

Zocher, Katrin

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Exiting primary care providers

Katrin Zocher^{‡b}

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Abstract

This article studies the impact of primary care providers (PCPs) exit from the local health care system on patients' health care utilization. I compare patients with each other whose physicians have left the local health care system at different points in time due to retirement, relocation, or other reasons. Estimation results indicate that the imminent exit leads soon-leaving physicians to changing their treatment behavior, which has a significant impact on patients' health care spending. In addition, successors and new PCPs provide significantly more preventive services in the post-exit-period and refer patients more often to specialists for further examinations than the physicians who exit later. The increased inpatient expenditures in the post-exit period are caused by patients themselves (through outpatient department visits), by the new PCPs (through referrals), and presumably by specialists. Self-initiated substitution behavior of patients (e.g., less PCP care, more specialist care) after the exit is observed but is low in magnitude. Although an overall increase in health service utilization is observed, mortality in the post-exit periods is significantly increased among affected patients. A possible explanation is the low frequency follow-up care of patients who were referred to hospitals by their former PCP in the notification-period.

Keywords: physicians exit, retirement, disruption, discontinuity, successor

[‡]Katrin Zocher, Johannes Kepler University of Linz, Department of Economics, Altenberger Straße 69, 4040 Linz, Austria; e-mail address: katrin.zocher@jku.at.

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1 Introduction

Primary care providers (PCPs) are patients' first point of contact in case of malaise and thus the starting point for the treatment of diseases (Boerma, Zee, and Fleming, 1997). PCPs refer patients to specialists and hospitals when necessary and are responsible for management and follow-up treatment of acute and chronic diseases. They carry out preventive medical examinations and undertake routine monitoring, immunization, and advice on health-promoting behavior (Boerma, Zee, and Fleming, 1997). Thus, PCPs provide comprehensive, coordinated, and continuous care to a broad population (Starfield, 1994). If PCPs leave the local health system, patients potentially face discontinuity in health care (e.g., Bischof and Kaiser, 2021). Although there has always been a natural end to any patient-physician relationship, it is only in recent years that attempts have been made to quantify discontinuity and measure the impact of PCP exits on patients' health care utilization, health status, and health care spending. One reason for the increased focus is the approaching retirement wave of the baby boomer generation, who also comprise a large proportion of doctors (e.g., Zhang, 2019; Bischof and Kaiser, 2021). This aging trend among physicians can be observed in many Organisation for Economic Co-operation and Development (OECD) countries around the world. In the EU, between 22% (Malta) and 56% (Italy) of all active physicians are over 55 years of age and will thus retire in the next 10 years (Eurostat, 2020). Similar numbers can be found for the US, where 45% of all physicians are above the age of 55 (AAMC, 2021), and in other OECD countries like Israel (50%), Japan (37%), and Chile (28%) (OECD, 2019). A large share of older physicians implies that a large proportion of patients in a given health care system will soon have to deal with the approaching retirement of their PCP.

So far, research in this field has indicated that PCP retirement or relocation leads to a long-term reduction in primary care utilization of affected individuals (e.g., PCP visits) and an increase in specialized care, emergency department visits (e.g., Schwab, 2018, Sabety, 2020, Bischof and Kaiser, 2021), and use of preventative services offered by specialists (e.g., Simonsen et al., 2021; Kwok, 2019). The findings on the exit effects on patients' health status are diverse. While some researchers have interpreted increased inpatient expenditures, when changing to a new physician, as a health deterioration (e.g., Bischof and Kaiser, 2021), others describe the increase in provided preventative services, like diabetes care, in the post-exit period as positively impacting health status (e.g., Simonsen et al., 2021). Overall, individual

health care spending increases substantially. Sabety (2020) found that in the first year after PCP exit, individual total health care spending increases by around 144.3 USD.

This study examines the effects of PCP exit from local health care systems on patients' health care utilization, focusing on the discontinuity caused by general physician (GP) exit and patients' change to a new successor. I compare patients with each other whose physicians have left the local health care system at different points in time due to retirement, relocation, or other reasons. The used Upper Austrian (UA)¹ data base allows a precise analysis of the services patients receive before and after PCP exit and the identification of providers as well as initiators of used health care services. Given the unique data, this study is able to provide new and detailed insights in physician and patient behavior around the time of the PCP exit. The results show that leaving PCPs significantly increase health care services for (high-risk) patients prior to the exit. In addition, successors provide significantly more preventive services in the post-period and refer patients more often to specialists for further examinations than the control-group physicians. The observed post-exit decrease in PCP visits is caused by PCPs referring patients to specialists and by patients who reduce PCP visits over time. However, self-initiated substitution behavior of patients (e.g., less PCP care, more specialist care) in the post-exit period was observed but was low in magnitude. Despite the comprehensive services provided, mortality among patients who experience disruption was increased. A possible explanation for this is the poor follow-up care of patients who are referred to the hospital by their soon-leaving PCP in the pre-exit period and who are discharged right before or during the exit.²

Besides the detailed insights on physician and patient behavior, the main differences between this study and previous research are, on the one hand, the observed discontinuity caused by the PCP exit and, on the other hand, the understanding of the PCP exit as a process that takes place over a longer period of time.

In the recent literature the observed PCP exits include several components: loss of trusted

¹Upper Austria is one of the nine states in Austria.

²The research by Simonsen et al. (2021) and Zhang (2019) is the most closely related to this study. Simonsen et al. (2021) compare patients who experienced a practice closure with patients who experienced a practice closure slightly later. The authors found an increase in fee-for-service per physician visit as well as a rise in the probability of detection of diseases post-exit, leading to the conclusion that practice closures and re-matching with new physicians actually has some positive impacts on individual health. Zhang (2019) also compared patients whose PCPs had retired at different times. The author found minor anticipatory effects in the pre-exit period and a strong increase in specialist care and inpatient care in the post-exit period. This study's results were consistent with these findings, and it additionally more closely examined the drivers behind the results and the influence of adjusted pre-exit behavior on the post-exit period.

expert, reduced access to health care, search costs of finding new (trusted) providers, and patients' self-selection of new physicians (e.g., Bischof and Kaiser, 2021; Fadlon and Van Parys, 2020; Kwok, 2019; Sabety, 2020; Simonsen et al., 2021; Zhang, 2019). Some researchers have used variation in search costs to determine differences in health care spending among patients (e.g., Zhang, 2019; Fadlon and Van Parys, 2020). In addition, observed post-exit differences in health care service utilization can not only be attributed to patients' changed circumstances but also to physicians' lack of information regarding patients' past health issues and to patients' switch to different practice styles³. Obviously, the estimated exit effect in these cases is multi-layered, and the influencing components are often indistinguishable from each other, and may also interact with each other. In the empirical analysis, I can exclude some of the reinforcing effect components mentioned. Because officials in UA assign successors to vacant PCP positions, patients' search costs are excluded, and access to health care is almost always stable. In 95% of the observed PCP exits, a successor takes over the patients and (often) the practice. In addition, the predecessor and the patients have no direct impact on the selection of the successor; therefore, patients' self-selection of their new PCP is strongly reduced.

Until now, studies have described practice closures or PCP retirements often as abrupt events, which patients suddenly have to deal with. Anticipation on the patient side and pre-exit adjusted behavior by the leaving PCP is assumed only very shortly before the disruption occurs, if at all (e.g., Bischof and Kaiser, 2021; Simonsen et al., 2021; Kwok, 2019)⁴. However, PCPs usually accompany (especially vulnerable) patients for many years, and their relationship is well established (Lam et al., 2020). Physicians feel responsible for their patients (Silver et al., 2016) and are concerned about the effects their retirement has on them (Hedden et al., 2021). Therefore, concerns about the future care of their patients may have an impact on the treatment behavior of leaving PCPs. At the same time, for many patients, PCP retirement is associated with stress and anxiety (Lam et al., 2020), which may affect both health care utilization and health status itself. Furthermore, practice

³Simonsen et al. (2021) investigate in detail whether the effects are due to practice closures or the change in provider. In a decomposition analysis, they found that the effects are driven by the disruption itself. Fadlon and Van Parys (2020) showed that 43% of patients switch to physicians in the same practice. In addition, they tested whether individual pre-exit characteristics influence practice style (choice of low/high-intensity care physicians) in the post-exit period. They found significant but minimal sorting of patients by practice styles.

⁴An exception is the work by Schwab (2018).

closure and the search for a suitable successor involve additional work, which may result in physicians having less time than usual for their patients while they prepare for the exit. Thus, behavioral changes may occur before the PCP actually leaves, which may also affect the post-exit period. Therefore, I describe the exit of a PCP as a process with several steps instead of an suddenly occurring event. First, the physician decides to leave the local health care system and then eventually informs the patients. Then, the physician exits the local health care system, and patients either remain with the successor or look for new PCPs. The steps should also not be considered strictly distinct. Patients may seek new physicians because of the approaching leave, but they may not wait for the disruption to occur and change physicians prior to the actual exit. Given the data, it is possible to very precisely analyze the services used or induced by physicians before and after exit, and I can examine in detail anticipatory effects and also partially link these to post-exit behavioral changes.

The remainder of the article is divided as follows: Section 2 explains the UA health care system and Section 3 describes the data. Section 4 explains the estimation method. The estimation results as well as health implications are provided in Sections 5 to 7. Section 8 analyzes how pre-exit behavioral changes affect post-exit health care utilization, and Section 9 summarizes the results and concludes.

2 Institutions, exiting PCPs, and successors

Membership for individuals in Austrian health insurance fund is mandatory and determined by place of residence and profession. Insurance contributions are approximately 7.6% of income and cover a wide range of intramural and extramural services within the health care system with only minimal deductibles (e.g., charges for prescriptions) (Hofmarcher, 2013). In 2017, 99.9% of the population had health insurance (Bachner et al., 2019). The Austrian health care system is characterized by free access to outpatient and inpatient care; although there is no strict gate-keeping system, outpatient primary care is mainly provided by self-employed, insurance-contracted general physicians (GPs) in single practices in a fee-for-service system (Bachner et al., 2019; Hofmarcher, 2013). Therefore, in this study PCP exit refer to exits of GPs with single practices. Of all Austrian physicians (GPs and specialists), 59% in the outpatient sector work with health insurance funds and account for approximately 78% of health care expenditures in the same sector (Sinabell, 2016). The UA's Regional

Health Insurance Fund is the largest health care provider in UA and covers more than 1.2 million people, which corresponds to more than 75% of UA's population (OOEGKK, 2017). Excluded from this health insurance fund are, for example, self-employed individuals, civil servants, and farmers. In the last quarter of 2017, around 74% of all outpatient GPs located in UA were contracted by this insurance provider. These physicians hereafter are referred to as *contracted GPs*.

If the contracted physician retires or no longer wishes to fill the insurance-contracted position, the physician has to terminate the contract with the UA Regional Health Insurance Fund. According to law, this has to be done at least three months before the end of the calendar quarter prior to the quarter when termination would occur (ASVG, 2020). The UA Medical Association, which is the official representative of physicians in UA (ÄrzteG, 2021), recommends submitting the notice of termination at least six to twelve months in advance to ensure continuity of care for patients, as the refilling of these positions often takes time⁵. The quarter in which the physician notifies the Regional Health insurance Fund about contract termination is defined as initiation of the exit process of the PCP. At this point, the family physician takes the first step to leave the local health care system⁵. As soon as the UA Regional Health Insurance Fund receives the termination, the Medical Association and the UA Regional Health Insurance Fund decide whether the position is to be retained and refilled with a successor, relocated, or canceled. ⁶ In case of a planned replacement, the position is then advertised on the website of the UA Medical Association, and interested physicians have three to six weeks to apply.⁵

At the end of the application period for the contracted physician position, the applicant with the highest scoring is given the position. Scores correspond to amount of experience as a physician, number of diplomas and additional training, and provided GP emergency services. Candidates are ranked according to their scores, and the best candidate is selected. There is no hearing or interview, nor can the previous contracted physician (predecessor) influence the overall result (Oö Gebietskrankenkasse and Ärztekammer Oberösterreich, 2018). Usually, the successor fills the position immediately after the predecessor's exit (*hard transition*), to

⁵ Source: M. Keplinger, UA Medical Association, personal communication, August 2018

⁶The number of contracted GPs positions in UA is negotiated every year between the UA Medical Association and the UA Regional Health Insurance Fund. Both parties also decide the location (on the municipality level) of a contracted physician position. Thereby, they have to follow the Austrian Healthcare Structure Plan, which includes a list of all nationwide planned contracted physician positions across all regions in Austria. Source: M. Keplinger, UA Medical Association, personal communication, August 2018

avoid a break in care for patients during the transition. The exiting physicians also can choose a *soft transition* instead of a *hard transition*. In this case, both the predecessor and successor work together for 1-12 quarters (also called *transition time*, R) in the practice before the predecessor finally exits and the successor takes over completely.^{5,7}

3 Data

3.1 Assigning patients to their PCP and health care variables

Although patients usually have a PCP, whom they regularly visit, there is no official registration or patient-PCP list. Therefore, to accurately assign patients to their PCP, I use quarterly data provided by the UA Regional Health Insurance Fund (2005-2017). This individual-level data contains detailed information on each patient-physician encounter and the corresponding expenditures covered by the UA Regional Health Insurance Fund. The PCP of an insured individual in a quarter is defined as the general physician (GP), with whom the patient had the highest spending in two out of the last three quarters⁸. This procedure is used on the one hand to avoid outliers – for example the patient switches from her/his usual PCP to a different PCP only once (e.g., if the PCP is on vacation) – and on the other hand to be able to recognize fairly quickly a permanent change. If patients rarely see PCPs, it may not be possible to assign patients to a PCP for some quarters. In these cases, the information from the previous quarters is used.

The UA Regional Health Insurance Fund (2005-2017) data include besides detailed information on health care expenditures and physician visits, referrals to GPs and specialists, covered expenses for prescribed drugs (including ATC codes), and information on inpatient hospital stays and outpatient department visits. The data on inpatient hospital treatments consist of detailed information regarding the duration of the stay, diagnoses following the

⁷If the predecessor is willing to hand over the patient files, the successor must take them over in exchange for a transfer fee. However, the transfer of the patient records is not mandatory. According to the UA Medical Association, it sometimes occurs that doctors do not pass on their patient files to their successors, but no numbers could be given. Source: M. Keplinger, UA Medical Association, personal communication, August 2018.

⁸An example to define the PCP of an individual in the third quarter of 2007: Assume that GP A charges for the treatment patient i € 50 in the first quarter of 2007, € 60,- in the second quarter of 2007, and € 0 in the third quarter of 2007, while GP B charges treatments for the same patient € 0 in the first quarter of 2007, € 0 in the second quarter of 2007, and € 120 in the third quarter of 2007. Thus physician A is the PCP for individual i in the third quarter of 2007 because this physician charged the most in two of the last three quarters (in the first and second quarters of 2007), and B charged the most only in the third quarter.

International Classification of Diseases (ICD-10), covered expenditures, and referring physicians⁹. Unfortunately, the data on outpatient department visits only contain the quarter of the visit, and no further information on the provided services is given. In addition, the data are only available from 2011 to 2017. The main outcome variable *total health care expenditure* is the sum of covered fees for physicians, expenditures for prescribed drugs, and for inpatient hospital stays. I combine the described individual health care utilization data with information from the Austrian Social Security Database (ASSD, 2005-2017), which additionally provides individual-level information on gender, birth year and place of residence (Zweimüller et al., 2009).

