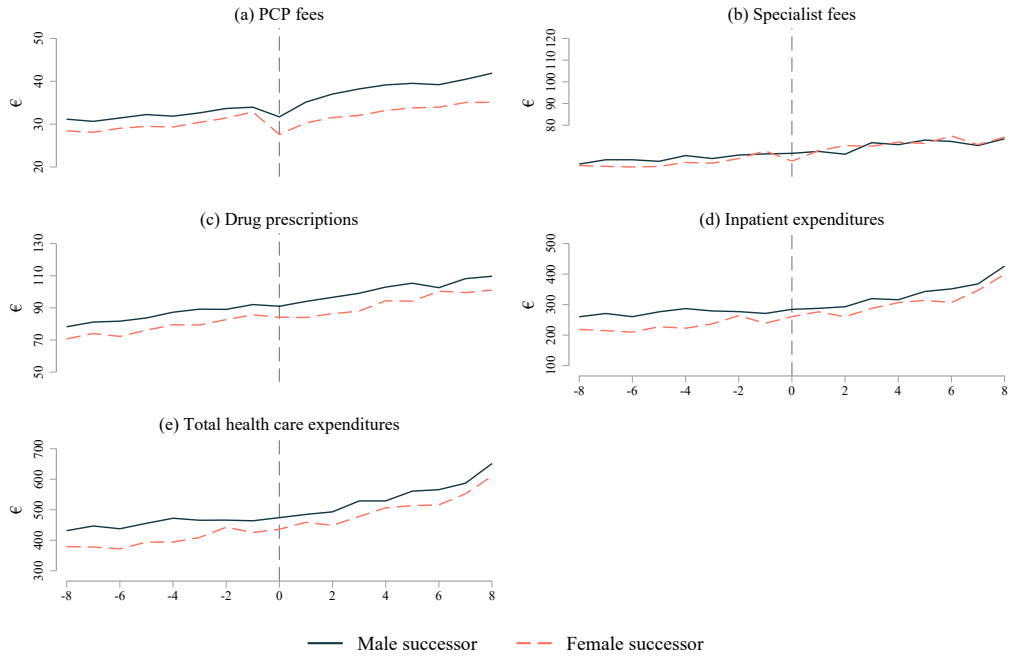
to the pre-period and to their male counterparts. Notably, this is the case despite gender-neutral remuneration schemes, as contracts with the health insurance funds are the same for male and female PCPs. Since our evidence is not consistent with patient discrimination against female PCPs, we argue that the effect may be largely driven by a reduction in working hours of female PCPs.

## VI. Health care utilization of patients

In Chapter V.B, we show that patients are more likely to change their assigned female PCP rather than an assigned male PCP. Here, we are now interested in the individual health care utilization of patients who stay and are actually treated by a female or male PCP. To do so, we use patient-level data and restrict our sample to patients who stay with the same practice for two years before and after the replacement.

We begin by showing average health care expenditures for PCPs, specialists, drug prescriptions, hospital stays, and total health care expenditures in Figure 4.

Figure 4: Average health care expenditures relative to PCP exit

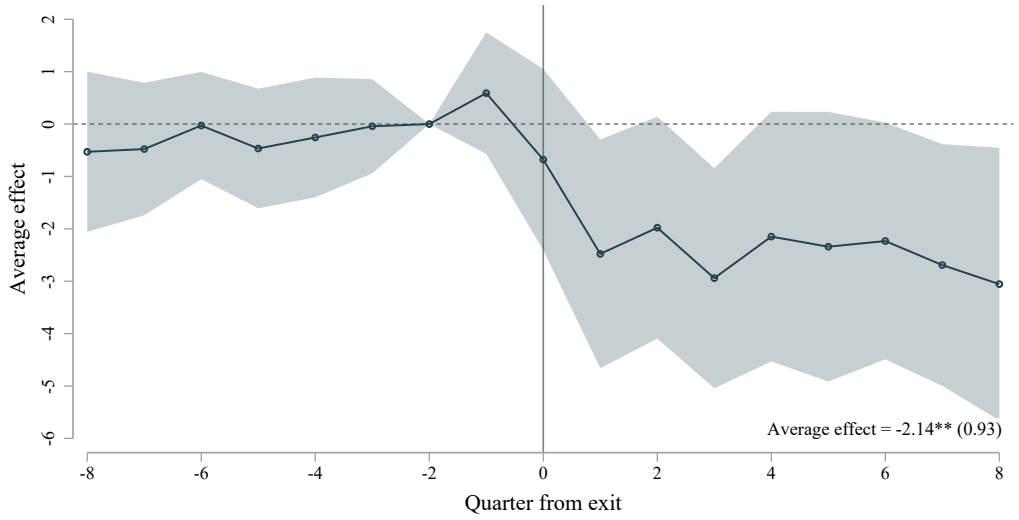



*Notes:* This figure shows average patient health care expenditures in each relative quarter controlling for patient age and calendar year. The samples are split by the gender of the successor who starts working in relative quarter $q = 0$.

While there are small baseline differences in the pre-period, these differences are remarkably stable. We find similar patterns for components of outpatient preventive health care (PCP visits, health screenings, diabetes care, and referrals to laboratories and radiologists) in Appendix Figure A.3. The parallel pre-trends reassure us that, in the absence of treatment, health care expenditures of patients with a female successor would have developed similarly to those of patients with a male successor.

We now turn to the causal effect of female successors on PCP fees and the provision of preventive care. Then, we move on to further outcomes, such as the relevance of gender concordance, and health care utilization of patients who change PCPs.

Figure 5: Dynamic effects on PCPs fees




*Notes:* This figure provides event study estimates for the differential impact of a female PCP on patients' PCP fees following equation (3). The shaded band represents the 95% confidence intervals with standard errors clustered at the practice level. The average effect stems from estimations following equation (2). In Appendix Figure A.4 Panel *(a)*, we additionally show event studies using the Sun & Abraham estimator.

## VI.A. PCP treatment

To analyze the effect of female PCPs on the treatment they provide to their patients, we estimate equation (3) for patients who stay with their successor. Figure 5 shows event study results for PCP fees. Additionally, we show coefficients from the estimator proposed by Sun and Abraham (2021) in Appendix Figure A.4 Panel *(a)*.

Before the replacement, patients with assigned male and female PCPs have remarkably similar PCP fees. After the successor takes over, however, the fees of patients with female successors drop significantly compared to those of patients with male successors. The effect kicks in immediately and does not disappear in the two years following the replacement. On average, PCP fees are 2 € lower per quarter for patients with a female PCP than for patients with a male successor. Compared to a pre-period average of about 33 €, this corresponds to a gap of 6.5 percent.

This difference may arise either because patients are less likely to visit a female

PCP in general, or because female PCPs provide fewer services to patients per visit. We show that being assigned a female successor does not affect a patient's likelihood of visiting their PCP in Table 4 Panel *(b)*.[29] Looking at the descriptive differences in Figure 4 Panel *(a)*, the average increase in PCP fees after the replacement is small for patients with female PCPs, while there is a marked increase in average PCP fees for patients with male PCPs compared to the exiting PCPs.

Patients with female successors may substitute PCP services for specialist care or hospital treatment.[30] In Table 4 Panel *(a)*, we present results for various components of health care utilization following equation (2). Appendix Figure A.5 shows the corresponding dynamic results following equation (3). We do not find statistically significant increases in spending on specialists, drug prescriptions, or inpatient care. Therefore, we argue that the gender of successors has no effect on patients' health-seeking behavior outside of the PCP practice.