3.2 Data on physicians, physician exits and successors

Although data are available on the exact exit quarter for most contracted physicians, information about the exact time when the physician terminated the contract with the UA Health Insurance Fund is missing. However, it is possible to ascertain the month of the first job posting from the occupation data and job vacancy data from the UA Medical Association (2005-2017). The occupation data contain detailed information on all filled contracted positions in UA, including information on the physician, who fill the position, filling date, predecessor, type of transition (soft, hard), and transition time. The data also provides demographic information on all contracted physicians, including gender, year of birth, and retirement date. This data can be linked to the job vacancy data, which further provides information on the dates of advertisements on the UA Medical Chamber website, planned filling date, number of applicants, and ranking (according to score) of applicants for each vacancy of an open contracted position in UA between 2005 and 2017. As the leaving physicians must send notification of termination in advance, it can be assumed that the exit process of the PCP begins at latest one quarter before the quarter of the first call for applications for this position.¹⁰

⁹Specialists who refer patients to the hospital are not accurately recorded. The identification of the referring specialist is often missing or the same identification number is used for internal hospital referrals, referrals between hospitals, and referrals by specialists or other institutions. This makes assignments of specialists to referrals sometimes impossible. Referrals by GPs are much better recorded.

¹⁰Figure A.1 in the Web Appendix displays these job advertisements relative to the actual exit of the contracted PCPs. The job advertisements are split by positions with and without successful refillings. A total of 79% (88%) of vacancies were refilled with the first (or second) job advertisement (given any successor is found). The Figures clearly indicate that most doctors follow the recommendation of the Medical Association and send their notification some time before the three-month limit. From the non successor sample, it is also apparent, that some physicians may postpone their planned exit date if no successor can be found.

I set the reference quarter, and thus the start of the leaving process, at relative quarter $q = -5$, as most physicians send notification of termination somewhat later, given the quarter of the first job advertisements.¹¹ I excluded from the treatment group all individuals whose leaving PCPs chose a soft transition with a transition time longer than one quarter, since less than 8% of all observed replacements have a transition time between 2 to 12 quarters and it would be difficult to interpret the estimation results in the post-exit period with varying transition times. In addition, I removed all observations whose PCPs ($N_{PCP} = 5$) transferred only their secondary practice to a successor because I could not distinguish which patients went to the primary practice and which went to the secondary practice.

Figure A.2 in the Web Appendix illustrates the predecessors' and successors' quarterly (Regional Health insurance fund) charged fees around the exit. In contrast to many previous studies (e.g., Fadlon and Van Parys, 2020, Sabety, 2020), most successors in UA have not worked previously as PCPs or even as outpatient physicians in UA. Therefore, successors' practice style is unknown to the patients and leaving physicians prior to the exit or, given a soft transition, until the successor and predecessor begin working together. Additionally, the new PCPs and patients do not know each other; therefore, they establish a new relationship with each other when the successor starts working, and the PCPs may need to close some information gaps about their patients' past and current health issues.

4 Estimation method and descriptive statistics

[Figure 1 here]

PCPs may leave the local health care sector due to retirement, relocation, or other reasons (e.g., start working in a hospital or leave the profession). Therefore, the individually experienced timing of the event might not be random. Retirement is strongly correlated with physician age, and thus unobserved patient characteristics, for example, preferences related to doctor experience, could be correlated with the choice of a PCP and therefore also with the time of treatment (e.g., retirement of the PCP). Thus, the compared patients differ systematically, and the effects of the exit cannot be considered separately from the effects of

¹¹It would also be possible to set individual starting points of the notification-periods, as physicians send the notification at different relative quarters, but given the estimation method, this does not provide any further insights and only complicates the interpretation.

unobserved heterogeneity (Ruhm, 1991). Therefore, to estimate the causal effect of the exit of the PCP on patients' health care utilization, I create a quasi-experimental setting. The methodology follows the discussion in Ruhm (1991), Fadlon and Nielsen (2021), and Halla, Schmieder, and Weber (2020). In this setting, I compare patients with each other whose physician exit on different points in time. In detail, the PCP of an individual (treatment group) leaves the local health care system on the last day of quarter t and the control group individual's PCP exits slightly later on the last day of quarter $t + \Delta$. By referring to the leaving quarter t , a difference-in-difference estimation can be conducted to examine the effect of the exit process on individual health care utilization.

Figure 1 illustrates the identification strategy, with t denoting the leaving quarter of the treatment group individual's PCP and $t - n$ marking the quarter before the start of the exit process of the PCP, which is, given the discussion in chapter 3.2, relative quarter $q = -5$. The observation period is divided into several periods, which correspond to the time of exit of the PCP. The *pre-period* corresponds to the period before exit notification of treatment group PCPs (which spans from $t - n - s$ until $t - n$). A pre-period comparison should not reveal any significant differences between the treatment and control groups, since otherwise assumptions regarding the common trend would be violated. The *notification-period* is defined as the the period between exit notification and actual exit (also called exit-period, which spans from $t - n$ until t). During this period, the doctor decides to leave the local health care system and informs health care officials and eventually patients. Patients and PCPs may adjust their health care utilization and health service provision already within this period. The *post-period* describes the period between the exit of treatment group PCPs at t and the beginning of the exit process of control group PCPs at quarter $t + \Delta - n$. Starting at $t + 1$, successors of leaving PCPs begin working, and treated patients switch to new PCPs (successors or other PCPs). The *catch-up-period* covers the complete exit processes of control group PCPs, from notification to actual exit (from $t + \Delta - n$ until $t + \Delta$).

With this method, I cannot completely rule out biased effects caused by unobserved characteristics. However, I can assume that two individuals with the same birth year and sex have similar unobserved characteristics, if their PCPs leave in the same quarter t (Fadlon and Nielsen, 2021). Therefore, two individuals should be very similar, if not the same, in their unobserved characteristics given the same sex, birth year, and a fixed t , when the PCP

of the first individual exits at t and the PCP of the second individual leaves at $t + \Delta$, where Δ is small (Fadlon and Nielsen, 2021; Ruhm, 1991; Halla, Schmieder, and Weber, 2020). Meaning, the treatment and control groups are assumed to be equal prior the start of the leaving process, given a short duration between the exit of the treatment group PCPs and the exit of the control group PCPs. If the exit points in time of both groups are close, the timing of experiencing the PCP exit is assumed to be as good as random. Therefore, the size of Δ is a crucial choice¹². I chose $\Delta = 12$ for the main analysis, to additionally ensure a sufficient length of the pre-exit and post-exit periods and a large sample size. In the quarterly analysis of the effects of the exit process on individual health outcomes, I used the following model:

$$Y_{igt} = \alpha D_{it} + \sum_{l=-11}^{l=12} \delta_l I\{q = l\} + \sum_{\substack{l=-11 \\ l \neq -5}}^{l=12} \beta_l D_{it} \times I\{q = l\} + \lambda_{it} + u_{iq} + v_{igt}. \quad (1)$$

Y_{igt} denotes the health outcome for individual i in relative quarter q with physician (pseudo-) exit quarter in t . q is the relative quarter to the exit quarter t of treatment groups PCPs (see Figure 1). D_{it} is the treatment indicator and equals 1 ($D_{it} = 1$) if the individual experiences PCP exit at the end of t and equals 0 ($D_{it} = 0$) if the individual experiences PCP exit at the end of $t + 12$ ($\Delta = 12$). $q = -11$ refers to the beginning of the pre-period, and $q = 12$ indicates the last observed period, which is the last active quarter of control group PCPs prior to their exit. Given a duration of the pre- and notification-periods of 12 quarters, the setting implies that the individuals in the treatment (control) group stay with their PCP for at least three (six) years until their PCPs exit the local health care system at the end of t ($t + 12$). Individuals in the treatment group are allowed to drop out of the sample in the post- and catch-up-periods¹³. β_l are the coefficients of interest, as they represent the differences between the treatment and control groups within each relative quarter in each period. These

¹²Chapter A.2.1 in the Web Appendix briefly discusses several sizes of Δ .

¹³This method is used to be able to also capture treatment effects on highly vulnerable individuals who, for example, might die during the post- and catch-up-periods. In Chapter A.2.2 in the Web Appendix, I discuss and show estimation results for several modified definitions of treatment and control groups. The estimation results reveal the same pattern over all variations and lead to the same conclusions as in the main analysis in the article. There is also a small group of patients who preemptively change their PCP during the notification-period. Figure A.11a in Chapter A.3 in the Web Appendix shows that patients whose PCP leaves the local health care system by the end of $q = 0$ are significantly less likely to stay with their family physician from $t - n$ to t than patients whose PCP exits the local health system in $t + 12$. This group is referred to as *movers* and is discussed in more detail in the appended Chapter A.3. Of all patients, 94% stay with their soon-leaving PCP throughout the notification-period.

estimates show the average treatment effect of the treated. While it is possible to estimate the effects of the exit process on patient health outcomes in the notification-period, it is not possible to distinguish between the leaving-process effect and the actual disruption effect in the post-period, because the anticipatory effect may still affect the post-period and thus have an impact on (perceived) disruption in care. λ_{it} is the *gender-birth year-exit quarter* fixed effect, and u_{iq} is the region (urban vs. rural) fixed effect. The error term is given with v_{iqt} . The standard errors are clustered on the individual level. The reference quarter is the first quarter of the notification-period, $q = -5$. The notification-period begins right before officials receive notice of the PCP’s decision to leave the local health system. In this quarter, expectations regarding future health care supply should be the same among the treatment and control groups (Halla, Schmieder, and Weber, 2020). Only after the start of the leaving process changes in patient and PCP behavior become visible. Individuals in this model can be in both the treatment and control groups, but not as a counterpart for itself. It is additionally ensured that for each gender-birth year-exit quarter combination, there is at least one treatment and one control group individual.

Among the treatment group only patients with a hard transition or soft transition with a transition time of one quarter ($R = 1$) are kept, whereas in the control group individuals with a hard transition and soft transition with any transition time are kept. Therefore, within the final treatment group, PCPs with a hard or no transition leave at the end of relative quarter $q = 0$, and PCPs with a soft transition leave at the end of relative quarter $q = 1$, whereas within the control group, PCPs with a hard or no transition leave at the end of relative quarter $q = 12$ and PCPs with a soft transition leave at $q = 12 + R^{14}$.

5 Results

5.1 Descriptive statistics

[Table 1 here]

The final sample consist of 79,339 treatment-group and 78,532 control-group individuals. Descriptive statistics are summarized in Table 1. Both the treatment and control groups

¹⁴Descriptive statistics and estimation results wherein the control group individuals were also limited to a transition time of $R = 1$, given a soft transition, were almost identical to the main analysis sample. The results are available upon request.

were on average over 50 years old, and thus above the 2017 Austrian average age of 42.5 (Statistik Austria, 2021). This large proportion of older individuals can be attributed to the requirements of the sample and estimation method (e.g., duration of patient-PCP relationship). The health care expenditures of the treatment (column 1) and control groups (column 2) are period-based quarterly averages. In column (3), the differences in expenditures between both groups are presented. In addition, Figure 2a shows the average total health care expenditures for each group for each relative quarter. The gray lines in the Figure mark the beginning of the respective periods. Both the Table and the graph show that in the pre-period, the total expenditures of both groups are almost identical (€ 471.3 and € 470.7), but they move apart in the notification-period because of a rise in inpatient expenditures of the treatment group. In the post-period, the difference becomes even larger before it decreases in the catch-up-period. For other health care services (e.g., physician and GP fees) an expenditure increase is either not discernible or only apparent at a much lower level (e.g., expenditures for prescribed drugs) among the treatment group¹⁵.

[Figure 2 here]

5.2 Total health care expenditures

Figure 2b shows the estimation results for β_t for Model 1 for the main outcome variable, total health care expenditures. Detailed results of all presented estimation-based figures can be found in the Web Appendix in Chapter A.1. In the pre-period, from $q = -11$ to $q = -6$, there are no observable significant differences in total health care expenditures between the treatment and control groups. Thus, the parallel trend assumption is not violated, and the results can be interpreted accordingly. Significant expenditure differences between the treatment and control group occur for the first time in the beginning of the notification period. The difference increases from € 51.2 in $q = -4$ to € 78.9 by the end of the notification-period. Compared to the period sample mean of $\mu_{note}^{total} = 536.3$, the estimated differences in $q = 0$ correspond to expenditure increase of up to 14.7%. In the post-period, from $q = 1$ to $q = 6$, the expenditures of the treatment group continue to grow and lead to a significant expenditure difference in relative quarter $q = 6$ of € 126.7. Only at the end of the catch-up-period, during the control group PCPs' exit process, the expenditure difference

¹⁵Summary statistics on PCPs can be found in the Web Appendix in Table A.1.

becomes insignificant again. These results show that physician exit has an impact not only on patients after the exit, but begins affecting them before the exit, and the planned exit causes significant increases in patients' health care expenditures.

5.3 Physician fees and expenditures for prescribed drugs

[Table 2 here]

Figures 2c-2e show the estimation results for total health care expenditure components. Regarding expenditures for prescribed drugs (Figure 2c), significant differences in expenditures are observable only in the notification-period and are rather small. For physician fees (Figure 2d), significant differences between the treatment and control groups are only observed in the post-period.

In addition to expenditure variables, categorical variables were created to indicate whether a visit was observed in the respective specialty (GP, radiology, gynecologist and obstetrics etc.) in the corresponding quarter ($= 1$), or not ($= 0$). Table 2 presents excerpts for different specialties expenditures and visits for the notification- and post-periods. Only GP visits, laboratory visits and radiologist visits show significant changes in the period before PCP exit. After PCP exit, the probability of GP visits are significantly reduced. On average, people in the treatment group have a reduced quarterly GP visit probability of approximately 1.2 percentage points in the first year after the exit. However, physician fees show a significant increase in the post-period. These results imply that patients are less likely to see a GP just before and for several quarters after exit, but patients who see a GP in the post-period are provided more services than those whose PCP leaves the local health system later. At the same time, diagnostic examinations (radiology and laboratory) increase in the notification-period, and again in the post-period.

5.4 Inpatient hospital expenditures

The effect of PCPs exits on total expenditures is largely caused by the increase in inpatient hospital expenditures, which also begin to increase significantly in the notification-period within the treatment group. In relative quarter $q = 0$, treatment-group patients' inpatient expenditures are on average € 72 higher than those for patients whose physician exits later. Table A.5 in the Web Appendix presents the estimation results for inpatient hospital expen-

ditures by ICD-10 Chapters. The largest increases in spending are observed in the treatment of neoplasm (ICD-10 Chapter 2) and of circulatory system diseases (ICD-10 Chapter 9). The results do not indicate that the diseases suddenly occurred in treatment-group individuals because of the (imminent) exit of their PCP but that they are more likely to be hospitalized when their physician soon leaves the health care system. To determine which paths patients use to obtain treatment in the hospital, I also examined hospital referrals and outpatient department visits. Table 2 shows some of these results in columns (7) and (8). Accordingly, in the period before exit, hospital referrals by soon-exiting PCPs increase significantly by approximately 15% (e.g., in $q = -4$). In contrast, patients' outpatient department visits only increase slightly in the post-period. These last two results indicate that the increased hospital expenditures in the notification-period are caused by the exiting PCP. Although patients may ask for a referral, the physician makes the decision and ultimately issues the referral, and thus cause the increased inpatient spending.

The change in (exiting) physicians' behavior can be interpreted as a premature attempt to compensate for expected negative effects from the disruption in health care resulting from the PCP exit. Under these circumstances, the increase in inpatient services for patients could be interpreted as a concern driven behavior of the leaving PCP who take care of patients health before they exit the local health care system. However, other motivations may also drive the physician's behavior. Soon-leaving physicians may be more inclined to refer patients to the hospital because they do not want to be in charge of their care anymore or are unable to because of time constraints while preparing their exit (hands-off behavior), and negative feedback from patients potentially becomes less important with the imminent exit. Since the observed positions are refilled in more than 95% of PCP exits, the successor might also implicitly influence the leaving PCP's behavior, as the successors' judgment may matter to the predecessor. Increased expenditures might be therefore an attempt to communicate, that the leaving PCPs have provided comprehensive care to their patients. The following heterogeneity analysis shows that there are different behavioral responses by physicians and patients depending on the patients' health status. The central finding is that it is not only relevant that changes occur prior to exit, but also that they vary among different patient groups. However, one limit of this study is that no clear answer can be given for the motivation for the changed behavior of the leaving PCP.

6 Heterogeneity according to risk types

[Figure 3 here]

In the heterogeneity analysis, patients are divided into two risk groups. Those in the high-risk group were hospitalized in the pre-period for blood pressure, chronic respiratory diseases, diabetes, autoimmune diseases, cardiovascular diseases, or cancer. These individuals are hereafter referred to as people with pre-existing diseases or high-risk patients. Patients with no such pre-existing diseases in the pre-period belong to the low-risk group¹⁶. Figure 3 presents the estimation results for total health care expenditures for both risk groups. In the high-risk (3a) as well as in the low-risk group (3b), a significant increase in health care expenditures is observable in the notification-period, and these continue to rise in the post-period. The expenditure differences between the treatment and control groups follows the same pattern in both risk groups, but the expenditure differences for people without pre-existing diseases are considerably smaller than those between the treatment and control group in the high-risk sample. The treatment-group high-risk individuals have on average € 171.2 higher expenditures in relative quarter $q = 0$ than those in the control group, while the low-risk individuals have on average € 47.7 higher expenditures than the respective control individuals.

In both risk groups, more than 90% of the total health care differences between the treatment and control groups are explained by the difference in inpatient hospital expenditures (see Table 3). People with pre existing diseases receive more inpatient care due to increased inpatient hospital referrals by their soon-leaving PCPs and by the successor. In relative quarter $q = -4$, the probability of inpatient hospital treatment owing to a PCP referral is 19% higher for treatment-group high-risk patients in comparison to the control-group high-risk patients. Since the probability for outpatient department visits is not increased within the high-risk group, the increased pre-exit inpatient treatments are solely caused by the leaving PCPs. The higher probability of PCP hospital referrals in the notification-period is not observed among low-risk patients. In addition, among the low-risk patients, outpatient department visits also increase significantly only in the post-period.

In the post-period, GP visits decrease significantly in the low-risk group as well as in

¹⁶In the Appendix, in Figure A.3 and Table A.7, the estimation results for a risk classification by age (above or below 60 years of age in $q = 0$.) are shown. The results mirror those presented here.

the high-risk group, but for both groups, the decrease is rather small (1%-2% relative to the mean). This is related to the observation, that for approximately 73% of the observed treatment-group individuals the successor becomes the PCP for at least in one quarter in the post-period¹⁷. Judging only from the GP visits among the low-risk and high-risk groups, there is persistent (over several quarters) reduction in primary health care utilization (GP visit) in the post-period. In fact, a reduction in health care utilization seems to exist only in the first quarter. In the second quarter in the post-period, GP visits are still significantly reduced, but specialist visits with and without GP referrals increase significantly in the treatment group for both risk types.

[Table 3 here]

This analysis provides three important findings. First, for the low-risk patients, the approaching exit is not highly relevant as it only translates in to (significant) additional expenditures in the notification-period of about € 140. Only after the actual exit, a significant change in behavior does occur.

Second, in the post-period, only some of the patients substitute GP services with specialist visits. The large shift from GPs to specialized care, which is also observed in other relevant studies (e.g., Bischof and Kaiser, 2021), is strongly induced by the new PCPs, as the probability of specialist visits from successor or new PCP referrals rises significantly. Furthermore, the increased inpatient treatments in the low-risk group are caused by the patients themselves and presumably by specialist referrals to hospitals. The successor or new PCP seems to have only an indirect influence on inpatient treatment, as patients are referred by the PCPs to specialists (GP spec. referral), and specialists presumably refer the patients to hospitals.¹⁸

Third, the findings for high-risk patients differ from those low-risk patients. Patients

¹⁷The other 27% moved to a different GP, changed the insurance provider, or left the sample for other reasons in the post-period. In rural areas, 78% remained with the successor, which was 71% in urban areas. In urban areas, it is also important which transfer model is chosen: If a soft transition is chosen, 78% remain with the successor in urban areas, whereas only 48% remain if a hard transition is chosen by the leaving PCPs.

¹⁸As can be seen from the table A.9 in the Web Appendix, hospital days for treated individuals in both risk groups are significantly higher in the post-period than for the respective control individuals. Overall, however, outpatient department visits and GP hospital referrals increase only slightly, if at all. This does not fully explain the increase in hospitalizations. Since GP referrals to specialists are increasing strongly, it is reasonable to assume that specialists refer patients to hospitals and that GPs (successor or other new PCP), therefore, only indirectly influence the observed increase of hospital days. Unfortunately, as already explained in chapter 3.1, the referrals of specialists to hospitals are not recorded in the data in sufficient quality.

with pre existing conditions are referred to hospitals by their PCPs prior to the actual exit. This results in a pre-exit increase in the use of inpatient services. In contrast to the low-risk patients, however, the high-risk patients do not increase their outpatient department visits in the post-period. In fact, increased inpatient utilization occurs directly and presumably also indirectly from referrals by the new PCPs. The difference in referral behavior of the leaving PCP in the notification-period with regard to risk type implies that leaving physicians only increase services for highly vulnerable groups.¹⁹

7 Impact on mortality

So far, the effects on health status appear to be diverse and multifaceted. On the one hand, when patients switch to a new physician (successor or other PCPs) in the post-period, they receive more specialized care and preventative services²⁰, which potentially have positive health effects. On the other hand, health care utilization partly shifts to lower-quality care (e.g., substitution of GP visits with outpatient department visits) and inpatient treatment increase significantly. Furthermore, a great amount of information about patients and past treatments may also be lost with the PCP's exit and the switch to new PCPs.

Although mortality is often referred to as a crude indicator (Zhang, 2019), it can be quite relevant for elderly patients with severe pre-existing conditions, especially in the face of a disruption in health care. For the analysis of the effect of PCP exit on mortality a new model is estimated. Therefore, patients whose PCP leaves the local health care system in $q = 0$ (treated) are compared with patients whose PCP leaves the local health care system in $q = \Delta$ (control; where Δ is either 12 or 20). For both patient groups, the leaving GP is the PCP from $q = -11$ to $q = -1$. The relative quarter $q = 0$ is the baseline quarter since it is the last active quarter for PCPs with a hard transition. The observation period is extended to 24 quarters after exit. Thus, given the observation period from 2005 to 2017, cumulative mortality is estimated up to 12-24 quarters after the exit of the treatment-group PCPs, depending on the (pseudo-) exit timing. The estimation model is as follows:

¹⁹Further heterogeneity analysis (practice location, transition types, etc.) can be found in the Web Appendix in Chapter A.4.

²⁰For details on the utilization of preventative health care services see Chapter A.5 in the Web Appendix. The results reflect the findings by (Simonsen et al., 2021), who find a large increase in diabetes care in the post-exit period.

$$M_{itq} = \alpha ET_{it} + \sum_{l=0}^{l=24} \delta_l I\{q = l\} + \sum_{\substack{l=0 \\ l \neq 0}}^{l=24} \beta_l ET_{it} \times I\{q = l\} + \lambda_{it} + u_{iq} + v_{itq}, \quad (2)$$

where M is an indicator variable, that equals one if individual i dies in this quarter or has already died and zero otherwise. ET equals one if individuals experience the exit of their PCP in t (treatment group) and is zero if the individuals experience the exit of their PCP in $t + \Delta$ (control group). All other variables are consistent with Model 1. The model is estimated for two different samples. In the first sample, the control-group PCPs exit in $q = 12$ ($\Delta = 12$), and in the second sample, the control-group physicians leave the local health care system in the relative quarter $q = 20$ ($\Delta = 20$). Figures 4a and 4b present the average cumulative mortality rates, and Figures 4c and 4d present the respective estimation results.

[Figure 4 here]

In the first sample, there are no significant differences between the treatment and control groups until the exit of control-group PCPs in $q = 12$. In this sample, the distance between the PCP exits of the treatment and control groups is small (three years). In addition, given the observed adjustment behavior of the leaving PCP several quarters before the actual exit, which starts in $q = 7$ (which is $t + \Delta - n$) for the control group, the observation period of the treatment and untreated control groups is additionally reduced. The observed post-period of six quarters (from $q = 1$ to $q = 6$) is likely too short to estimate the exit effect on mortality. Increasing the Δ also extends the post-period in which the treatment-group PCPs have already left the local health care system but the control-group PCPs have not yet started the exit process. The results for the prolonged post-period ($\Delta = 20$) show that five years after exit, mortality among the treatment group is 16% higher, relative to the mean ($\beta_{20} = 0.006$, $\mu = 0.038$), in comparison to the control group.²¹ this finding is in contrast to previous research results: Disruption in health care has been found to have a negative effect on patients' health status but no effect on mortality (e.g., Bischof and Kaiser, 2021; Zhang, 2019). However, the results of this analysis show that despite increased service utilization in the notification- and post-periods, disruption in health care supply still negatively affects

²¹An additional heterogeneity analysis reveals that mortality is slightly higher in urban areas and among high-risk patients (see Table A.10 in the Web Appendix).

patients' health status.

8 Post-period health care utilization patterns

Because the results show that leaving PCPs significantly increase provided services before their exit, patients' and (new) PCPs' behavior in the post-period may be influenced by the adjusted behavior of the leaving PCP. In addition, the behavior adjustment might influence mortality in the post-period. In order to examine this further, additional descriptive analysis are conducted to answer three questions: First, do patients who receive increased care in the notification-period are also receiving extra care in the post-period; and second, do post-period PCPs treat patients who received increased care prior the exit differently than patients who didn't receive increased care in the notification-period; and third, how do patients who received increased care in the notification-period behave in the post-period. As mainly the inpatient expenditures are influenced prior the PCP exit, the focus in these analysis is on patients with increased and not increased inpatient care in the notification-period.

To answer the first question, I investigate whether the increased inpatient spending in the notification- and post-periods is observed among the same treatment-group patients. Therefore, I calculated the quarterly average inpatient expenditures for the control and treatment groups (Figure 5a). The treatment group is split according to patients' inpatient hospital spending. The patients in the first group (in Figure 5a; treatment *high-note*) have higher inpatient expenditures than the corresponding gender-birth year-exit quarter group average at least in one quarter in the notification-period. The average is calculated within each group including all treatment and control group individuals. The results show that although these patients have increased expenditures (by definition) in the notification-period, their inpatient expenditures decrease considerably in the post-period. The reverse can be observed for treated patients who have higher expenditures than the corresponding gender-birth year-exit quarter group average in at least one quarter in the post-period (in Figure 5a; treatment *high-post*). Descriptively, they show a small increase in expenditures in the notification-period before the large increase in the post-period. These expenditure patterns imply that the observed increased inpatient expenditures from $q = -4$ to $q = 6$ are not recurrent and long-term hospitalizations of the same patients, but only short-term increase of inpatient services by different patients: Some patients experience increased inpatients

services in the notification-period, while others use more inpatient services in the post-period, and only a small number have increased inpatient expenditures in both periods. Therefore, the leaving PCP directly causes increased inpatient expenditures in the notification-period, but presumably not in the post-period for some patients.

[Figure 5 here]

For the analyses of extramural services, also treated patients with average or below-average inpatient expenditures in the notification-period (*average-note*) and in the post-period (*average-post*) are considered. Again, the averages are calculated for each gender-birth year-exit quarter group.²² To examine changes in outcomes, the observed variables of interest are normalized to zero in relative quarter $q = -5$. Thus, for each defined subgroup of the treatment group, the graphs always show the changes in outcomes relative to the baseline quarter. Five different binary outcomes are observed: (5b) GP visits, (5c) specialist visit from GP referral, (5d) specialist visits without referral, (5e) receiving (extramural) diabetes care, and (5f) participation in general health check ups. The figures show that in comparison to the other groups, patients with increased inpatient spending in the notification-/post-periods (*high-note* and *high-post*) also have an increased probabilities of GP and specialist visits in the same period. Thus, hospitalization is associated with increased physician utilization and not with a reduction of these services, which implies that there is no substitution of services but rather joint increase of all services. In contrast, compared to the control group, *average-note* patients have reduced GP visits and increased specialist visits (without referral) in the post-period, which may be an indication of possible substitution behavior.

For answering the second question, services (usually) provided by the new PCPs are observed (referrals to specialists, diabetes care, and general health check-up). Given the figures (5c), (5e) and (5f) there is hardly any difference between the respective groups observable. The preventative services increase similarly among all groups in the post-period. Thus, for the new PCPs in the post-period, it does not seem to be relevant whether the predecessor induced increased inpatient services; in the post-period, these patients (*high-note*) have similar increases in utilization of preventative care and specialist referrals relative to the baseline quarter as patients who did not have increased inpatient services in the notification-period

²²Patients in the notification-period groups are not excluded from being in one of the defined post-period groups. Meaning that patients in the *average-note* group can also be in the *average-post* group or *high-post* group.

(average-note). This is an indication that the changed behavior of the leaving PCP in the notification-period likely has little impact on the behavior of the following PCP, because the latter increases services equally for all groups, at least descriptively. The results may also show, that besides treating their newly received patients, physicians also want to gain information on patients' health status.²³

For answering the third question, GP visit changes are analyzed for treatment (*high-note treat*) and control-group patients²⁴ (*high-note control*) who had above-average inpatient expenditures in the notification-period. From the figure (Figure 6a) it can be seen that GP visits in the post-exit period for the treatment group with high inpatient spending decrease from the notification- to the post-period and even fall below the level of $q = -5$, whereas GP visits for the control group whose PCP is still active after their hospitalization are markedly higher. Figure 6b presents estimated differences (following Model 1) in GP visits between treatment- and control-group patients who had above-average inpatient spending in the notification-period. Patients whose PCP retired have significantly lower long-term GP visits in the post-period; in relative terms, the reduction is about 11%. In addition, the treatment group shows a significantly increased cumulative mortality (Figure 6c)²⁵.

[Figure 6 here]

The descriptive analysis suggests that follow-up care after hospital discharge is relatively less frequent for patients who experienced PCP exit during or after their hospital stay than for patients who experienced no disruption at their hospital discharge and that this circumstance has an impact on patient health. Riverin et al. (2018) show that physician visits shortly after hospital discharge significantly reduce the likelihood of readmission for high risk, elderly, or chronically ill patients. Lam et al. (2018) show a positive significant relationship between follow-up PCP visit after hospital discharge and familiarity of the PCP²⁶. Moreover, in a

²³Simonsen et al. (2021) come to a similar conclusion: When patients start seeing a new physicians, patients' medical needs are reevaluated, which can lead to initiation of new treatments. This current study shows that the reassessments take place mainly through general health check-ups and specialist referrals by the new PCP, which then lead to further service utilization.

²⁴Control-group patients in the main analysis were required to be consistently insured throughout the post- and catch-up-periods. This assumption is relaxed in this analysis to retain vulnerable control-group individuals in the sample. The treatment- and control-group individuals can be consistently insured, change insurance providers, or die in the post-period.

²⁵The effect on cumulative mortality is estimated as in Model 2, but the reference quarter is $q = 1$ since average inpatient spending in this analysis is calculated from $q = -4$ to $q = 0$.