### VI.B. Preventive care

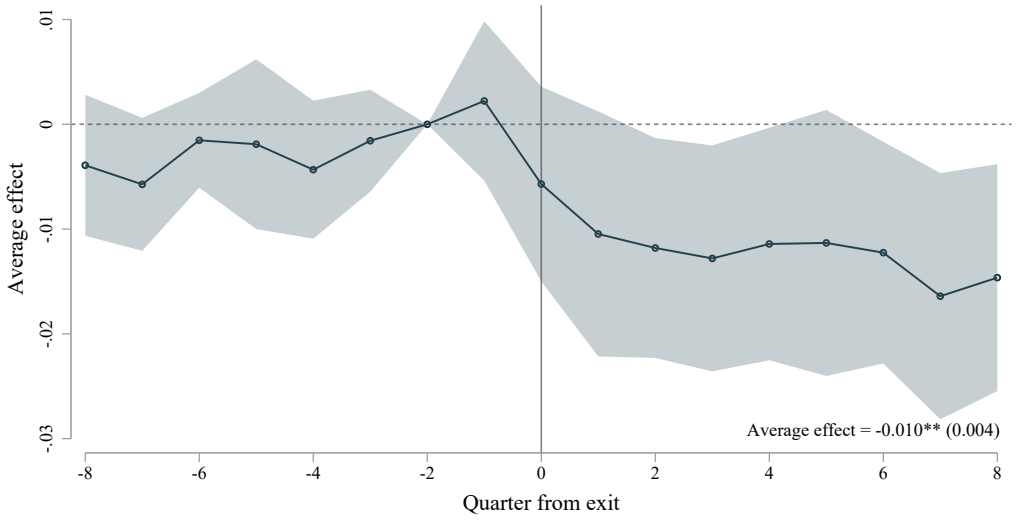
One of the most important tasks of PCPs is to provide preventive care. In Panel *(b)* of Table 4, we provide estimation results following equation (2) for several indicators of preventive care on the extensive margin. We find a significant negative effect on the likelihood that PCPs perform a health screening.[31] Patients with female PCPs are, on average, 1 pp less likely to receive a health screening per quarter compared to patients with male PCPs, a 27% change relative to the pre-period mean. We plot the dynamic effects of female PCPs on health screenings in an event study in Figure 6. Consistent with the decrease in PCP fees in Figure 5, the effect occurs immediately after the replacement and remains stable throughout the entire post-period.

[29] For the years 2013 to 2018, we observe the exact number of PCP visits per patient. We also find no effect on the number of visits per quarter.

[30] As described in Chapter II, in Austria it is relatively easy for patients to see a specialist even without a referral from their PCP. Laboratory and radiology are two notable exceptions. Visits in these areas are usually induced by referrals from PCPs or other physicians.

[31] In Austria, general health screenings are free of charge once a year for patients over the age of 18. The annual participation rate is about 20 percent. The physical examination includes a comprehensive medical history and a battery of age- and gender-specific diagnostic and laboratory tests to identify health risks and screen for diseases. In addition, PCPs are tasked with providing guidance and advice on lifestyle decisions during these screenings (Pruckner et al., 2020).

Figure 6: Dynamic effects on health screenings




*Notes:* This figure provides event study estimates for the differential impact of a female PCP on patients' health screening participation following equation (3). The shaded band represents the 95% confidence intervals with standard errors clustered at the practice level. The average effect stems from estimations following equation (2). In Appendix Figure A.4 Panel *(b)*, we additionally show event studies using the Sun & Abraham estimator.

Table 4: Effect of female PCP on health care utilization

| | *Panel (a): Fees and expenditures* | | | | |
|---|---|---|---|---|---|
| | PCP fees (1) | Specialist fees (2) | Drug prescriptions (3) | Hospital expenditures (4) | Total health care expenditures (5) |
| Average effect | −2.14** | 1.09 | 2.88 | 13.63 | 15.45 |
| | (0.93) | (1.06) | (3.65) | (13.68) | (14.44) |
| Patient age | 0.60*** | −0.81** | 9.73*** | 6.60 | 16.11*** |
| | (0.13) | (0.37) | (0.95) | (5.33) | (5.39) |
| Experience | 2.53*** | 5.37*** | −0.63 | 43.27*** | 50.54*** |
| | (0.17) | (0.45) | (1.08) | (5.18) | (5.29) |
| Pre-Mean | 32.86 | 78.69 | 95.76 | 282.14 | 489.46 |
| *N* | 1,121,626 | 1,121,626 | 1,121,626 | 1,121,626 | 1,121,626 |
| | *Panel (b): Any preventive care* | | | | |
| | PCP visit (1) | Health screening (2) | Diabetes care (3) | Laboratory referral (4) | Radiology referral (5) |
| Average effect | −0.002 | −0.010** | −0.003** | −0.013 | −0.005 |
| | (0.004) | (0.004) | (0.001) | (0.008) | (0.006) |
| Patient age | −0.003*** | −0.001 | 0.003*** | 0.004*** | −0.002*** |
| | (0.001) | (0.001) | (0.000) | (0.001) | (0.001) |
| Experience | 0.021*** | 0.003*** | 0.001*** | 0.009*** | 0.004*** |
| | (0.001) | (0.001) | (0.000) | (0.002) | (0.001) |
| Pre-Mean | 0.679 | 0.037 | 0.068 | 0.094 | 0.041 |
| *N* | 1,121,626 | 1,121,626 | 1,121,626 | 1,117,667 | 1,117,667 |

*Notes:* This table shows the effect of a female PCP on patients' health care expenditures and preventive care. In Panel *(a)*, we present effects on PCP fees, specialist fees, drug expenditures, hospital expenditures, and total health care expenditures. In Panel *(b)*, we analyze whether patients received preventive care in a given quarter, such as whether they visited a PCP at all, health screenings, diabetes care, laboratory visit via PCP referral, and radiology visit via PCP referral. The results stem from a TWFE estimation following equation (2). Standard errors are clustered at the practice level and shown in parentheses. Asterisks indicate significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Similarly, patients with female successors are, on average, 0.3 pp less likely to receive diabetes care than patients with male successors, a 5% change relative to the pre-period mean. We do not find significant effects on the likelihood of patients receiving a laboratory or radiology referral from their PCP. Because the difference in health screenings between patients with female and male successors is strikingly large, we analyze potential drivers of this effect.

**Male PCPs drive the gap** The raw trends in Appendix Figure A.3 *(a)* show that the gap in health screening is almost entirely due to an increase in screenings by male successors. We see the same pattern in Table 5, where we calculate the average difference between the pre- and post-periods for patients with female and male successors. Moreover, the increase in health screenings for patients with male successors is noticeable for both male and female patients, and for patients younger and older than 65 (Figure A.6). In Appendix Table B.4 Panels *(a)* and *(b)*, we additionally estimate our standard model and split the sample by patient gender and age. We find no significant differences in the effect of PCP gender for either group. The finding that male PCPs provide more health screenings regardless of patient gender and age is consistent with the work of Currie et al. (2016).

**Differences in screening behavior** There are several potential reasons why female and male PCPs may differ in their propensity to perform health screenings. For example, the gap may be due to different valuations of the benefits of screening or differences in revenue-maximizing behavior. If male PCPs were more convinced of the benefits of screening, we would also expect an increase in related costs (e.g., laboratory referrals). This is not the case. Instead, PCPs may perform screenings purely for financial reasons. If male PCPs act in a more revenue-maximizing way than their female counterparts, this could explain their higher propensity to perform screenings. Our findings in Chapter V.A are consistent with this hypothesis. It is also in line with studies showing that female PCPs are more altruistic in their treatment of patients (Andreoni and Vesterlund, 2001; Attema et al., 2023).

Alternatively, female and male PCPs may differ in how much they rely on screening tests to treat their patients. Female PCPs may prioritize learning about

Table 5: Differences in PCP fees and health screening participation

| | *Gender Successor* | | |
|---|---|---|---|
| | Male | Female | Differences |
| | (1) | (2) | (3) |
| *Panel (a): PCP fees* | | | |
| Pre-period | 33.29 | 32.14 | −1.15 |
| | (0.77) | (1.20) | (1.42) |
| Post-period | 38.03 | 34.66 | −3.37** |
| | (0.88) | (1.07) | (1.38) |
| Difference over time | 4.75*** | 2.52** | DD = −2.22** |
| | (0.63) | (0.78) | (1.00) |
| *Panel (b): Health screening* | | | |
| Pre-period | 0.033 | 0.037 | 0.004 |
| | (0.003) | (0.006) | (0.007) |
| Post-period | 0.041 | 0.035 | −0.006 |
| | (0.003) | (0.004) | (0.005) |
| Difference over time | 0.008** | −0.002 | DD = −0.010** |
| | (0.002) | (0.004) | (0.004) |
| Number of patients | 41,533 | 24,445 | |

*Notes:* This table shows the average PCP fees and health screening participation per patient and quarter in the pre- and post-replacement period by successor gender. These numbers differ from our estimation results as they represent purely averages and do not include fixed effects or controls. In Panel *(a)*, we focus on the PCP fees and in Panel *(b)* on the probability of taking up health screening. Standard errors are clustered at the practice level and reported in parentheses. Asterisks indicate significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

their patients from the exiting PCP rather than performing screenings. To test this, we split the sample by whether the transition was soft or hard (i.e., whether the exiting and new PCPs worked together during the replacement) and show results in Appendix Table B.4 Panel *(c)*. We find a larger gender difference in soft transitions, which is consistent with female PCPs relying more on learning about their patients from the exiting PCP. However, the effects are not statistically significantly different from each other.