²⁶PCP familiarity is very roughly defined in the study. The indicator simply indicates whether patients "reported access to a primary care provider" to the transitional care specialist in the hospital.

qualitative study Griffiths et al. (2021) found that family physicians are preferred over other physicians (such as specialists) by patients for follow-up care because these physicians have been with the patients for a long time and know the patients best. Patients with hospitalization right before the exit of their PCP must consult with a physician unfamiliar to them after discharge to discuss follow-up care. The low post-hospitalization physician visits shown here may indicate a lack of trust between the patient and the follow-up care provider²⁷. Patients thus lack a medical adviser who monitors the progress of the disease/healing and intervenes accordingly if necessary. Patients may also subsequently reduce therapeutic measures, which has a direct impact on individual health status.

In summary, there is no descriptive indication of predecessors influencing the behavior of successors and new PCPs. However, treatment-group patients use follow-up primary care (GP visits) less frequently even after hospital discharge than the control group. This might be related to the lack of trust with a new PCP. Although they receive some increased specialized care, beginning in the third quarter after PCP exit²⁸, mortality is still significantly increased among patients who experience a disruption in health care. The post-exit health care of high-risk patients with hospitalization in the notification period therefore appears to be insufficient.

9 Conclusion

In this study, I varied the timing of PCP retirement and relocation to analyze the effect of PCP exit on patients' health care utilization, health status, and physician behavior. PCP exit is understood as a process rather than a sudden event and involves the end of a trusting relationship and the beginning of a new patient-physician relationship and therefore may cause discontinuity of care. At the beginning of the notification-period, the physician decides to soon leave the health care system and informs officials (e.g., the UA Regional Health Insurance Fund) and eventually patients. The analysis shows that treated patients with severe pre-existing conditions are significantly more likely than control-group patients, to be

²⁷Physician visits are (descriptively) less reduced for patients with a soft transition after hospitalization than for patients with a hard transition even in the long term (see Figure A.4 in the Web Appendix), which supports the theory of reduced follow-up care for patients with unfamiliar PCPs after a hospital stay.

²⁸The Web Appendix also presents results for specialist visits by PCP referral and without referral (see Table A.11). These results show that referrals by GPs to specialists increase significantly in the post-period for treatment-group high-note patients, while specialist visits without referral show no statistical significance.

referred to hospitals by their leaving PCP before the actual exit. This leads to significant increases in health care spending even before the exit. Since the PCPs' other provided services remain unchanged, the increases in spending indicate are not driven by economic motives.

In the post-exit-period, the successor begins working, and the former PCP leaves the local health system. Self-initiated substitution behavior (e.g., more specialized care and fewer PCP visits) is observed (descriptively) only for patients with lower inpatient expenditures in the notification-period. Overall, patients experience a significant increase in preventative care (diabetes care and general health check-up), diagnostic tests (radiology visits and laboratory visits), and referrals to specialists. Therefore, the change to a new PCP can improve the health status of patients (Simonsen et al., 2021). The new PCPs make little distinction as to which patient groups they provide the additional services. Since the successor's assignment to the vacant position eliminates most of patients' search costs, the increased services by the successor are related to a possible information gap on the health status of the transferred patients and the up-to-date treatment knowledge of the successor²⁹. The expenditure growth in this period is mainly driven by hospitalizations, which are a consequence of succession or new PCP referrals to hospitals, patients' outpatient visits, and presumably specialist hospital referrals. In the catch-up-period, the differences between the treatment and control groups decrease as the exit process of the control-group PCPs begins.

Although an overall increase in provided and used services is observed for patients, mortality is significantly increased. A possible explanation is the low frequency follow-up care of patients who were referred to hospitals by their former PCP in the notification-period and have to discuss follow-up care with physicians unknown to them in the post-period. A health policy intervention should therefore target these patients. Predecessors could arrange after care when patients' receive the hospital referral by selecting follow-up medical advisors together with the patient and schedule appointments in advance. Similarly, hospitals should be informed about the new contact person and adjust their referral behavior and information exchange accordingly. The introduction of official guidelines regarding the transfer of practices or practice closures for physicians can possibly positively contribute to an increase in health care quality.

²⁹The successor is on average 40 years old, which implies that they completed (educational) training only a few years ago.

Aging among GPs is also a cause for concern, as the approaching wave of retirements in many OECD countries may make it difficult to fill vacancies. In addition to the discontinuity caused by PCP exit, this trend can lead to a reduction in access to health care for patients, and thus, the positive health effects of succession disappear. An additional comparison in the Web Appendix (see Table A.16 in Chapter A.4) shows that GP visits further decrease when no successor can be found, and therefore drug prescriptions, diagnostic testing, and hospitalization expenditures also decrease in the long term. Measures such as electronic patient files, in which prescriptions, diagnostic reports, and treatment history are stored and to which all physicians have access, can help to reduce the information gap between retiring PCPs and new PCPs in the long term. This system helps remaining physicians care for the patients, as the patients' health status can be identified more easily and the extra time previously needed to close the information gap can be used for patients who are especially in need.

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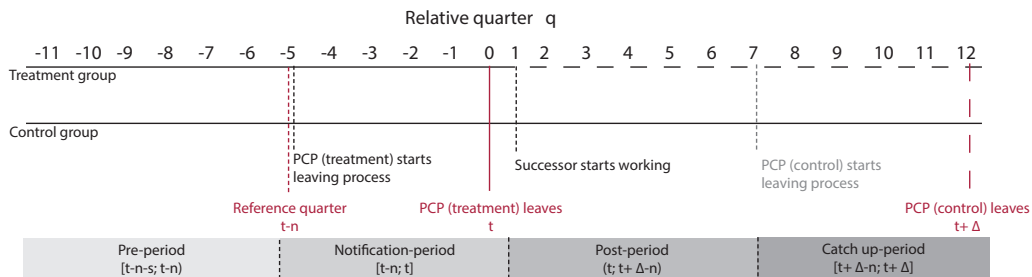
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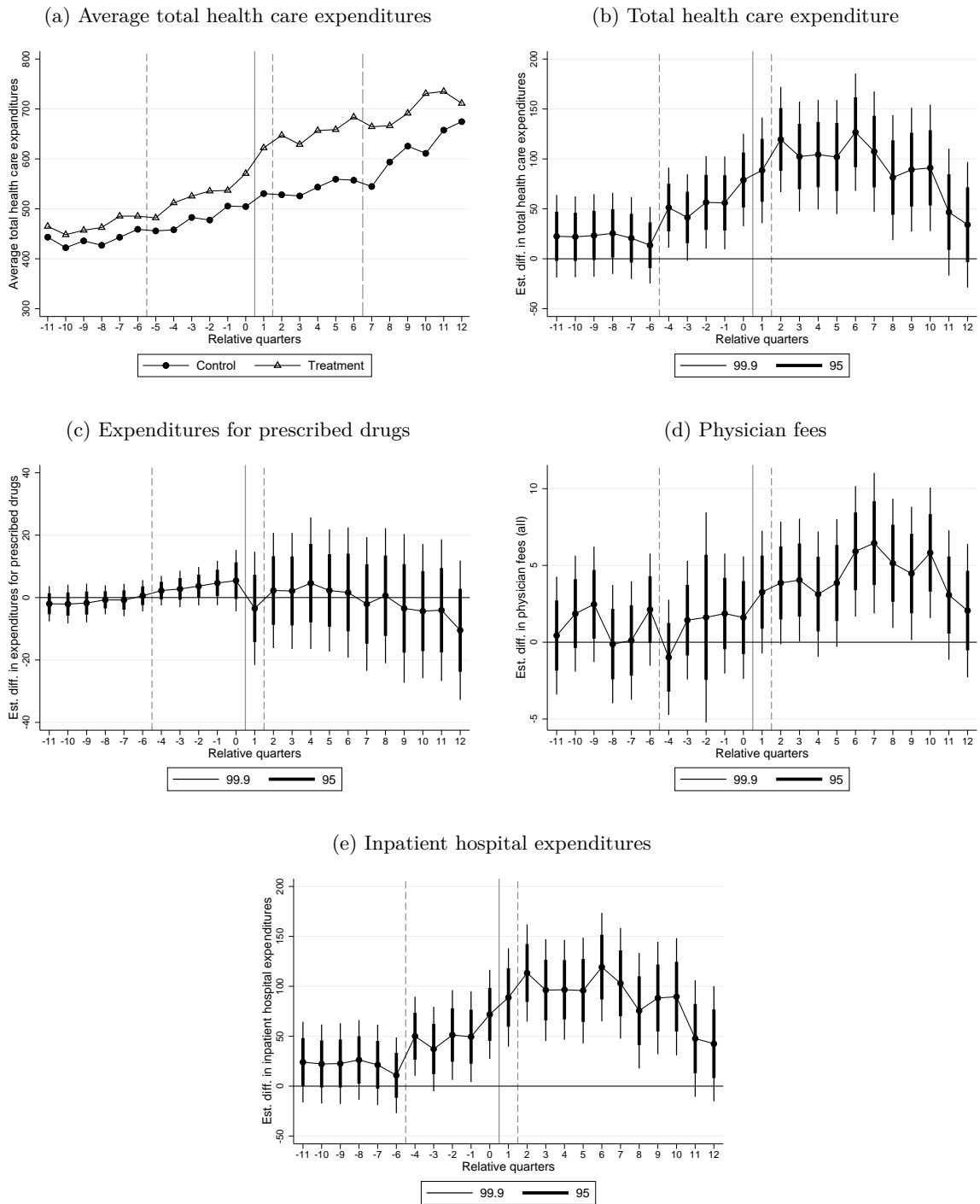
10 Figures and Tables

Figure 1: Illustration of the identification strategy and the defined periods



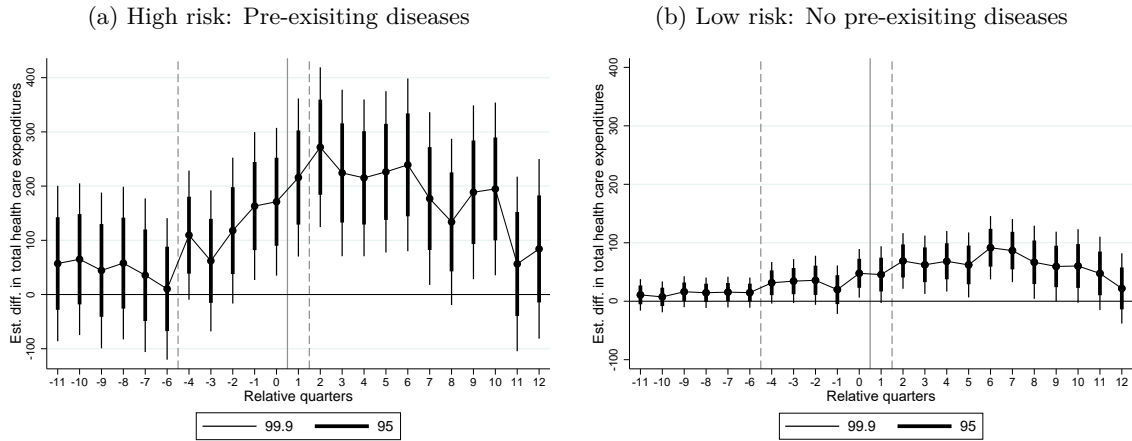
Note: The Figure represents the estimation method. In the main sample analysis a three years time lag ($\Delta = 12$) between the exits of the PCPs of the treatment and control groups is applied. t denotes the quarter of the treatment-group PCPs exits, s is the duration of the pre-period, n is defined as the duration of the notification-period, and $\Delta - n$ describes the length of the post-period.

Figure 2: Main results



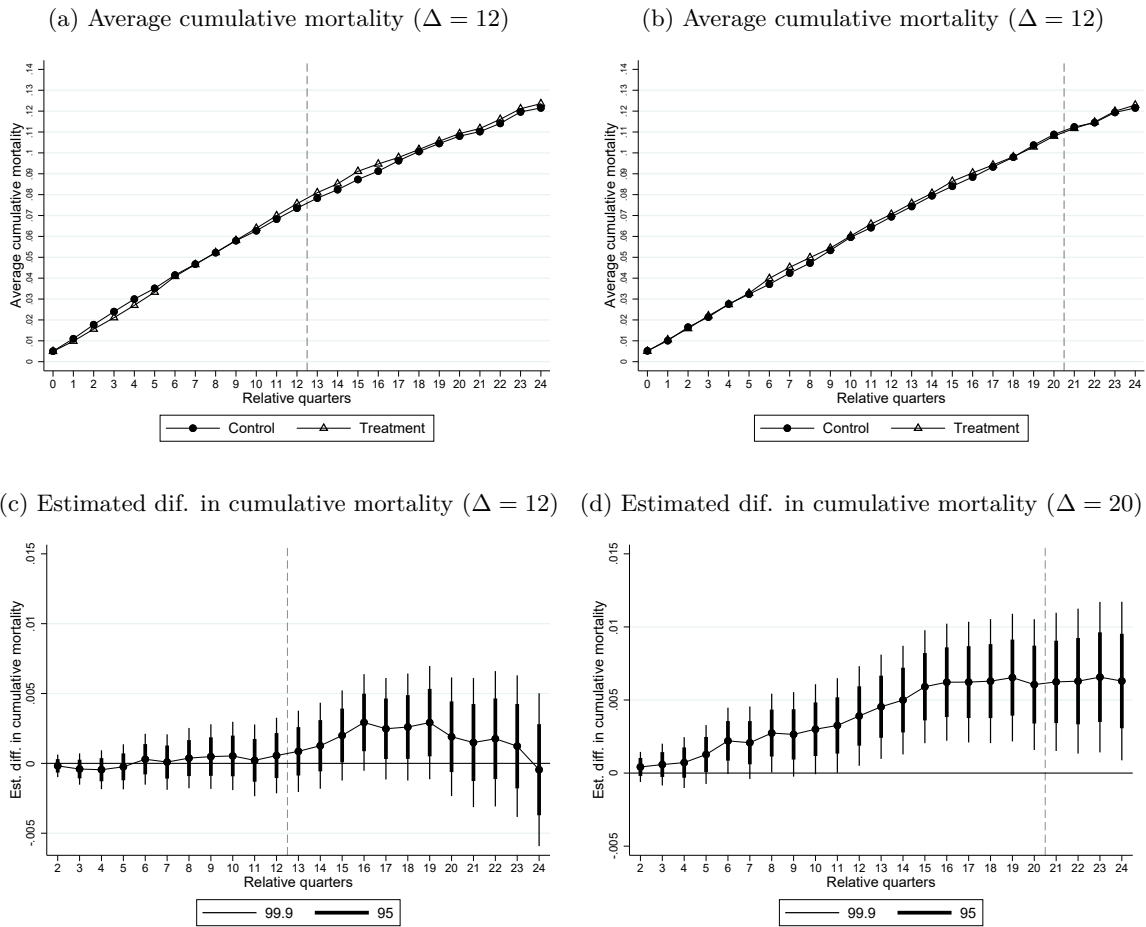
Note: In (a) the quarterly average total health care expenditures and in (b) - (e) estimated differences, with 99.9% and 95% confidence interval, for different types of expenditures are shown. Total health care expenditures are the sum of inpatient hospital expenditures, physician fees, and expenditures for prescribed drugs. Detailed estimation results are shown in Table A.2 in the Web Appendix.