Finally, we come back to the difference in working hours established in Chapter V.E. Since female physicians, on average, work fewer hours, they also have less time to carry out health screening appointments, which are usually very time-

consuming.

### VI.C. The role of gender concordance

Previous related work has focused on the importance of physician-patient concordance (e.g., Cabral and Dillender, 2024). One prominent hypothesis is that female physicians are particularly well equipped to care for their female patients. To further analyze this, we estimate the effects on patient health care utilization by patient gender. In addition, we estimate a model following equation (2) fully interacted with an indicator variable equal to one, if the patient is female, and zero otherwise to show whether the estimates are significantly different from each other.

In Appendix Table B.5 we show results for health care utilization (Panel *(a)*) and for preventive care outcomes (Panel *(b)*). Except for hospital expenditures, the effects seem to be slightly larger for male patients. However, there are no statistically significant differences between female and male patients. We conclude that patient-physician gender concordance does not seem to play a relevant role in our setting, in contrast to, for example, Cabral and Dillender (2024) and Greenwood et al. (2018).

### VI.D. What happens to moving patients?

So far, we have shown that female PCPs provide fewer services than their male counterparts and that patients assigned to female PCPs are more likely to change PCPs. This increased patient movement creates two additional channels through which the successor's gender potentially affects patients' health care utilization. First, successor gender may affect health care costs of moving patients differently than those of staying patients. Second, the act of moving away from the assigned PCP itself may lead to higher health care costs.

To test the first channel, we first compare the effect of the successor's gender on total health care costs for patients who stay and those who move away.[32] Table 6 Columns (1) and (2) show results following equation (2). The gender of the successor does not significantly affect movers' total health care expenditures.

[32] We require all patients to stay with the UAHIF for the entire observation period so that we can track their health care utilization.

Table 6: PCP gender difference for staying and moving patients

| | Patients | | |
|---|---|---|---|
| | Stay (1) | Move (2) | All patients (3) |
| Gender effect | 15.45 | 22.64 | |
| | (14.44) | (14.76) | |
| Moving effect | | | 29.65*** |
| | | | (10.43) |
| Pre-Mean | 489.46 | 416.94 | 468.26 |
| *N* | 1,121,626 | 463,199 | 1,584,825 |

*Notes:* This table shows the effect of a female PCP on patients' total health care expenditures following equation (2). Column (1) shows the successor gender effect for patients who stay with the same PCP practice for the entire observation window. Column (2) focuses on patients who move away from their assigned PCP within 2 years after the replacement. In Column (3), we additionally show the effect of changing PCPs. This result comes from a TWFE estimation, similar to equation (2), where we compare health care costs of patients who change PCP to those who stay, using the same set of control variables as detailed in equation (2). Standard errors are clustered at the practice level and reported in parentheses. Asterisks indicate significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

To address the second channel, we estimate the effect of moving away from the assigned PCP on health care costs in Table 6 Column (3) using a TWFE model similar to equation (2), where the treatment is defined as changing PCP, rather than being assigned a female successor. We find that moving patients face, on average, 29.65 € higher health care costs than patients who stay, an increase of 6% relative to the pre-period mean. Thus, while the gender of the successor has no significant effect on health care costs of moving patients, the fact that patients with assigned female successors move more frequently leads to higher total costs.

## VII. Discussion and conclusion

In this paper, we analyze the causal effect of physician gender on practices and patients. We exploit a quasi-random assignment of PCPs to patients which provides a unique testing ground for studying the effects of physician gender. To do so, we compare practices that are taken over by a female successor to those that are taken over by a male successor after a male PCP exits their position.

We find that female PCPs generate 14% less revenue than their male counterparts. This is driven by a decrease in the number of patients seen by female PCPs and a gap in treatment provision. The gap in treatment is due to male PCPs providing more services, in particular health screenings, compared to the exiting PCP and their female counterparts. Turning to the patient level, we find that patients who have stayed with a particular PCP practice for at least two years before the replacement are 6 pp more likely to change their PCPs when they are assigned a female successor. Our evidence is not consistent with patients discriminating against female PCPs. Instead, the gap seems to be explained by female physicians working fewer hours. This is especially driven by physicians with children.

Our results raise several questions: (a) Do patients benefit from being treated by male PCPs and thus receiving more services? (b) Does the gap in health care provision have cost implications for the public health care system? (c) Do female PCPs impose spillovers by seeing fewer patients?

**(a) Benefits of having a male PCP?** In Austria's universal health care system, a marginal change in the provision of services may have only little impact on patients' health.[33] Furthermore, as the effectiveness of screening is debated (Hackl et al., 2015), we do not expect the gap in health screenings to affect patients in the long run. We argue that any potential benefit for patients due to male PCPs providing slightly more services is likely to be negligible.

**(b) Costs to the health care system?** To answer the question of whether the gender gap in health care provision has a significant impact on the public health care system, we offer a back-of-the-envelope calculation. Female PCPs generate, on average, 6,190 € less revenue per quarter, i.e., about 28,000 € per year. We multiply this by the number of (all) female PCPs in Upper Austria in 2018, 164. Thus, female PCPs generate about 4 million € less expenditure for the public health care system. Compared to the total UAHIF expenditures for covered services in 2018, this corresponds to about 0.002 percent. Since we find no evidence that patients

[33] Access to health care is reported to be above average compared to other OECD countries, with only 0.2% of respondents reporting unmet needs in 2021 (OECD, 2023).

increase other health care utilization, these 4 million € can be interpreted as savings for the public health care system.

**(c) Spillovers of female PCPs?** Since female PCPs, on average, see fewer patients and provide fewer services than their male counterparts, patients may be more likely to substitute their health care utilization in other areas. We show that neither the patients who stay with their assigned PCP nor the patients who change PCPs increase their health-seeking behavior compared to patients with male PCPs. However, female PCPs indirectly lead to higher health care costs. Patients with assigned female successors are more likely to move away from their PCP, and patients who move face higher health care costs. On average, 78 more patients change PCPs when assigned a female successor.[34] We multiply this by the increase in health care costs of 29.65 € per quarter. Thus, increased patient movement due to being assigned a female successor leads to approximately 18,500 € higher costs in the two years after a replacement. In total, we observe 52 replacements with female successors, so the total health care costs increase by just over 960,000 €.

Taken together, these considerations suggest that female PCPs have both direct and indirect effects on the public health care system. On the one hand, they reduce costs by providing fewer services without expected negative implications for patients. On the other hand, the increased likelihood that patients change PCPs associated with assigned female PCPs leads to higher health care costs.

[34] 33.7% of patients with female successors and 26.3% of patients with male successors change PCP within two years after the replacement. Multiplying the difference in moving patients (0.337 – 0.263) by the average number of patients per practice, 1,051, equals 78.

## References


Abadie, A., Athey, S., Imbens, G. W., and Wooldridge, J. M. (2022). When Should You Adjust Standard Errors for Clustering? *Quarterly Journal of Economics*, 138(1):1–35.

Ahammer, A. (2018). Physicians, sick leave certificates, and patients' subsequent employment outcomes. *Health Economics*, 27(6):923–936.

Alsan, M., Garrick, O., and Graziani, G. (2019). Does Diversity Matter for Health? Experimental Evidence from Oakland. *American Economic Review*, 109(12):4071–4111.

Andreoni, J. and Vesterlund, L. (2001). Which is the Fair Sex? Gender Differences in Altruism. *Quarterly Journal of Economics*, 116(1):293–312.

Anwar, S., Bayer, P., and Hjalmarsson, R. (2012). The Impact of Jury Race in Criminal Trials. *Quarterly Journal of Economics*, 127(2):1017–1055.