Figure 3: Total health care expenditures by risk type



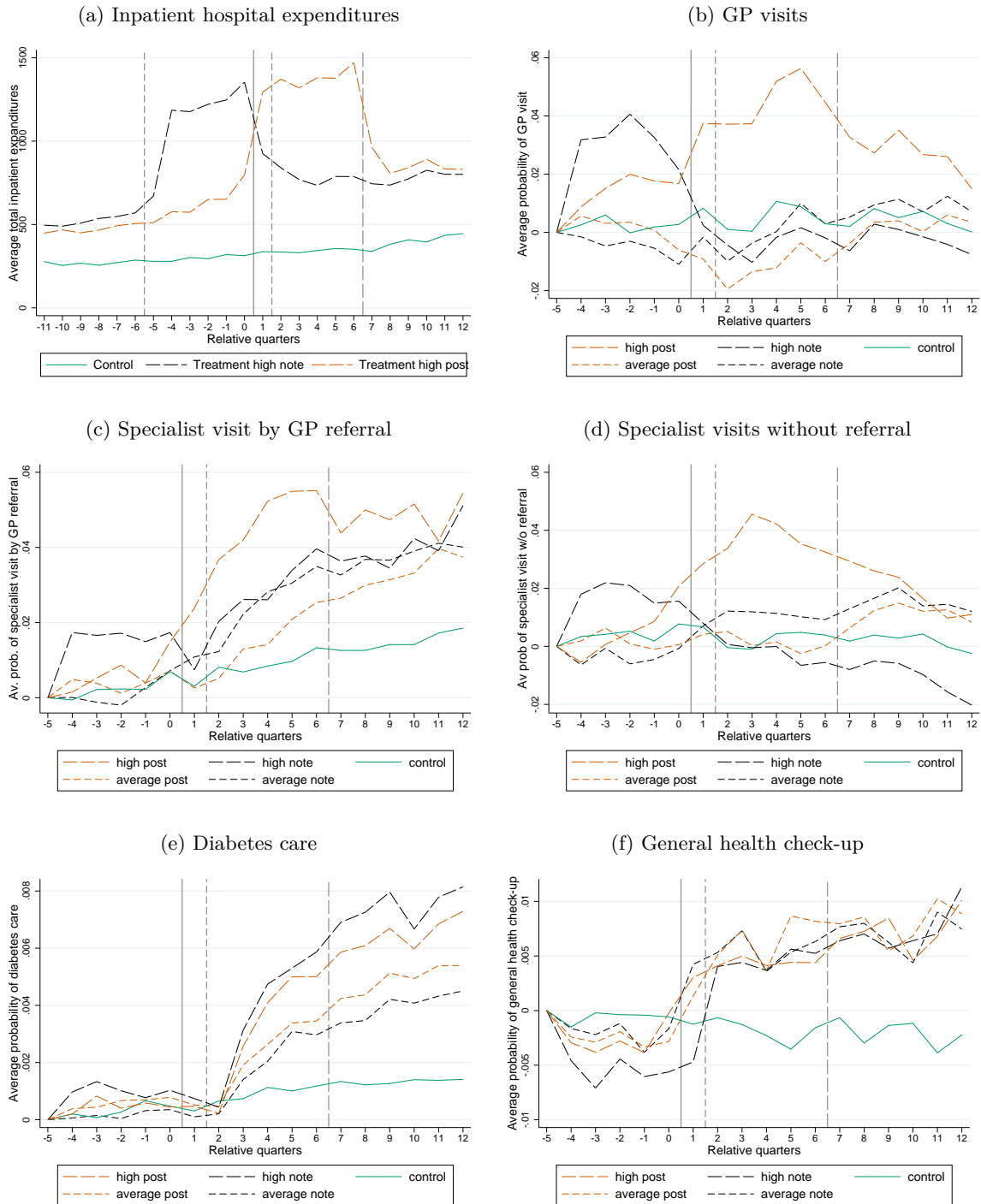
Note: Estimation results, with 99.9% and 95% confidence interval, for total health care expenditures for individuals (a) with and (b) without pre-existing diseases. Those in the high-risk group were hospitalized in the pre-period for blood pressure, chronic respiratory diseases, diabetes, autoimmune diseases, cardiovascular diseases, or cancer. Detailed estimation results presented in Table A.7 in the Web Appendix.

Figure 4: Mortality analysis



Note: In (a)/(b) the average cumulative mortality rate and in (c)/(d) the estimation results, with 99.9% and 95% confidence interval, for cumulative mortality rate following Model 2 are presented. Detailed estimation results can be found in Table A.10 in the Web Appendix.

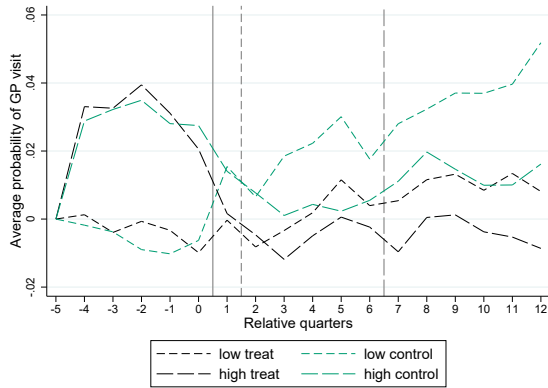
Figure 5: Health care utilization by inpatient expenditures



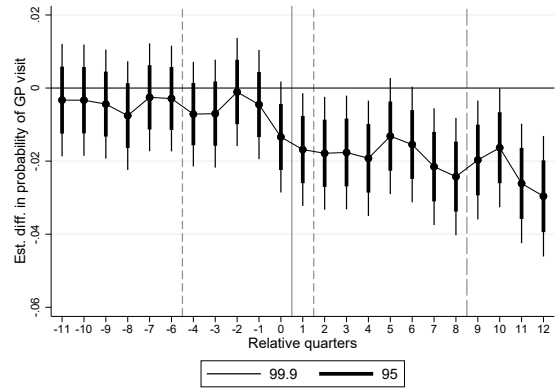
Note: In (a) quarterly average inpatient expenditures of the control and two subsamples of the treatment groups are shown. (b)-(f) show the average visits and participation rates relative to basis quarter $q = -5$ for (b) GP visits, (c) specialist visits from GP referrals, (d) specialist visits without referral, (d) receiving (outpatient) diabetes care and (f) participation in general health check up. High and average are defined by the individual inpatient spending in the respective period (notification- or post-period). High/average indicates that the patient has above average /average or below-average inpatient expenditures in the respective period in their gender-birth year-treatment quarter group. The average in each group is calculated by including all treatment and control individuals within each group.

Figure 6: Health care utilization by inpatient expenditures

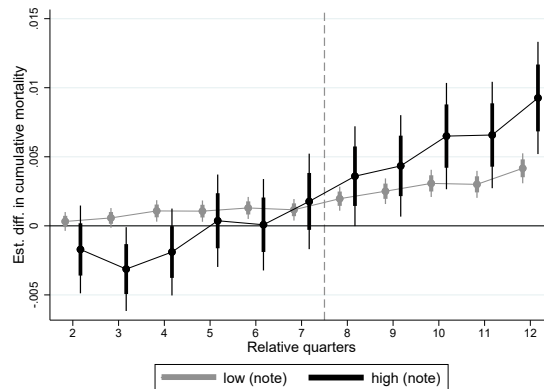
(a) Average change in probability of GP visit



(b) GP visits (high-note; treat vs. control)



(c) Cumulative mortality (high/average note; treat vs. control)



Note: In (a) quarterly average probability of GP visits relative to basis quarter $q = -5$ is shown. (b) shows the estimated GP visit probability differences between people from the treatment and control groups, who had at least in one quarter of the the notification-period higher inpatient spending then people from the corresponding gender-birth year-treatment quarter-group on average. (c) shows the estimated differences for cumulative mortality for patients with above (black) and average or below-average (gray) inpatient spending between the treatment and control groups, with reference quarter $q = 1$. Estimation results can be found in the Web Appendix in Table A.11.

Table 1: Descriptive statistics for treatment and control group

	Treat (1)	Control (2)	Differences (3)
<i>Individual characteristics</i>			
N	79,339	78,532	
N × relative quarters	1,865,879	1,884,768	
Mean age at $q = 0$	50.9	53.4	
Share females in %	51.6	52.2	
Share urban in $q = 0$ in %	24.6	27.0	
<i>Pre-period (-11 until -6) average quarterly expenditures</i>			
Total health care expenditures	471.3	470.7	0.6
Inpatient hospital expenditures	287.9	283.5	4.4
Physician fees (specialists and GPs)	100.0	103.4	-3.4
GP fees	29.6	31.0	-1.4
Expenditures for presc. drugs	83.4	83.8	-0.4
<i>Notification-period (-5 until 0) average quarterly expenditures</i>			
Total health care expenditures	548.4	521.7	26.7
Inpatient hospital expenditures	345.5	319.1	26.4
Physician fees (specialists and GPs)	108.0	111.6	-3.6
GP fees	32.3	33.7	-1.4
Expenditures for presc. drugs	94.9	91.0	3.9
<i>Post-period (1 until 6) average quarterly expenditures</i>			
Total health care expenditures	682.7	595.0	87.7
Inpatient hospital expenditures	459.4	374.1	85.3
Physician fees (specialists and GPs)	119.2	119.4	-0.2
GP fees	36.2	36.5	-0.3
Expenditures for presc. drugs	104.1	101.5	2.6
<i>Catch-up-period (7 until 12) average quarterly expenditures</i>			
Total health care expenditures	750.1	699.9	50.2
Inpatient hospital expenditures	508.5	454.8	53.7
Physician fees (specialists and GPs)	127.8	127.8	0.0
GP fees	38.4	39.8	-1.4
Expenditures for presc. drugs	113.8	117.3	-3.5

Note: Expenditures are in €.

Table 2: Estimation results

Rel. quarter	Visits (Indicator)			Fees/Expenditures			Hospital (Indicator)	
	Any GP visit (1)	Laboratory visit (2)	Radiology visit (3)	Any GP fee (4)	Laboratory fee. (5)	Radiology fee (6)	PCP referral ¹ (7)	Outpat. dept. visit (8)
<i>Notification-period</i>								
-4	0.001 (0.002)	0.000 (0.002)	0.000 (0.002)	-0.2 (0.2)	-0-0 (0.1)	0.0 (0.1)	0.002* (0.001)	0.001 (0.004)
-3	-0.000 (0.002)	-0.000 (0.002)	-0.002 (0.002)	0.0 (0.3)	0.0 (0.1)	-0.1 (0.1)	0.001 (0.001)	0.001 (0.004)
-2	0.009*** (0.002)	0.003 (0.002)	0.004* (0.002)	-0.9 (1.7)	0.1 (0.1)	0.2 (0.1)	0.002* (0.001)	0.000 (0.004)
-1	0.000 (0.002)	-0.000 (0.002)	-0.000 (0.002)	0.4 (0.3)	0.1 (0.1)	0.1 (0.1)	0.002** (0.001)	0.004 (0.004)
0	-0.006** (0.002)	0.008*** (0.002)	0.002 (0.002)	0.5 (0.3)	0.4*** (0.1)	0.2 (0.1)	0.001 (0.001)	0.004 (0.004)
<i>Post-period</i>								
1	-0.009*** (0.002)	0.012*** (0.002)	0.004* (0.002)	0.7* (0.3)	0.4*** (0.1)	0.2 (0.1)		0.008 (0.004)
2	-0.014*** (0.002)	0.020*** (0.002)	0.006*** (0.002)	0.4 (0.3)	0.6*** (0.1)	0.4** (0.1)		0.014** (0.004)
3	-0.011*** (0.002)	0.022*** (0.002)	0.010*** (0.002)	1.3*** (0.3)	0.7*** (0.1)	0.5*** (0.1)		0.008 (0.004)
4	-0.013*** (0.002)	0.025*** (0.002)	0.008*** (0.002)	1.1*** (0.3)	0.8*** (0.1)	0.5*** (0.1)		0.004 (0.004)
5	-0.007** (0.002)	0.026*** (0.002)	0.009*** (0.002)	1.5*** (0.3)	0.8*** (0.1)	0.4** (0.1)		-0.000 (0.004)
6	-0.003 (0.002)	0.029*** (0.002)	0.010*** (0.002)	1.6*** (0.3)	0.8*** (0.1)	0.6*** (0.1)		0.010* (0.005)
Mean note	0.680	0.128	0.069	33.1	2.7	4.2	0.013	0.215
Mean post	0.682	0.141	0.073	36.3	2.9	4.6	0.012	0.221

Detailed estimation results are presented in Tables A.3, A.4 and A.6 in the Web Appendix. Estimation output for (1)/(4) general physician visits and fees, (2)/(5) laboratory visits and fees, (3)/(6) radiology visits and fees, (7) treatment in a hospital due to the PCP referral and (8) outpatient department visits are shown. The indicator variables equal one if a visit was observed and zero otherwise. The mean of the dependent variable in the notification- and the post-period is presented. Coefficients on sex-birth year-exit quarter and region dummies are not shown. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$. ¹ In (7) the new PCP might not be correctly assigned to the patient in the beginning of the post-period (after the exit of the former PCP) due to the used patient-PCP assigning procedures, especially if the treated person refuses to see any GP after the exit of the old PCP (see Chapter 3.1). Therefore, only the notification-period results are shown. The results for the all periods can be found in the Web Appendix.