Anwar, S., Bayer, P., and Hjalmarsson, R. (2019). A Jury of Her Peers: The Impact of the First Female Jurors on Criminal Convictions. *Economic Journal*, 129(618):603–650.

Ärzte-Gesamtvertrag (2020). *Dachverband Der Sozialversicherungsträger*.

Attema, A. E., Galizzi, M. M., Groß, M., Hennig-Schmidt, H., Karay, Y., L'Haridon, O., and Wiesen, D. (2023). The formation of physician altruism. *Journal of Health Economics*, 87:102716.

Bagues, M., Sylos-Labini, M., and Zinovyeva, N. (2017). Does the Gender Composition of Scientific Committees Matter? *American Economic Review*, 107(4):1207–1238.

Baker, L. C. (1996). Differences in Earnings between Male and Female Physicians. *New England Journal of Medicine*, 334(15):960–964.

Bertrand, M., Black, S. E., Jensen, S., and Lleras-Muney, A. (2019). Breaking the Glass Ceiling? The Effect of Board Quotas on Female Labour Market Outcomes in Norway. *Review of Economic Studies*, 86(1):191–239.

Bouissiere, A., Laperrouse, M., Panjo, H., Ringa, V., Rigal, L., and Letrilliart, L. (2022). General practitioner gender and use of diagnostic procedures: A French cross-sectional study in training practices. *BMJ Open*, 12(5):e054486.

Cabral, M. and Dillender, M. (2021). Disparities in Health Care and Medical Evaluations by Gender: A Review of Evidence and Mechanisms. *AEA Papers and Proceedings*, 111:159–163.

Cabral, M. and Dillender, M. (2024). Gender Differences in Medical Evaluations: Evidence from Randomly Assigned Doctors. *American Economic Review*, 114(2):462–499.

Canaan, S. and Mouganie, P. (2023). The Impact of Advisor Gender on Female Students' STEM Enrollment and Persistence. *Journal of Human Resources*, 58(2):593–632.

Card, D., DellaVigna, S., Funk, P., and Iriberri, N. (2020). Are Referees and Editors in Economics Gender Neutral? *Quarterly Journal of Economics*, 135(1):269–327.

Carrell, S. E., Page, M. E., and West, J. E. (2010). Sex and Science: How Professor Gender Perpetuates the Gender Gap. *Quarterly Journal of Economics*, 125(3):1101–1144.

Cook, C., Diamond, R., Hall, J. V., List, J. A., and Oyer, P. (2021). The Gender Earnings Gap in the Gig Economy: Evidence from over a Million Rideshare Drivers. *Review of Economic Studies*, 88(5):2210–2238.

Cullen, Z. and Perez-Truglia, R. (2023). The Old Boys' Club: Schmoozing and the Gender Gap. *American Economic Review*, 113(7):1703–40.

Currie, J., MacLeod, W. B., and Van Parys, J. (2016). Provider practice style and patient health outcomes: The case of heart attacks. *Journal of Health Economics*, 47:64–80.

Dahrouge, S., Seale, E., Hogg, W., Russell, G., Younger, J., Muggah, E., Ponka, D., and Mercer, J. (2016). A Comprehensive Assessment of Family Physician Gender and Quality of Care: A Cross-Sectional Analysis in Ontario, Canada. *Medical Care*, 54(3):277–286.

Danzer, N., Halla, M., Schneeweis, N., and Zweimüller, M. (2022). Parental leave, (in)formal childcare, and long-term child outcomes. *Journal of Human Resources*, 57(6):1826–1884.

Esteves-Sorenson, C. and Snyder, J. (2012). The gender earnings gap for physicians and its increase over time. *Economics Letters*, 116(1):37–41.

Fadlon, I. and Van Parys, J. (2020). Primary care physician practice styles and patient care: Evidence from physician exits in Medicare. *Journal of Health Economics*, 71:102304.

Ganguli, I., Sheridan, B., Gray, J., Chernew, M., Rosenthal, M. B., and Neprash, H. (2020). Physician Work Hours and the Gender Pay Gap — Evidence from Primary Care. *New England Journal of Medicine*, 383(14):1349–1357.

Gershenson, S., Hart, C. M. D., Hyman, J., Lindsay, C. A., and Papageorge, N. W. (2022). The Long-Run Impacts of Same-Race Teachers. *American Economic Journal: Economic Policy*, 14(4):300–342.

Godager, G., Hennig-Schmidt, H., Li, J. J., Wang, J., and Yang, F. (2021). Does gender affect medical decisions? Working Paper.

Greenwood, B. N., Carnahan, S., and Huang, L. (2018). Patient–physician gender concordance and increased mortality among female heart attack patients. *Proceedings of the National Academy of Sciences*, 115(34):8569–8574.

Hackl, F., Halla, M., Hummer, M., and Pruckner, G. J. (2015). The Effectiveness of Health Screening. *Health Economics*, 24(8):913–935.

Hall, J. A. and Roter, D. L. (2002). Do patients talk differently to male and female physicians? *Patient Education and Counseling*, 48(3):217–224.

Hedden, L., Barer, M. L., Cardiff, K., McGrail, K. M., Law, M. R., and Bourgeault, I. L. (2014). The implications of the feminization of the primary care physician workforce on service supply: A systematic review. *Human Resources for Health*, 12(1):32.

Hill, A. J., Jones, D. B., and Woodworth, L. (2023). Physician-Patient Race-Match Reduces Patient Mortality. *Journal of Health Economics*, 92:102821.

Hoekstra, M. and Street, B. (2021). The Effect of Own-Gender Jurors on Conviction Rates. *Journal of Law and Economics*, 64(3):513–537.

Hofmarcher, M. (2013). *Austria: Health System Review*. Number 15(7) in Health Systems in Transition. World Health Organization. Regional Office for Europe.

HVB (2019). *Statistisches Handbuch Der Österreichischen Sozialversicherung*. Hauptverband der österreichischen Sozialversicherungsträger.

Jackson, J. L., Farkas, A., and Scholcoff, C. (2020). Does Provider Gender Affect the Quality of Primary Care? *Journal of General Internal Medicine*, 35(7):2094–2098.

Krähenmann-Müller, S., Virgini, V. S., Blum, M. R., da Costa, B. R., Collet, T.-H., Martin, Y., Cornuz, J., Zimmerli, L., Gaspoz, J.-M., Bauer, D. C., Kerr, E. A., Aujesky, D., and Rodondi, N. (2014). Patient and physician gender concordance in preventive care in university primary care settings. *Preventive Medicine*, 67:242–247.

Mauvais-Jarvis, F., Bairey Merz, N., Barnes, P. J., Brinton, R. D., Carrero, J.-J., DeMeo, D. L., De Vries, G. J., Epperson, C. N., Govindan, R., Klein, S. L., Lonardo, A., Maki, P. M., McCullough, L. D., Regitz-Zagrosek, V., Regensteiner, J. G., Rubin, J. B., Sandberg, K., and Suzuki, A. (2020). Sex and gender: Modifiers of health, disease, and medicine. *The Lancet*, 396(10250):565–582.

Mishra, A., Read, S. H., and Rochon, P. A. (2020). Influence of Physician Sex and Gender on Prescribing Practices Among Older Adults. *Journal of the American Geriatrics Society*, 68(12):2764–2767.

OECD (2023). *Health at a Glance 2023: OECD Indicators*. Health at a Glance. OECD.

Orzella, L., Chini, F., Giorgi Rossi, P., and Borgia, P. (2010). Physician and patient characteristics associated with prescriptions and costs of drugs in the Lazio region of Italy. *Health Policy*, 95(2):236–244.

Pruckner, G. J., Schober, T., and Zocher, K. (2020). The company you keep: Health behavior among work peers. *European Journal of Health Economics*, 21(2):251–259.

Sabety, A. (2023). The value of relationships in healthcare. *Journal of Public Economics*, 225:104927.

Sasser, A. C. (2005). Gender Differences in Physician Pay: Tradeoffs Between Career and Family. *Journal of Human Resources*, 40(2):477–504.

Schmid Mast, M., Hall, J. A., Cronauer, C. K., and Cousin, G. (2011). Perceived dominance in physicians: Are female physicians under scrutiny? *Patient Education and Counseling*, 83(2):174–179.

Seabury, S. A., Chandra, A., and Jena, A. B. (2013). Trends in the Earnings of Male and Female Health Care Professionals in the United States, 1987 to 2010. *JAMA Internal Medicine*, 173(18):1748–1750.

Simonsen, M., Skipper, L., Skipper, N., and Thingholm, P. R. (2021). Discontinuity in care: Practice closures among primary care providers and patient health care utilization. *Journal of Health Economics*, 80:102551.

Statistics Austria (2022). *Demographische Indikatoren Oberösterreich*.

Statistics Austria (2023). *Bevölkerung Zu Quartalsbeginn Seit 2010 Nach Bundesland Und Staatsangehörigkeit*.

Statistics Austria (2024). Microcensus Labor Force Survey / Housing Survey.

Sun, L. and Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, 225(2):175–199.

Theurl, E. and Winner, H. (2011). The male–female gap in physician earnings: Evidence from a public health insurance system. *Health Economics*, 20(10):1184–1200.

Tsugawa, Y., Jena, A. B., Figueroa, J. F., Orav, E. J., Blumenthal, D. M., and Jha, A. K. (2017). Comparison of Hospital Mortality and Readmission Rates for Medicare Patients Treated by Male vs Female Physicians. *JAMA Internal Medicine*, 177(2):206.

Walker, B., Wisniewski, J., Tinkler, S., Stano, M., and Sharma, R. (2023). Foreign Physicians: Discriminatory Patient Preferences and Doctor Availability. Working Paper.

Wallis, C. J., Ravi, B., Coburn, N., Nam, R. K., Detsky, A. S., and Satkunasivam, R. (2017). Comparison of postoperative outcomes among patients treated by male and female surgeons: A population based matched cohort study. *BMJ*, (359):j4366.

Weber, A. and Zulehner, C. (2010). Female Hires and the Success of Start-up Firms. *American Economic Review*, 100(2):358–361.

Zeltzer, D. (2020). Gender Homophily in Referral Networks: Consequences for the Medicare Physician Earnings Gap. *American Economic Journal: Applied Economics*, 12(2):169–197.

Zhang, X. (2022). The effects of physician retirement on patient outcomes: Anticipation and disruption. *Journal of Public Economics*, 207:104603.

Zocher, K. (2024). Exiting primary care providers. *Health Economics*, (forthcoming).

# Online Appendix

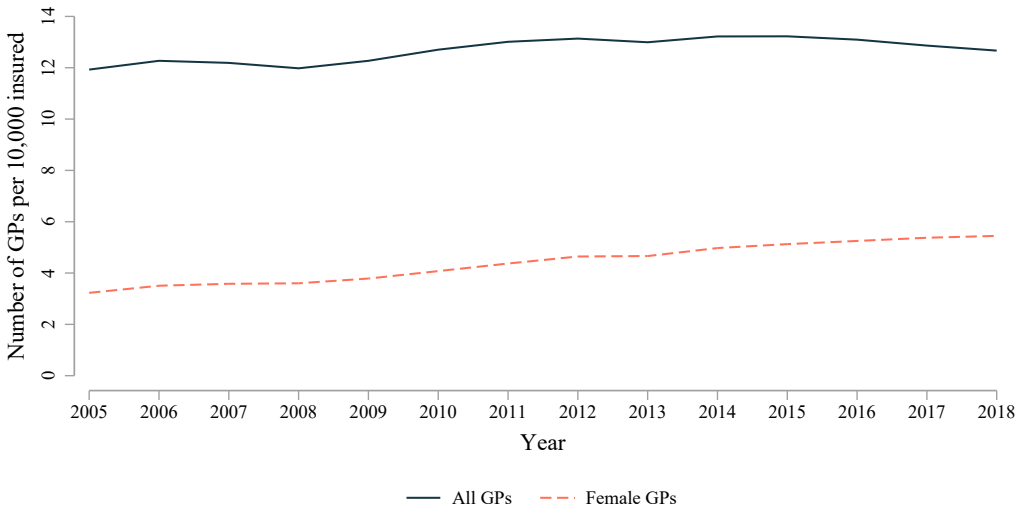
This online appendix contains additional figures and tables for the paper *"When women take over: Physician gender and health care provision"* by Gerald J. Pruckner, Flora Stiftinger, and Katrin Zocher.

## Contents

# A. Additional figures

## A.A. Institutional details

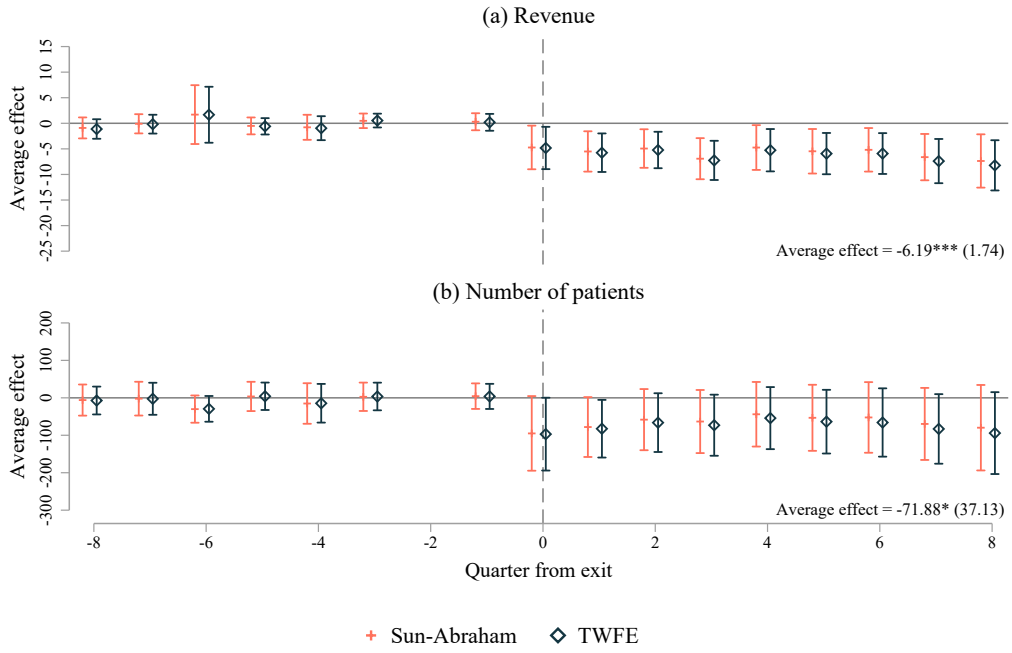
Figure A.1: Number of GPs in UA per 10,000 insured




*Notes*: The figure shows the number of all (solid line) and female (dashed line) GPs per 10,000 UAHIF insured. This includes GPs in single and group practices as well as contracted and private GPs. Numbers are from own calculations based on administrative data by the UAHIF from 2005 to 2018 and and data by the UA Medical Association from 2005 to 2018.

## A.B. Effects of patient movement on PCPs

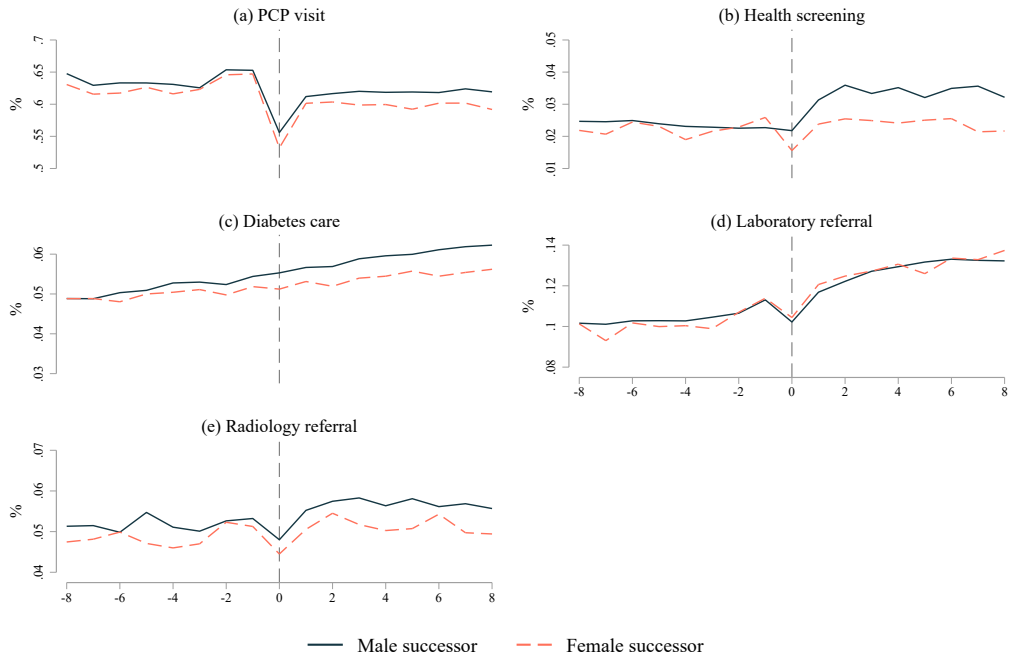
Figure A.2: Effect on number of patients and revenue




*Notes:* This figure shows event study estimates for the differential impact of a female PCP on *(a)* revenue (in 1,000€) and *(b)* total number of unique patients per quarter. Estimates stem from a TWFE estimation following equation (3) as well as the corresponding Sun & Abraham estimation. The vertical lines represent the 95% confidence intervals. The average effect stems from estimations following equation (2).