Table 3: Excerpt of the estimation results by risk type

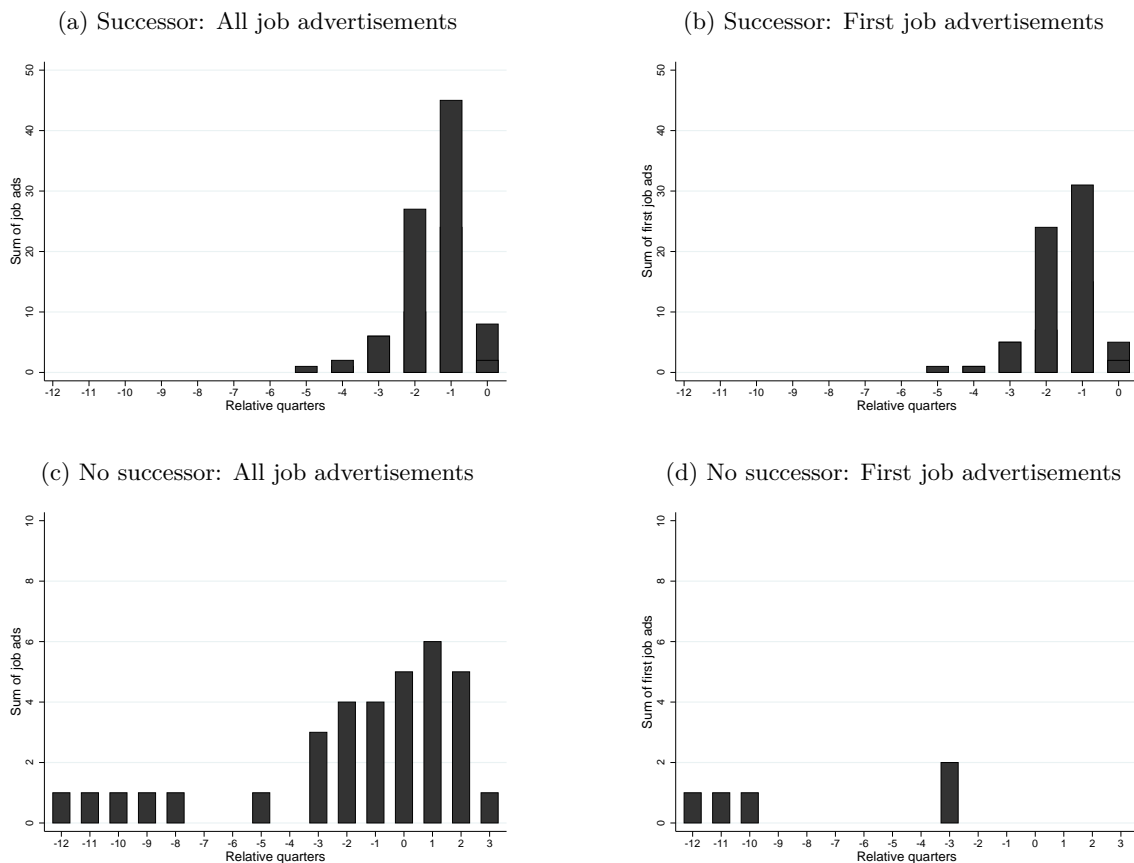
Rel. quarter	Inpatient exp. (1)	Outpat dept. visit (2)	GP hosp. referral (3)	PCP hosp. referral ¹ (4)	GP spec. referral (5)	Spec. w/o referral ² (6)	Any GP visit (7)
Individuals without pre-existing diseases							
<i>Notification-period</i>							
-4	31.7** (10.6)	-0.001 (0.005)	0.001 (0.001)	0.001 (0.001)	-0.002 (0.003)	-0.008* (0.003)	0.001 (0.003)
-3	31.0** (11.1)	-0.001 (0.005)	0.000 (0.001)	0.001 (0.001)	0.001 (0.003)	-0.006 (0.003)	0.002 (0.003)
-2	33.7** (12.3)	0.004 (0.005)	0.000 (0.001)	0.000 (0.001)	0.001 (0.003)	-0.002 (0.003)	0.010*** (0.003)
-1	16.8 (12.3)	0.003 (0.005)	0.000 (0.001)	0.000 (0.001)	-0.001 (0.003)	-0.006 (0.003)	0.002 (0.003)
0	44.0*** (12.3)	0.003 (0.005)	-0.000 (0.001)	-0.000 (0.001)	0.003 (0.003)	-0.007 (0.003)	-0.005 (0.003)
<i>Post-period</i>							
1	46.2*** (13.8)	0.008 (0.005)	-0.000 (0.001)		0.001 (0.003)	-0.002 (0.004)	-0.007* (0.003)
2	65.6*** (13.5)	0.013** (0.005)	-0.000 (0.001)		0.006* (0.003)	0.008* (0.004)	-0.013*** (0.003)
3	56.5*** (14.2)	0.012* (0.005)	-0.002* (0.001)		0.012*** (0.003)	0.007* (0.004)	-0.012*** (0.003)
4	62.1*** (14.7)	0.007 (0.005)	-0.001 (0.001)		0.013*** (0.003)	-0.000 (0.004)	-0.012*** (0.003)
5	56.6*** (15.8)	0.001 (0.005)	-0.001 (0.001)		0.017*** (0.003)	-0.001 (0.004)	-0.006* (0.003)
6	84.2*** (15.5)	0.011* (0.005)	0.001 (0.001)		0.023*** (0.003)	0.005 (0.004)	-0.002 (0.003)
Mean note.	213.0	0.174	0.010	0.008	0.146	0.426	0.626
Mean post	297.4	0.187	0.011		0.160	0.437	0.632
Individuals with pre-existing diseases							
<i>Notification-period</i>							
-4	104.1** (35.8)	0.007 (0.010)	0.006* (0.002)	0.005* (0.002)	0.004 (0.005)	0.009 (0.006)	0.003 (0.004)
-3	55.6 (38.9)	0.006 (0.010)	0.004 (0.002)	0.004 (0.002)	-0.000 (0.005)	0.013* (0.006)	-0.007 (0.004)
-2	103.1* (40.2)	-0.010 (0.010)	0.006* (0.002)	0.005* (0.002)	0.008 (0.005)	0.016** (0.006)	0.005 (0.004)
-1	146.1*** (40.6)	0.007 (0.010)	0.008*** (0.002)	0.007** (0.002)	0.005 (0.005)	0.013* (0.006)	-0.005 (0.004)
0	154.3*** (39.7)	0.006 (0.010)	0.006* (0.003)	0.006** (0.002)	0.011* (0.005)	0.014* (0.006)	-0.010** (0.004)
<i>Post-period</i>							
1	215.0*** (42.8)	0.010 (0.010)	0.001 (0.003)		0.013* (0.005)	0.010 (0.006)	-0.017*** (0.004)
2	256.7*** (42.9)	0.018 (0.010)	0.004 (0.002)		0.017** (0.005)	0.026*** (0.006)	-0.017*** (0.004)
3	216.5*** (44.5)	-0.003 (0.010)	0.002 (0.003)		0.028*** (0.005)	0.025*** (0.006)	-0.008* (0.004)
4	202.2*** (41.3)	-0.002 (0.010)	0.003 (0.003)		0.033*** (0.005)	0.026*** (0.006)	-0.014*** (0.004)
5	217.0*** (43.4)	-0.003 (0.010)	0.006* (0.003)		0.043*** (0.005)	0.013* (0.006)	-0.009* (0.004)
6	229.5*** (46.3)	0.006 (0.010)	0.003 (0.003)		0.039*** (0.006)	0.024*** (0.006)	-0.007 (0.004)
Mean note.	685.9	0.342	0.034	0.027	0.235	0.529	0.836
Mean post	770.5	0.328	0.033		0.249	0.523	0.832

Excerpt of Tables A.7, A.8 and A.9 in the Web Appendix. Estimation output for (1) inpatient hospital expenditures, (2) outpatient department visits and (3) inpatient treatment due to GP referral, (4) inpatient treatment due to PCP referral, (5) specialist visit from GP referral, (6) specialist visit from PCP referral and (7) GP visits are shown. The referral and visit variables are indicators. The mean of the depended variable in the notification- and post-period is shown. Coefficients on sex-birth year-exit quarter and region dummies are not shown. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$. ¹ The PCP is probably not correctly assigned to the treated patient in the beginning of the post-period (after the exit of the former PCP) due to the used patient-PCP assigning procedures, especially if the treated person refuses to see any GP after the exit of the old PCP (see Chapter 3.1). Therefore, the results for the post-period are only presented in the Web Appendix. ² In the high risk sample the common trend assumption in the pre-period regarding specialist visits without referral is violated.

A Web Appendix

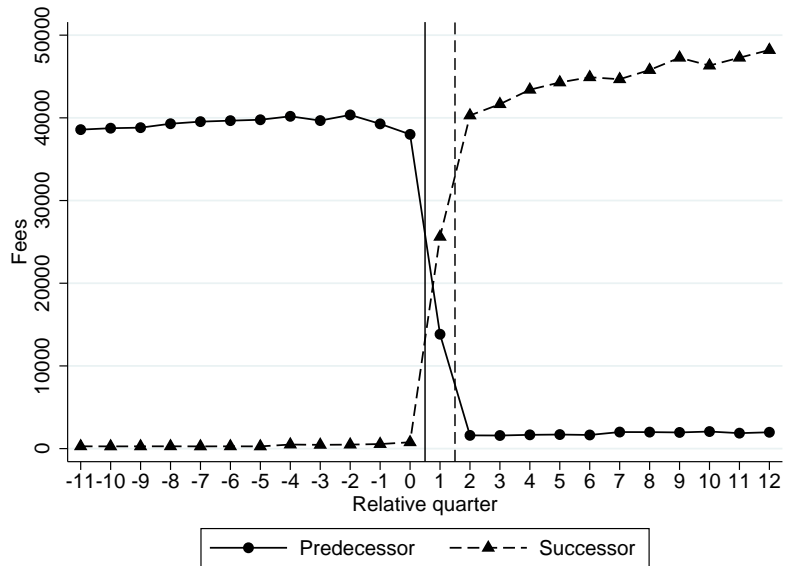
A.1 Detailed estimation output, additional figures, and descriptive statistics

Figure A.1: UA job advertisement data for insurance-contracted positions



Note: On the left (right) hand side the number of all (first) job vacancies of the treatment groups GPs by quarters relative to the actual exit are presented. The sample is additionally split into positions, which found and which did not find a successor. 79% (88%) of vacancies, where a successor was found, got refilled with the first (or second) job advertisement. The number of positions which could (not) be refilled is $N_{GP}^T = 98$ ($N_{GP}^T = 5$). There was no vacancy information available for 4 successfully refilled contracted positions.

Figure A.2: Average fees of leaving PCP and successors



Note: The triangles (circles) corresponds to the average charged fees of the successor (predecessor). Quarters are relative to the exit quarter of the treatment group PCPs. In relative quarter one, the successor and predecessor work together in case of a soft transition. Therefore the income for the predecessor is still increased and the fees for the successor are yet relative small in comparison to the following quarters.

Table A.1: Descriptive statistics over PCPs

	Treat (1)	Control (2)
Number of GPs	106	137
Share in % of female GPs	7.1	4.8
Average age at $q = 0$	62.0	60.1
<i>PCS's reason to leave in %</i>		
Relocation in UA	3.8	4.4
Retirement	85.8	80.3
Other reasons ¹	10.4	15.3
<i>Type of transition in %</i>		
Hard transition	32.1	35.0
Soft transition ²	63.2	60.6
No transition	4.7	4.4
<i>Successor and practice characteristics</i>		
Practice is in urban area in % ³	35.0	37.0
Practice with own pharmacy in % ⁴	21.4	27.8
Female successors in % ⁴	36.7	44.4
Average number of job ads ⁴	1.6	1.8
Successor's average experience (scores) ⁴	37.2	38.4

Note: ¹ Other reasons include e.g. starting working in a hospital or different state or leaving the profession (no physician died). ² In the treatment group individuals are excluded with a longer transition time than 1 quarter. In the control group, those individuals are kept (10 physicians in the control group, chose a longer transition period than one quarter). ³ For 3 positions of the treatment group and for 10 positions of the control group and ⁴ for 3 positions of the treatment group and for 5 positions of the control group and all positions without a successor there was no information available.

In Table A.1 the PCPs of the treatment and the control group are compared. The exiting PCPs are on average 60 to 62 years old and most of them leave the local health care system due to their retirement. Regarding the successor and transition characteristics it can be seen from the Table that the positions must be advertised 1.6/1.8 times before they can be refilled with a successor and the observed PCPs choose a soft transition more often than a hard transition. The successful applicants achieve an average (experience) score of 37.2/38.4, with a minimum of 7.25 and a maximum of 54.8.

Table A.2: Estimated differences between treatment and control group (Figure 2)

Rel. quarter	Total expend. (1)	Inpatient hosp. expend. (2)	Physician fees (3)	Exp. pres. drugs (4)	PCP fees ¹ (5)
<i>Pre-period</i>					
-11	22.5 (12.6)	24.1* (12.3)	0.4 (1.2)	-2.0 (1.7)	0.4 (0.2)
-10	22.0 (12.3)	22.2 (12.0)	1.9 (1.1)	-2.1 (1.9)	0.3 (0.2)
-9	23.3 (12.6)	22.6 (12.3)	2.5* (1.1)	-1.7 (1.9)	0.1 (0.2)
-8	25.5* (12.3)	26.3* (12.1)	-0.1 (1.2)	-0.7 (1.4)	0.0 (0.2)
-7	20.6 (12.4)	21.3 (12.2)	0.1 (1.2)	-0.8 (1.6)	0.0 (0.2)
-6	13.6 (11.7)	10.9 (11.5)	2.1 (1.1)	0.6 (1.5)	0.2 (0.2)
<i>Notification-period</i>					
-4	51.2*** (12.2)	50.0*** (12.0)	-1.0 (1.1)	2.2 (1.4)	0.2 (0.2)
-3	41.4** (13.1)	37.2** (12.9)	1.4 (1.2)	2.8 (1.8)	-0.0 (0.2)
-2	56.5*** (14.1)	51.2*** (13.7)	1.6 (2.1)	3.7* (1.9)	0.7*** (0.2)
-1	56.0*** (14.1)	49.5*** (13.8)	1.9 (1.2)	4.7* (2.2)	-0.1 (0.2)
0	78.9*** (14.1)	71.8*** (13.6)	1.6 (1.2)	5.4 (3.0)	-0.8*** (0.2)
<i>Post-period</i>					
1	88.6*** (16.1)	88.8*** (15.0)	3.3** (1.2)	-3.5 (5.5)	-24.5*** (0.2)
2	119.5*** (16.0)	113.3*** (14.8)	3.9** (1.2)	2.3 (5.6)	-9.0*** (0.3)
3	102.4*** (16.7)	96.2*** (15.5)	4.0*** (1.2)	2.1 (5.6)	0.0 (0.2)
4	104.3*** (16.7)	96.5*** (15.2)	3.1* (1.2)	4.6 (6.4)	0.8** (0.2)
5	101.9*** (17.4)	95.8*** (16.1)	3.9** (1.3)	2.3 (5.9)	0.8** (0.3)
6	126.7*** (17.9)	119.2*** (16.5)	5.9*** (1.3)	1.6 (6.3)	1.0*** (0.3)
<i>Catch-up-period</i>					
7	107.4*** (18.3)	103.0*** (16.8)	6.5*** (1.4)	-2.1 (6.5)	0.2 (0.3)
8	81.3*** (19.0)	75.6*** (17.6)	5.1*** (1.3)	0.6 (6.6)	0.5 (0.3)
9	89.3*** (18.8)	88.3*** (17.1)	4.5*** (1.3)	-3.5 (7.2)	0.4 (0.3)
10	91.1*** (19.2)	89.6*** (17.8)	5.8*** (1.3)	-4.3 (6.5)	-0.1 (0.3)
11	46.7* (19.3)	47.7** (17.7)	3.1* (1.3)	-4.0 (6.9)	-0.2 (0.3)
12	34.1 (19.1)	42.5* (17.5)	2.1 (1.3)	-10.5 (6.8)	0.5* (0.3)
Obs.	3,750,647	3,750,647	3,750,647	3,750,647	3,750,647
Mean dept. var.	591.2	378.0	114.6	98.6	31.0

Note: This table shows the estimation results of Equation 1, comparing total health care expenditures (column 1), inpatient hospital expenditures (2), physician fees (3), expenditures for prescribed drugs (4) and PCP fees (5) of treatment and control individuals. Total health care expenditures is the sum of inpatient hospital expenditures, physician fees and expenditures for prescribed drugs. Coefficients on sex-birth year-exit quarter and region dummies are not shown. The mean of the dependent variable is displayed at the bottom of the Table. Clustered standard errors in parentheses. * p < 0.05, ** p < 0.01, and *** p < 0.001. ¹ The new PCP might not be correctly assigned to the patient in the beginning of the post-period (after the exit of the former PCP) due to the used patient-PCP assigning procedures, especially if the treated person refuses to see any GP after the exit of the old PCP (see Chapter 3.1). Therefore, the drop, beginning in q = 1, might only be technically and not causally related to the PCPs' exit.

Table A.3: Estimated expenditure differences between treatment and control group for selected physician fees

GP and specialist expenditures																	
	GP	Anesthes.	Ophtal.	Surgery	Skin & Venereal	Gyn. and obstetrics	Internal med.	Pediat.	ENT	Pulm	Neuro. & Pschiatry	Orthop.	Radio.	Trauma surg.	Urology	Dentist	Laboratory
-11	0.1 (0.3)	-0.0 (0.0)	-0.1 (0.1)	-0.0 (0.1)	0.0 (0.1)	-0.0 (0.1)	0.1 (0.2)	0.1*** (0.0)	-0.1 (0.1)	-0.1 (0.1)	-0.0 (0.1)	0.1 (0.1)	0.1 (0.1)	-0.0 (0.0)	0.0 (0.1)	-0.6 (1.0)	0.1 (0.1)
-10	-0.1 (0.3)	-0.0 (0.0)	-0.1 (0.1)	-0.1 (0.1)	-0.0 (0.1)	0.2 (0.1)	0.1 (0.2)	0.1*** (0.0)	-0.1 (0.1)	-0.1 (0.1)	-0.1 (0.1)	0.2 (0.1)	0.1 (0.1)	0.0 (0.0)	0.1 (0.0)	1.3 (0.9)	0.1 (0.1)
-9	-0.1 (0.3)	-0.0 (0.0)	-0.0 (0.1)	-0.2* (0.1)	-0.1 (0.1)	-0.2 (0.1)	0.0 (0.2)	0.1* (0.0)	-0.1 (0.1)	-0.1 (0.1)	-0.0 (0.1)	0.1 (0.1)	-0.0 (0.1)	0.0 (0.0)	0.0 (0.0)	2.1* (0.9)	0.0 (0.1)
-8	-0.2 (0.3)	-0.0 (0.0)	-0.1 (0.1)	-0.1 (0.1)	-0.1 (0.1)	0.1 (0.1)	-0.0 (0.2)	0.0 (0.0)	-0.2** (0.1)	-0.1* (0.1)	-0.1 (0.1)	0.1 (0.1)	-0.0 (0.1)	-0.0 (0.0)	0.0 (0.1)	0.6 (0.9)	0.0 (0.1)
-7	-0.1 (0.3)	0.0 (0.0)	-0.1 (0.1)	-0.2* (0.1)	-0.1 (0.1)	-0.1 (0.1)	-0.2 (0.2)	0.0 (0.0)	-0.2* (0.1)	-0.2* (0.1)	-0.0 (0.1)	0.0 (0.1)	-0.0 (0.1)	0.0 (0.0)	0.1 (0.1)	-0.0 (1.0)	0.1 (0.1)
-6	0.0 (0.2)	-0.0 (0.0)	0.0 (0.1)	0.0 (0.1)	-0.1 (0.1)	0.0 (0.1)	-0.2 (0.2)	0.0 (0.0)	-0.1 (0.1)	-0.1 (0.1)	0.0 (0.1)	0.0 (0.1)	0.1 (0.1)	0.1* (0.0)	0.1* (0.1)	1.4 (0.9)	0.0 (0.1)
-4	-0.2 (0.2)	-0.0 (0.0)	-0.2* (0.1)	-0.1 (0.1)	-0.0 (0.1)	-0.0 (0.1)	-0.3 (0.2)	0.0 (0.0)	-0.1 (0.1)	-0.1 (0.1)	-0.0 (0.1)	0.1 (0.1)	0.0 (0.1)	0.1 (0.0)	0.0 (0.1)	-0.0 (0.9)	-0.0 (0.1)
-3	0.0 (0.3)	-0.0 (0.0)	-0.1 (0.1)	-0.0 (0.1)	0.0 (0.1)	-0.2 (0.1)	-0.0 (0.2)	-0.0 (0.0)	-0.0 (0.1)	0.0 (0.1)	-0.1 (0.1)	0.1 (0.1)	-0.1 (0.1)	0.0 (0.0)	0.0 (0.1)	0.4 (1.0)	0.0 (0.1)
-2	-0.9 (1.7)	0.0 (0.0)	-0.1 (0.1)	-0.1 (0.1)	0.0 (0.1)	0.3 (0.2)	-0.3 (0.2)	-0.0 (0.0)	0.0 (0.1)	0.1 (0.1)	-0.0 (0.1)	0.4*** (0.1)	0.2 (0.1)	0.0 (0.0)	0.1 (0.1)	0.8 (0.9)	0.1 (0.1)
-1	0.4 (0.3)	0.0 (0.0)	-0.0 (0.1)	-0.1 (0.1)	0.1 (0.1)	0.2 (0.1)	0.1 (0.2)	-0.0 (0.0)	-0.0 (0.1)	-0.0 (0.1)	-0.1 (0.1)	0.1 (0.1)	0.1 (0.1)	0.0 (0.0)	0.1 (0.1)	0.0 (1.0)	0.1 (0.1)
0	0.5 (0.3)	-0.0 (0.0)	-0.1 (0.1)	-0.0 (0.1)	0.1 (0.1)	0.2 (0.1)	0.1 (0.2)	-0.0 (0.0)	-0.2 (0.1)	-0.0 (0.1)	-0.0 (0.1)	0.2 (0.1)	0.2 (0.1)	0.1 (0.0)	0.1 (0.1)	-1.4 (1.0)	0.4*** (0.1)
1	0.7* (0.3)	0.0 (0.0)	-0.2 (0.1)	-0.0 (0.1)	0.1 (0.1)	-0.1 (0.1)	0.3 (0.2)	-0.0 (0.0)	0.1 (0.1)	-0.1 (0.1)	-0.0 (0.1)	0.1 (0.1)	0.2 (0.1)	0.0 (0.0)	0.1 (0.1)	-0.5 (1.0)	0.4*** (0.1)
2	0.4 (0.3)	0.0 (0.0)	-0.0 (0.1)	-0.1 (0.1)	0.1 (0.1)	0.3 (0.2)	0.1 (0.2)	0.0 (0.0)	0.1 (0.1)	-0.1 (0.1)	-0.0 (0.1)	0.1 (0.1)	0.4** (0.1)	0.0 (0.0)	0.1 (0.1)	-0.2 (0.9)	0.6*** (0.1)
3	1.3*** (0.3)	-0.0 (0.0)	-0.1 (0.1)	0.0 (0.1)	0.0 (0.1)	0.4** (0.1)	0.2 (0.2)	-0.0 (0.0)	0.0 (0.1)	-0.1 (0.1)	0.0 (0.1)	0.0 (0.1)	0.5*** (0.1)	0.0 (0.0)	0.1* (0.1)	-1.4 (0.9)	0.7*** (0.1)
4	1.1*** (0.3)	0.0 (0.0)	-0.1 (0.1)	-0.0 (0.1)	0.1 (0.1)	0.2 (0.2)	0.1 (0.2)	-0.0 (0.0)	-0.1 (0.1)	-0.1 (0.1)	0.1 (0.1)	0.0 (0.1)	0.5*** (0.1)	-0.0 (0.0)	0.0 (0.1)	-1.1 (1.0)	0.8*** (0.1)
5	1.5*** (0.3)	-0.0 (0.0)	-0.2 (0.1)	0.0 (0.1)	0.2* (0.1)	0.2 (0.2)	0.1 (0.2)	-0.0 (0.0)	0.1 (0.1)	-0.1 (0.1)	0.1 (0.1)	-0.1 (0.1)	0.4** (0.1)	0.0 (0.0)	0.1 (0.1)	-1.0 (1.0)	0.8*** (0.1)
6	1.6*** (0.3)	0.0 (0.0)	-0.1 (0.1)	0.1 (0.1)	0.2** (0.1)	0.5** (0.2)	0.2 (0.2)	-0.0 (0.0)	0.1 (0.1)	-0.1 (0.1)	0.1 (0.1)	0.0 (0.1)	0.6*** (0.1)	-0.0 (0.0)	0.2** (0.1)	-0.4 (1.0)	0.8*** (0.1)
7	1.0** (0.4)	0.0 (0.0)	-0.2 (0.1)	-0.0 (0.1)	0.2* (0.1)	0.4* (0.2)	-0.0 (0.2)	-0.1* (0.0)	-0.0 (0.1)	-0.2* (0.1)	0.0 (0.1)	0.1 (0.2)	0.5*** (0.1)	0.0 (0.0)	0.2** (0.1)	0.9 (1.1)	0.8*** (0.1)
8	1.0** (0.3)	0.0 (0.0)	-0.1 (0.1)	-0.1 (0.1)	0.3** (0.1)	0.3 (0.2)	0.2 (0.2)	-0.1* (0.0)	-0.0 (0.1)	-0.0 (0.1)	0.0 (0.1)	-0.1 (0.1)	0.5*** (0.1)	-0.0 (0.0)	0.1 (0.1)	-0.6 (1.0)	0.9*** (0.1)
9	1.2*** (0.3)	0.0 (0.0)	-0.1 (0.1)	-0.1 (0.1)	0.1 (0.1)	0.4** (0.2)	0.0 (0.2)	-0.1* (0.0)	-0.1 (0.1)	0.0 (0.1)	0.1 (0.1)	0.1 (0.1)	0.3 (0.1)	0.0 (0.0)	0.1 (0.1)	-1.2 (1.0)	0.9*** (0.1)
10	-0.2 (0.3)	0.0 (0.0)	-0.1 (0.1)	-0.0 (0.1)	0.2 (0.1)	0.3 (0.2)	0.1 (0.2)	-0.1* (0.0)	0.0 (0.1)	-0.1 (0.1)	-0.0 (0.1)	0.1 (0.1)	0.3* (0.1)	0.0 (0.0)	0.1 (0.1)	0.3 (1.0)	1.0*** (0.1)
11	-0.3 (0.3)	0.0 (0.0)	-0.3** (0.1)	-0.1 (0.1)	0.0 (0.1)	0.5** (0.2)	-0.3 (0.2)	-0.1* (0.0)	-0.0 (0.1)	-0.2 (0.1)	0.1 (0.1)	-0.2 (0.1)	0.3* (0.1)	0.1 (0.0)	0.2** (0.1)	0.0 (1.0)	0.8*** (0.1)
12	-0.8* (0.3)	0.0 (0.0)	-0.2 (0.1)	-0.4** (0.1)	0.1 (0.1)	0.3 (0.2)	-0.3 (0.2)	-0.1*** (0.0)	-0.0 (0.1)	-0.1 (0.1)	0.1 (0.1)	-0.1 (0.1)	0.2 (0.1)	0.1 (0.0)	0.1 (0.1)	0.2 (1.0)	0.7*** (0.1)
Mean	34.7	0.0	4.7	0.9	2.3	6.0	5.0	0.4	2.2	1.9	2.0	2.5	4.4	0.3	1.7	28.6	2.8

Note: Number of observations in all estimations is $N = 3,750,647$ except for gynecology and obstetrics ($N = 1,946,120$). Results only for the main outpatient physician fee components are shown. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

Table A.4: Estimated expenditure differences between treatment and control group for selected physician visits

		GP and specialist visit (probability)															
	GP	Anesthes.	Ophtal.	Surgery	Skin & Venereal	Gyn. and obstetrics	Internal med.	Pediat.	ENT	Pulm	Neuro. & Pschiatry	Orthop.	Radio.	Trauma surg.	Urology	Dentist	Laboratory
-11	0.010*** (0.002)	-0.000 (0.000)	-0.000 (0.002)	0.000 (0.001)	-0.000 (0.001)	-0.003 (0.003)	0.000 (0.001)	0.002*** (0.001)	-0.001 (0.001)	-0.002 (0.001)	-0.001 (0.001)	0.000 (0.001)	-0.000 (0.002)	-0.000 (0.000)	0.001 (0.001)	0.006* (0.003)	0.001 (0.002)
-10	0.005* (0.002)	0.000 (0.000)	-0.000 (0.002)	-0.000 (0.001)	-0.001 (0.001)	0.003 (0.003)	0.001 (0.001)	0.002*** (0.001)	-0.003* (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.000 (0.001)	0.002 (0.002)	0.000 (0.000)	0.002 (0.001)	0.008** (0.003)	0.003 (0.002)
-9	0.004 (0.002)	-0.000 (0.000)	-0.001 (0.002)	-0.001 (0.001)	-0.002 (0.001)	-0.002 (0.003)	0.001 (0.001)	0.001 (0.001)	-0.002 (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.000 (0.001)	0.000 (0.002)	-0.000 (0.000)	0.000 (0.001)	0.008** (0.003)	0.000 (0.002)
-8	0.001 (0.002)	0.000 (0.000)	-0.001 (0.002)	0.000 (0.001)	-0.001 (0.001)	0.003 (0.003)	0.000 (0.001)	0.000 (0.001)	-0.003** (0.001)	-0.002 (0.001)	-0.002 (0.001)	-0.000 (0.001)	-0.001 (0.002)	-0.000 (0.000)	0.000 (0.001)	0.006* (0.003)	0.002 (0.002)
-7	0.004 (0.002)	0.000 (0.000)	-0.001 (0.002)	-0.000 (0.001)	-0.000 (0.001)	-0.002 (0.003)	-0.002 (0.001)	0.001 (0.001)	-0.003* (0.001)	-0.002 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.002 (0.002)	-0.000 (0.000)	0.003* (0.001)	0.003 (0.003)	0.000 (0.002)
-6	0.004 (0.002)	-0.000 (0.000)	0.002 (0.002)	-0.000 (0.001)	0.000 (0.001)	0.001 (0.003)	-0.000 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.000 (0.001)	0.001 (0.001)	0.002 (0.002)	0.001 (0.000)	0.003** (0.001)	0.006* (0.003)	0.002 (0.002)
-4	0.001 (0.002)	0.000 (0.000)	-0.005** (0.002)	0.000 (0.001)	-0.001 (0.001)	-0.000 (0.003)	-0.002 (0.001)	-0.000 (0.001)	-0.003** (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	0.000 (0.002)	0.000 (0.000)	-0.000 (0.001)	0.005* (0.003)	0.000 (0.002)
-3	-0.000 (0.002)	0.000 (0.000)	-0.001 (0.002)	-0.000 (0.001)	0.000 (0.001)	-0.003 (0.003)	-0.000 (0.001)	-0.000 (0.001)	-0.002 (0.001)	-0.000 (0.001)	-0.001 (0.001)	0.001 (0.001)	-0.002 (0.002)	0.000 (0.000)	-0.000 (0.001)	0.004 (0.003)	-0.000 (0.002)
-2	0.009*** (0.002)	0.000* (0.000)	-0.001 (0.002)	-0.000 (0.001)	-0.000 (0.001)	0.004 (0.003)	-0.001 (0.001)	-0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	-0.000 (0.001)	0.003** (0.001)	0.004* (0.002)	0.000 (0.000)	0.001 (0.001)	0.004 (0.003)	0.003 (0.002)
-1	0.000 (0.002)	0.000 (0.000)	-0.001 (0.002)	-0.000 (0.001)	0.002 (0.001)	0.003 (0.003)	0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.001 (0.001)	0.001 (0.001)	-0.000 (0.002)	0.000 (0.000)	0.001 (0.001)	-0.002 (0.003)	-0.000 (0.002)
0	-0.006** (0.002)	0.000 (0.000)	-0.001 (0.002)	-0.000 (0.001)	0.001 (0.001)	0.000 (0.003)	0.002 (0.001)	-0.001 (0.001)	-0.003* (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.002* (0.001)	0.002 (0.002)	0.000 (0.000)	0.001 (0.001)	-0.000 (0.003)	0.008*** (0.002)
1	-0.009*** (0.002)	0.000 (0.000)	-0.003 (0.002)	0.001 (0.001)	0.001 (0.001)	-0.000 (0.003)	0.003* (0.001)	-0.000 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.002 (0.001)	0.004* (0.002)	-0.000 (0.000)	0.001 (0.001)	-0.003 (0.003)	0.012*** (0.002)
2	-0.014*** (0.002)	0.000 (0.000)	0.001 (0.002)	-0.000 (0.001)	0.003* (0.001)	0.004 (0.003)	0.002 (0.001)	-0.000 (0.001)	0.002 (0.001)	-0.002 (0.001)	-0.000 (0.001)	0.001 (0.001)	0.006*** (0.002)	-0.000 (0.000)	0.002 (0.001)	0.002 (0.003)	0.020*** (0.002)
3	-0.011*** (0.002)	-0.000 (0.000)	-0.000 (0.002)	0.000 (0.001)	0.002 (0.002)	0.009** (0.003)	0.003* (0.001)	-0.000 (0.001)	0.001 (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.001 (0.001)	0.010*** (0.002)	0.000 (0.000)	0.002* (0.001)	-0.002 (0.003)	0.022*** (0.002)
4	-0.013*** (0.002)	0.000 (0.000)	-0.002 (0.002)	-0.000 (0.001)	0.001 (0.002)	0.005 (0.003)	0.003* (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.002* (0.001)	-0.000 (0.001)	0.001 (0.001)	0.008*** (0.002)	-0.001 (0.000)	0.001 (0.001)	-0.002 (0.003)	0.025*** (0.002)
5	-0.007** (0.002)	0.000 (0.000)	-0.002 (0.002)	0.001 (0.001)	0.002 (0.002)	0.003 (0.003)	0.002 (0.001)	-0.001** (0.001)	0.000 (0.001)	-0.002* (0.001)	0.001 (0.001)	-0.000 (0.001)	0.009*** (0.002)	-0.000 (0.000)	0.001 (0.001)	-0.003 (0.003)	0.026*** (0.002)
6	-0.003 (0.002)	-0.000 (0.000)	0.000 (0.002)	0.001 (0.001)	0.002 (0.002)	0.011*** (0.003)	0.004** (0.001)	-0.001 (0.001)	0.001 (0.001)	-0.002 (0.001)	0.001 (0.001)	0.001 (0.001)	0.010*** (0.002)	-0.001 (0.000)	0.003** (0.001)	0.002 (0.003)	0.029*** (0.002)
7	-0.006* (0.003)	0.000 (0.000)	-0.002 (0.002)	0.000 (0.001)	0.001 (0.002)	0.007* (0.003)	0.002 (0.001)	-0.001* (0.001)	-0.001 (0.001)	-0.003* (0.001)	0.001 (0.001)	0.000 (0.001)	0.008*** (0.002)	-0.000 (0.001)	0.004** (0.001)	0.000 (0.003)	0.025*** (0.002)
8	-0.005* (0.002)	0.000 (0.000)	-0.001 (0.002)	-0.000 (0.001)	0.004** (0.002)	0.007* (0.003)	0.002 (0.001)	-0.001* (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	0.008*** (0.002)	-0.000 (0.000)	0.002* (0.001)	0.003 (0.003)	0.029*** (0.002)
9	-0.000 (0.003)	0.000 (0.000)	0.000 (0.002)	-0.001 (0.001)	0.001 (0.002)	0.010** (0.003)	0.001 (0.001)	-0.001* (0.001)	-0.001 (0.001)	-0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	0.007*** (0.002)	-0.000 (0.000)	0.002 (0.001)	-0.004 (0.003)	0.028*** (0.002)
10	-0.004 (0.003)	-0.000 (0.000)	0.001 (0.002)	-0.000 (0.001)	0.003 (0.002)	0.005 (0.003)	0.002 (0.001)	-0.001** (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	0.000 (0.001)	0.006*** (0.002)	-0.000 (0.000)	0.002 (0.001)	0.002 (0.003)	0.031*** (0.002)
11	-0.004 (0.003)	0.000 (0.000)	-0.002 (0.002)	-0.002* (0.001)	0.000 (0.002)	0.010*** (0.003)	-0.001 (0.001)	-0.002*** (0.001)	-0.000 (0.001)	-0.002* (0.001)	0.001 (0.001)	-0.002 (0.001)	0.006*** (0.002)	-0.000 (0.000)	0.004*** (0.001)	0.002 (0.003)	0.026*** (0.002)
12	-0.006* (0.003)	-0.000 (0.000)	-0.002 (0.002)	-0.001 (0.001)	0.000 (0.002)	0.006* (0.003)	-0.002 (0.001)	-0.002*** (0.001)	-0.000 (0.001)	-0.002 (0.001)	0.001 (0.001)	-0.001 (0.001)	0.004* (0.002)	-0.000 (0.000)	0.002* (0.001)	0.001 (0.003)	0.023*** (0.002)
Mean	0.681	0.000	0.099	0.010	0.058	0.048	0.010	0.040	0.025	0.027	0.033	0.071	0.005	0.033	0.205	0.135	0.070