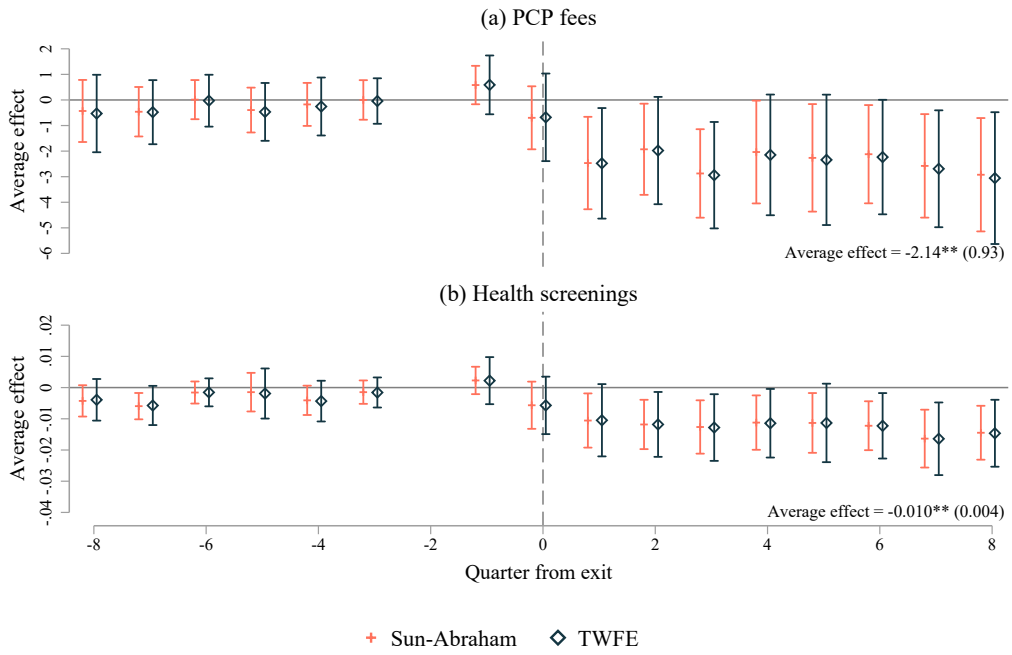
## A.C. Health outcomes

Figure A.3: Average health care utilization relative to PCP exit



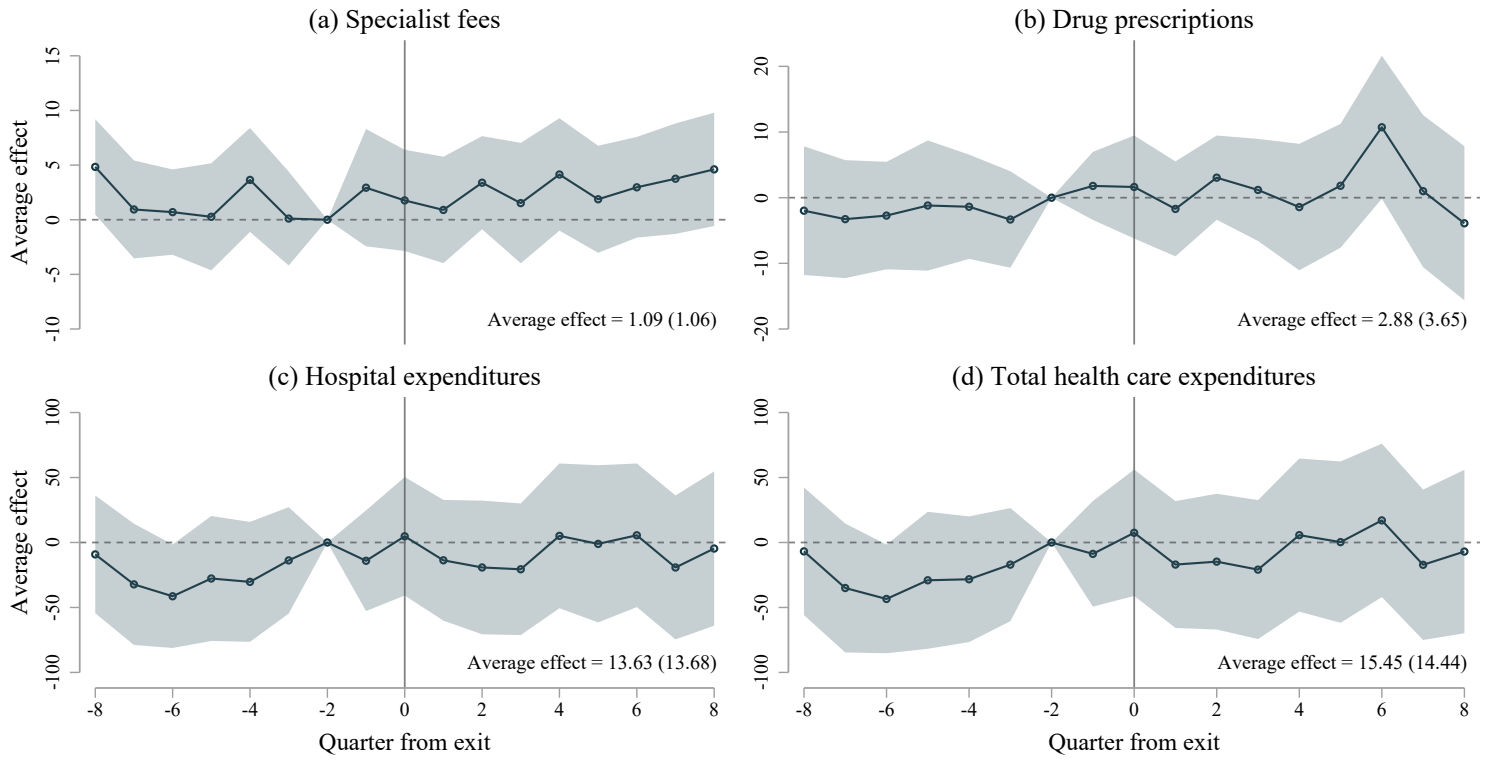

*Notes:* This figure shows average patient health care utilization in each relative quarter controlling for patient age and calendar year. The outcomes are binary variables indicating, whether the visit, service or referral was observed (= 1), or not (= 0). The samples are split by the gender of the successor who starts working in relative quarter $q = 0$.

Figure A.4: Dynamic effects on PCP fees and health screening



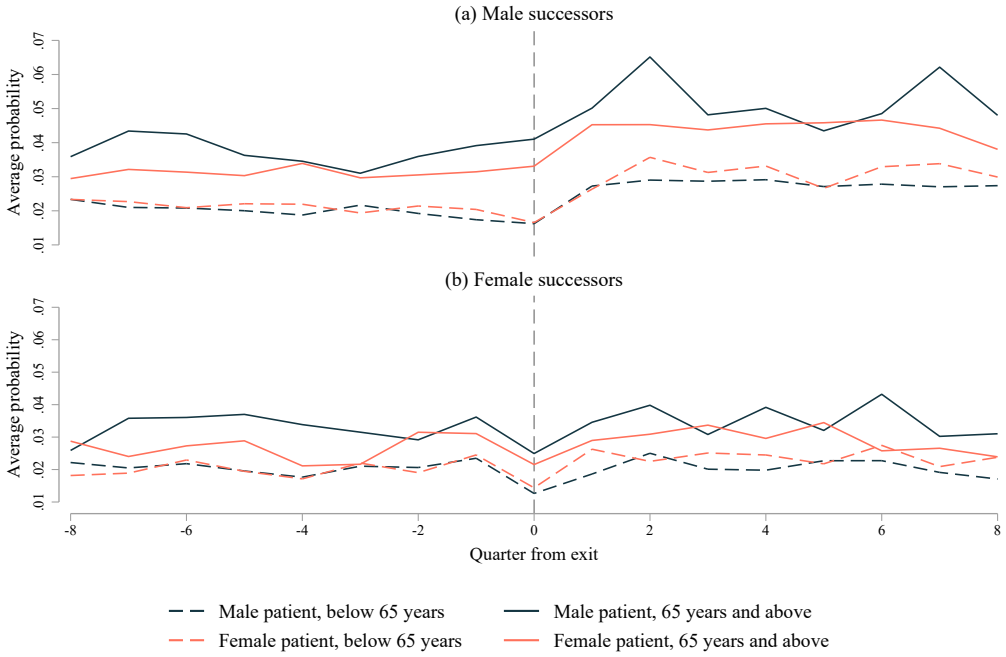

*Notes:* This figure provides event study estimates for the differential impact of a female PCP on *(a)* patients PCP fees and *(b)* the probability of receiving health screenings following equation (3) and the corresponding Sun & Abraham estimator. The vertical lines represent the 95% confidence intervals. The average effect stems from estimations following equation (2).

Figure A.5: Dynamic effects on health care expenditures




*Notes:* This figure provides event study estimates following equation (3) for the differential impact of a female PCP on patients' *(a)* specialist fees, *(b)* drug prescriptions, *(c)* hospital expenditures, and *(d)* total health care expenditures. The shaded area represents the 95% confidence band. The average effect stems from estimations following equation (2).

Figure A.6: Average health screening participation rate by succeeding PCP gender, patient gender, and patient age




*Notes:* This figure shows the average participation rate in health screenings in each relative quarter for patients with (a) male and (b) female succeeding PCPs. The averages control for patient age and the calendar year. The samples are additionally split according to patients gender and age.

# B. Additional tables

## B.A. Descriptives

Table B.1: Descriptive comparison of successors

| | | *Gender Successor* | | |
|---|---|---|---|---|
| | Baseline (1) | Male (2) | Female (3) | Difference (4) |
| *(a) Personal characteristics* | | | | |
| Age | 41.73 | 41.84 | 41.58 | 0.259 |
| Experience (Years since graduation) | 13.01 | 12.47 | 13.83 | −1.359 |
| Experience (Scores) † | 37.46 | 37.35 | 37.62 | −0.271 |
| *(b) Replacement characteristics* | | | | |
| No. of rounds | 1.53 | 1.49 | 1.60 | −0.103 |
| No. of applicants | 2.16 | 2.06 | 2.31 | −0.244 |
| Transition period (Y/N) | 0.64 | 0.62 | 0.67 | −0.053 |
| In-house pharmacy (Y/N) | 0.27 | 0.27 | 0.28 | −0.009 |
| Urban (Y/N) | 0.31 | 0.30 | 0.33 | −0.023 |
| No. of patients ‡ | 1,051 | 1,042 | 1,064 | −22.508 |
| *N* | 131 | 79 | 52 | |

*Notes:* This table compares socioeconomic and replacement characteristics of successor PCPs by their gender. Column (1) shows the total average, while column (2) shows averages for male and column (3) for female successors. Column (4) reports the difference between columns (2) and (3). Asterisks indicate significance from a two-sided $t$-test: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
† Scores are missing for 14 replacements.
‡ Number of patients refers to the quarterly average of individual patients treated in the two years before the replacement.

Table B.2: Descriptive comparison of patients

| | *Panel (a): Pre-period* | | |
|---|---|---|---|
| | Male successor | Female successor | Difference |
| | (1) | (2) | (3) |
| Patient age | 52.37 | 52.23 | 0.14** |
| Female patient | 0.51 | 0.52 | −0.01*** |
| Total health care expenditures | 491.88 | 485.34 | 6.54 |
| Drug prescriptions | 95.15 | 96.81 | −1.67 |
| Inpatient hospital expenditures | 285.16 | 277.00 | 8.16 |
| Specialist fees | 78.29 | 79.38 | −1.10** |
| GP fees | 33.29 | 32.14 | 1.15*** |
| GP visits | 0.69 | 0.68 | 0.01*** |
| Health screening | 0.03 | 0.04 | −0.00*** |
| Diabetes care | 0.06 | 0.06 | 0.00 |
| Laboratory visit | 0.13 | 0.13 | −0.01*** |
| Radiology visit | 0.07 | 0.07 | −0.00*** |
| | *Panel (b): Post-period* | | |
| | Male successor | Female successor | Difference |
| | (1) | (2) | (3) |
| Patient age | 54.49 | 54.35 | 0.14*** |
| Female patient | 0.51 | 0.52 | −0.01*** |
| Total health care expenditures | 605.17 | 612.05 | −6.88 |
| Drug prescriptions | 113.40 | 117.77 | −4.37** |
| Inpatient hospital expenditures | 367.36 | 371.04 | −3.68 |
| Specialist fees | 86.38 | 88.58 | −2.20*** |
| GP fees | 38.03 | 34.66 | 3.37*** |
| GP visits | 0.67 | 0.66 | 0.01*** |
| Health screening | 0.04 | 0.04 | 0.01*** |
| Diabetes care | 0.07 | 0.07 | 0.00*** |
| Laboratory visit | 0.15 | 0.16 | −0.01*** |
| Radiology visit | 0.08 | 0.08 | 0.00 |
| *N* | 373,797 | 220,005 | 593,802 |
| Number of patients | 41,533 | 24,445 | |

*Notes:* This table compares socioeconomic characteristics and health care outcomes of patients whose PCP is replaced by a successor and who stay with the same PCP practice for the entire observation window. In Panel (a), averages are calculated on a patient quarter level for the period of 2 years before the replacement, while Panel (b) covers the period of two years after the replacement are considered. Column (1) shows averages for patients of a male successor and Column (2) for patients of a female successor. Column (3) reports the difference between Columns (2) and (3). Asterisks indicate significance from a two-sided $t$-test: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

## B.B. PCP selection

Table B.3: PCP selection on position and patient characteristics

| | *(a) Potential income* | | | *(b) Practice attractiveness* | | |
|---|---|---|---|---|---|---|
| | Revenue in € | In-house pharmacy 0/1 | Urban 0/1 | Soft transition 0/1 | No. rounds | No. applicants |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Female successor | 605.95 | −0.042 | 0.022 | 0.025 | 0.04 | 0.45 |
| | (2,739.95) | (0.081) | (0.094) | (0.090) | (0.29) | (0.28) |
| Successor age | 434.65 | −0.025** | 0.002 | −0.022* | 0.04 | 0.01 |
| | (392.02) | (0.012) | (0.012) | (0.013) | (0.03) | (0.04) |
| Successor experience | −269.82 | 0.016 | 0.009 | 0.019 | −0.02 | 0.04 |
| | (419.08) | (0.011) | (0.013) | (0.013) | (0.03) | (0.04) |
| Pre-mean | 41,560.68 | 0.244 | 0.313 | 0.641 | 1.53 | 2.16 |
| $R^2$ | 0.216 | 0.133 | 0.057 | 0.106 | 0.095 | 0.313 |
| $N$ | 131 | 131 | 131 | 131 | 118 | 131 |
| | *(c) Patient types* | | | *(d) Average fees* | | |
| | Older than 65 share | Female patients share | Comorbidity share | PCP fees in € | Specialist fees in € | Drug prescription in € |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Female successor | 0.006 | 0.009 | 0.003 | −0.59 | −1.47 | 2.71 |
| | (0.014) | (0.008) | (0.005) | (1.22) | (2.81) | (4.48) |
| Successor age | 0.003** | 0.000 | 0.001 | 0.40** | −0.23 | 0.24 |
| | (0.002) | (0.001) | (0.001) | (0.18) | (0.38) | (0.69) |
| Successor experience | −0.002 | 0.001 | 0.000 | −0.38* | 0.49 | 0.04 |
| | (0.002) | (0.001) | (0.001) | (0.20) | (0.41) | (0.74) |
| Pre-mean | 0.301 | 0.515 | 0.109 | 32.45 | 76.71 | 88.74 |
| $R^2$ | 0.099 | 0.094 | 0.301 | 0.340 | 0.232 | 0.173 |
| $N$ | 131 | 131 | 131 | 131 | 131 | 131 |

*Notes:* This table shows results for the estimation of equation (1). Revenue is calculated as the quarterly average based on the two years before the replacement. In-house pharmacy is equal to 1 if an in-house pharmacy exists at the practice and 0 otherwise. Urban is equal to 1 if the practice is in a city with a population larger than 10,000 people. Soft transition is equal to 1 if the exiting and new PCP work together for one quarter after the replacement. Number of rounds indicates the number of calls before a successor was found. Number of applicants indicates how many PCPs applied to a given position. Shares of patients are calculated as the quarterly average based on the two years before the replacement. Patients with comorbidities is the share of patients who had at least one of the following diagnoses in the two years prior the replacement: Alzheimer's disease, cancer, depression, type-2 diabetes, influenza or pneumonia, heart, kidney, liver, or pulmonary disease, or a stroke. Outpatient expenditures indicate the average quarterly fees per patient in the two years prior to the replacement. PCP and specialist fees are all expenditures at (private and contracted) PCPs and specialists. Prescriptions include all medication prescribed by a doctor. Robust standard errors are shown in parentheses. Asterisks indicate significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

## B.C. Health outcomes

Table B.4: Effects on health screening

| | *Panel (a): Male patients* | |
|---|---|---|
| | Below 65 | Above 65 |
| Average effect | −0.009** | −0.014*** |
| | (0.004) | (0.005) |
| $t$-test for effect homogeneity | −1.24 ($p$ = 0.216) | |
| Pre-mean | 0.030 | 0.047 |
| $N$ | 387,467 | 156,958 |
| | *Panel (b): Female patients* | |
| | Below 65 | Above 65 |
| Average effect | −0.007* | −0.012* |
| | (0.004) | (0.006) |
| $t$-test for effect homogeneity | −1.24 ($p$ = 0.216) | |
| Pre-mean | 0.032 | 0.039 |
| $N$ | 359,376 | 217,825 |
| | *Panel (c): Transition type* | |
| | Hard | Soft |
| Average effect | −0.003 | −0.012** |
| | (0.006) | (0.006) |
| $t$-test for effect homogeneity | −1.10 ($p$ = 0.274) | |
| Pre-mean | 0.028 | 0.037 |
| $N$ | 360,757 | 760,869 |

*Notes:* This table shows the effect of a female PCP on the participation in health screenings by patient age for male patients *(a)* and female patients *(b)*, and by transition type *(c)*. The results stem from a TWFE estimation following equation (2). To show whether estimates in each panel are different from each other, we estimate an additional model where we fully interact equation (2) with patient age in Panel *(a)* and transition type in Panel *(b)* and provide the $t$- and $p$-values. Standard errors are clustered at the practice level and shown in parentheses. Asterisks indicate significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

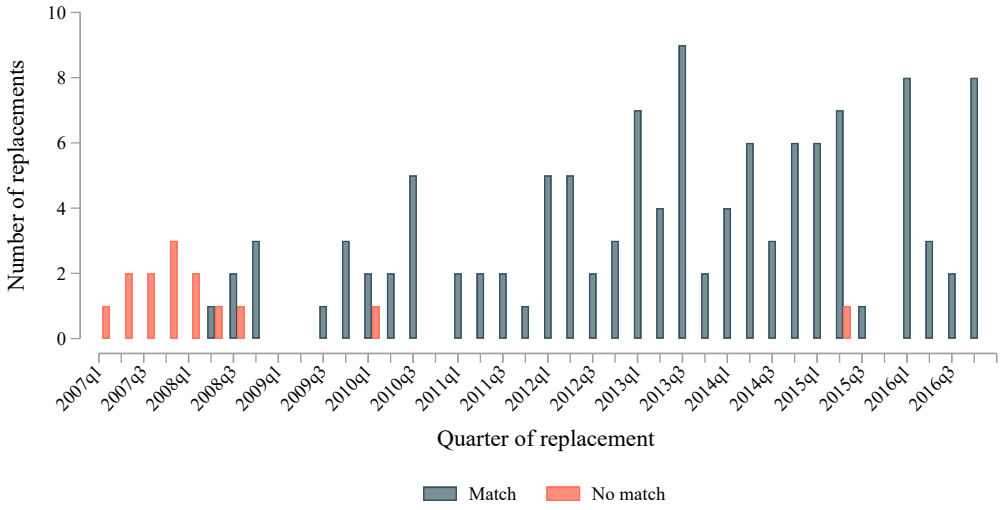
Table B.5: Differences in health care utilization by patient gender

| | *Panel (a): Health care utilization* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *PCP fees* | | *Specialist fees* | | *Drug prescriptions* | | *Hospital expenditures* | |
| | Male patients (1) | Female patients (2) | Male patients (3) | Female patients (4) | Male patients (5) | Female patients (6) | Male patients (7) | Female patients (8) |
| Average effect | −2.26*** | −2.05* | 1.73 | 0.48 | 4.41 | 1.61 | 10.75 | 16.05 |
| | (0.82) | (1.10) | (1.35) | (1.36) | (6.53) | (3.44) | (19.59) | (16.42) |
| *t*-test for effect homogeneity | 0.40 ($p = 0.692$) | | −0.80 ($p = 0.427$) | | −0.41 ($p = 0.679$) | | 0.18 ($p = 0.856$) | |
| Pre-mean | 29.194 | 36.324 | 70.243 | 86.666 | 92.596 | 98.753 | 279.001 | 285.095 |
| | *Panel (b): Preventive care* | | | | | | | |
| | *PCP visit* | | *Health screening* | | *Diabetes care* | | *Laboratory referral* | |
| | Male patients (1) | Female patients (2) | Male patients (3) | Female patients (4) | Male patients (5) | Female patients (6) | Male patients (7) | Female patients (8) |
| Average effect | −0.006 | 0.001 | −0.011** | −0.009* | −0.004** | −0.003* | −0.014* | −0.012 |
| | (0.005) | (0.004) | (0.004) | (0.005) | (0.002) | (0.002) | (0.008) | (0.008) |
| *t*-test for effect homogeneity | 2.27 ($p = 0.025$) | | 0.83 ($p = 0.408$) | | 0.68 ($p = 0.497$) | | 0.67 ($p = 0.503$) | |
| Pre-mean | 0.642 | 0.734 | 0.034 | 0.034 | 0.068 | 0.059 | 0.077 | 0.088 |
| *N* | 544,425 | 577,201 | 544,425 | 577,201 | 544,425 | 577,201 | 542,606 | 575,061 |

*Notes:* This table shows the effect of a female PCP on the probability of having a PCP or specialist visit, drug prescriptions, or hospital expenditures in a given quarter for male and female patients. The results stem from a TWFE estimation following equation (2). To show whether estimates in each panel are different from each other we estimate an additional model where we fully interact equation (2) with patient gender and provide the *t*- and *p*-values. Standard errors are clustered at the practice level and shown in parentheses. Asterisks indicate significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

## C. Matched occupational and vacancy data

Figure C.1: (No) Match position vacancy data




*Notes:* This figure shows the number of successful and unsuccessful matches of replacements to additional information regarding the replacement process. For the replacements with unsuccessful matches, details concerning the number of applicants and scores are missing.

This section discusses the match between the UA Medical Chamber's occupational data (2005–2018) and the web-scraped vacancy data (April 2008–December 2017). For almost all occupations from 2008 to 2017, we are able to establish a clear match between the occupation and the vacancy data through the location of the position, the transition model, the gender of the successor, and the time of the transfer. In Figure C.1, we show each quarter between the first quarter of 2007 and the last quarter of 2018. For quarters without a bar, there are no replacements. Between 2007 and 2018, we are missing the additional information on scores and applicants for 10% of replacements.