Note: Number of observations in all estimations is $N = 3,750,647$ except for gynecology and obstetrics ($N = 1,946,120$). Results only for the main specialty fields are shown. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

Table A.5: Estimated differences between treatment and control group for inpatient hospital expenditures

Relative quarter	ICD-10 Chapter																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
-11	1.8 (1.8)	-4.3 (4.7)	1.5 (1.3)	-0.0 (1.2)	2.5 (2.1)	0.4 (1.6)	1.2 (1.3)	-0.9 (0.8)	9.7 (5.7)	3.9 (2.3)	2.7 (2.7)	-1.4 (0.7)	3.1 (3.7)	-4.2 (2.2)	-1.5 (0.8)	0.3 (0.4)	1.2 (1.3)	1.0 (1.1)	0.8 (3.4)
-10	1.1 (1.9)	3.1 (4.4)	0.4 (0.5)	0.5 (1.2)	0.2 (2.2)	0.0 (1.5)	1.2 (1.3)	-0.2 (0.9)	11.0 (5.6)	2.3 (2.2)	0.9 (2.8)	-1.3 (0.8)	7.0 (3.7)	-2.4 (2.1)	-0.1 (0.8)	-0.1 (0.1)	2.0 (1.1)	0.2 (1.3)	-3.2 (3.3)
-9	1.1 (2.2)	-0.5 (4.6)	0.4 (0.5)	0.1 (1.2)	0.8 (2.3)	0.2 (1.6)	1.8 (1.2)	-0.8 (0.9)	9.2 (5.9)	0.8 (1.8)	3.6 (2.7)	-1.5* (0.7)	1.3 (3.8)	-3.5 (2.2)	0.3 (0.8)	-0.0 (0.0)	0.6 (0.7)	-0.8 (1.0)	1.2 (3.9)
-8	1.6 (1.9)	-1.9 (4.6)	0.9 (0.5)	0.6 (1.3)	0.2 (2.2)	-0.9 (1.6)	1.0 (1.2)	-0.9 (0.7)	7.5 (5.8)	2.1 (1.9)	5.5 (2.9)	-0.6 (0.7)	1.2 (3.7)	-2.2 (2.3)	-0.7 (0.9)	-0.0 (0.0)	0.3 (0.8)	1.8 (1.1)	-1.2 (3.5)
-7	1.7 (1.8)	-6.0 (4.4)	1.2 (0.7)	0.2 (1.1)	-0.4 (2.2)	-0.1 (1.6)	0.1 (1.2)	-1.2 (0.7)	15.4* (6.2)	1.0 (1.9)	0.1 (3.2)	-1.2 (0.8)	1.1 (3.7)	-3.8 (2.3)	-0.0 (0.9)	-0.0 (0.0)	1.0 (0.7)	0.4 (1.2)	1.4 (3.2)
-6	1.1 (1.8)	-5.8 (3.8)	1.0 (0.5)	0.1 (1.2)	2.5 (2.1)	-0.6 (1.5)	2.9* (1.2)	-0.0 (0.7)	5.1 (5.7)	0.2 (2.1)	0.2 (3.0)	-0.9 (0.7)	6.0 (3.7)	-2.8 (2.1)	-0.4 (0.8)	-0.2 (0.2)	1.5* (0.7)	2.4 (1.5)	-3.3 (3.4)
-4	0.6 (2.0)	2.9 (3.9)	1.1 (0.7)	0.2 (1.1)	5.3* (2.2)	-1.4 (2.0)	1.1 (1.2)	0.3 (0.8)	18.1** (6.3)	-0.2 (2.0)	3.7 (3.0)	-0.6 (0.8)	5.1 (3.9)	-1.4 (2.2)	-0.6 (0.9)	-0.1 (0.2)	2.0* (0.8)	0.7 (1.0)	2.0 (3.7)
-3	1.9 (2.0)	7.1 (4.6)	1.3* (0.6)	-0.2 (1.2)	4.8* (2.4)	0.6 (2.0)	0.6 (1.3)	-0.3 (0.9)	9.9 (6.1)	3.1 (2.3)	0.2 (3.3)	-1.1 (0.8)	3.0 (3.9)	-2.0 (2.4)	-0.9 (1.0)	-0.0 (0.0)	1.3* (0.6)	2.6 (1.4)	-7.1 (3.8)
-2	3.7 (2.0)	6.1 (5.0)	1.7 (0.9)	-0.5 (1.7)	2.7 (2.3)	-0.6 (3.2)	0.1 (1.3)	-0.6 (0.8)	15.9* (6.9)	2.3 (2.0)	3.9 (3.1)	-0.0 (0.9)	-0.5 (3.9)	-3.3 (2.4)	0.1 (0.8)	-0.1 (0.1)	1.3 (0.7)	1.8 (1.3)	-0.6 (3.7)
-1	0.6 (1.9)	9.2 (5.3)	-0.0 (0.6)	0.8 (1.3)	-0.5 (2.3)	1.0 (2.2)	0.7 (1.3)	-0.6 (0.8)	10.6 (6.7)	6.2** (2.3)	4.0 (3.7)	0.8 (1.0)	2.9 (3.9)	-1.2 (2.4)	0.9 (0.9)	-0.0 (0.0)	1.0 (0.7)	2.1 (1.4)	-1.1 (4.2)
0	4.4* (2.2)	17.3** (5.5)	1.1 (0.7)	-0.5 (1.3)	5.3* (2.5)	2.1 (1.8)	-0.2 (1.3)	-0.5 (1.0)	15.5* (6.3)	5.2* (2.4)	6.1 (3.2)	-1.8* (0.8)	3.1 (4.0)	-2.0 (2.4)	1.3 (0.9)	-0.0 (0.0)	0.6 (0.7)	2.0 (1.1)	0.6 (3.7)
1	4.0 (2.2)	23.7*** (6.0)	1.4* (0.7)	0.4 (1.3)	3.1 (2.5)	2.3 (2.4)	-0.6 (1.3)	0.3 (0.9)	20.9** (6.9)	2.5 (3.0)	6.2 (3.6)	-0.9 (0.9)	6.4 (4.1)	1.4 (2.7)	-0.4 (0.9)	-0.0 (0.0)	1.2 (0.7)	0.8 (1.3)	4.2 (4.4)
2	5.7* (2.6)	25.1*** (6.1)	2.4* (1.0)	2.0 (1.3)	9.4*** (2.7)	2.2 (2.9)	1.7 (1.3)	-0.9 (1.1)	22.4*** (6.5)	4.4 (2.6)	8.2* (4.1)	-0.3 (0.8)	2.5 (4.0)	1.7 (2.5)	-0.0 (0.9)	-0.0 (0.0)	0.7 (1.1)	3.2* (1.5)	7.3 (4.5)
3	3.8 (2.0)	30.4*** (6.2)	0.8 (0.5)	1.8 (1.5)	4.6 (2.6)	-0.5 (2.3)	1.2 (1.3)	0.5 (1.1)	24.9** (7.9)	6.9** (2.6)	6.2 (3.5)	0.2 (0.8)	-0.8 (4.2)	-3.8 (2.3)	0.2 (0.9)	-0.0 (0.0)	1.0 (0.7)	3.5* (1.4)	-1.0 (4.7)
4	6.2 (3.8)	27.3*** (6.0)	1.4* (0.6)	2.3 (1.5)	7.7** (2.8)	1.1 (1.7)	0.1 (1.3)	-0.6 (0.8)	23.2** (7.3)	3.5 (2.7)	3.6 (3.4)	0.2 (0.9)	4.4 (4.1)	-0.6 (2.5)	-0.3 (0.9)	-0.0 (0.0)	1.8* (0.9)	1.4 (1.2)	3.7 (4.1)
5	6.0 (3.9)	28.9*** (6.3)	0.8 (0.7)	2.8* (1.4)	7.0* (2.9)	-0.3 (2.2)	-0.1 (1.4)	1.1 (0.8)	9.4 (7.5)	11.5*** (3.3)	0.4 (3.6)	-0.0 (1.1)	5.8 (4.2)	0.3 (2.6)	0.1 (0.9)	-0.0 (0.0)	0.9 (0.9)	1.8 (1.7)	2.1 (4.5)
6	7.8* (3.9)	34.2*** (7.2)	-0.8 (0.8)	2.1 (1.3)	7.7** (2.8)	3.3 (1.9)	-0.2 (1.4)	-0.6 (0.8)	20.7** (7.0)	10.9*** (3.1)	5.8 (4.0)	0.6 (0.9)	7.6 (4.3)	0.1 (2.8)	-0.2 (1.0)	-0.0 (0.0)	2.0** (0.7)	2.0 (2.9)	4.2 (4.7)
7	9.6** (3.6)	20.8** (6.8)	-0.1 (1.0)	1.8 (1.7)	6.3* (2.9)	-0.3 (2.1)	0.7 (1.5)	-0.6 (0.9)	28.8*** (7.6)	5.5* (2.6)	8.1 (4.6)	-1.9 (1.0)	6.4 (4.6)	-1.1 (3.0)	-0.4 (1.0)	-0.0 (0.1)	1.6 (1.0)	4.3* (1.9)	-7.9 (4.7)
8	8.3* (3.2)	25.3*** (7.6)	-0.2 (0.8)	2.9* (1.3)	3.5 (3.0)	-0.7 (2.1)	1.1 (1.4)	0.2 (1.2)	21.0* (9.2)	11.5*** (3.2)	0.3 (3.7)	-1.4 (1.0)	1.6 (4.5)	-0.1 (2.8)	-0.3 (1.1)	-0.2 (0.1)	0.5 (0.8)	2.3 (1.3)	-4.3 (4.8)
9	6.3* (3.1)	19.3* (7.7)	1.2 (1.0)	2.3 (1.3)	-0.1 (2.9)	-1.1 (2.5)	0.7 (1.4)	-0.5 (0.9)	24.0** (8.4)	8.9** (2.9)	3.3 (3.7)	-0.8 (0.9)	3.3 (4.3)	-1.6 (2.5)	-0.7 (1.0)	-0.0 (0.0)	2.3** (0.8)	3.2* (1.5)	3.7 (4.5)
10	6.3* (3.1)	25.9** (8.6)	-0.1 (1.2)	0.5 (1.3)	4.3 (2.8)	3.7 (4.1)	1.2 (1.4)	-1.0 (1.0)	15.7 (8.1)	7.1 (3.7)	6.5 (3.8)	-1.1 (1.0)	2.4 (4.3)	-4.7 (2.6)	-0.3 (1.0)	-0.0 (0.0)	1.5* (0.8)	2.8 (1.6)	7.1 (4.4)
11	8.1* (3.4)	10.1 (7.3)	0.6 (0.8)	1.0 (1.5)	7.0* (2.9)	-3.4 (2.9)	0.5 (1.4)	-0.1 (0.9)	7.1 (8.6)	1.9 (2.9)	3.5 (4.2)	-0.4 (1.1)	6.0 (4.3)	-0.2 (2.7)	-1.0 (1.0)	-0.0 (0.0)	1.7* (0.8)	1.9 (2.2)	-5.7 (5.4)
12	-3.6 (2.8)	2.8 (7.9)	-2.0 (1.5)	-2.7 (1.4)	2.9 (3.0)	-3.5 (3.2)	1.6 (1.4)	-0.0 (1.1)	22.0** (8.4)	3.4 (2.8)	5.8 (4.0)	-1.3 (0.9)	7.1 (4.4)	-1.9 (2.9)	1.4 (1.0)	-0.0 (0.0)	1.1 (0.7)	2.5 (1.7)	-3.1 (4.9)
Mean dept. var.	7.0	50.9	1.8	6.9	16.9	11.5	13.2	2.7	65.5	14.9	26.8	3.1	41.5	17.1	3.8	0.0	1.0	8.8	30.7

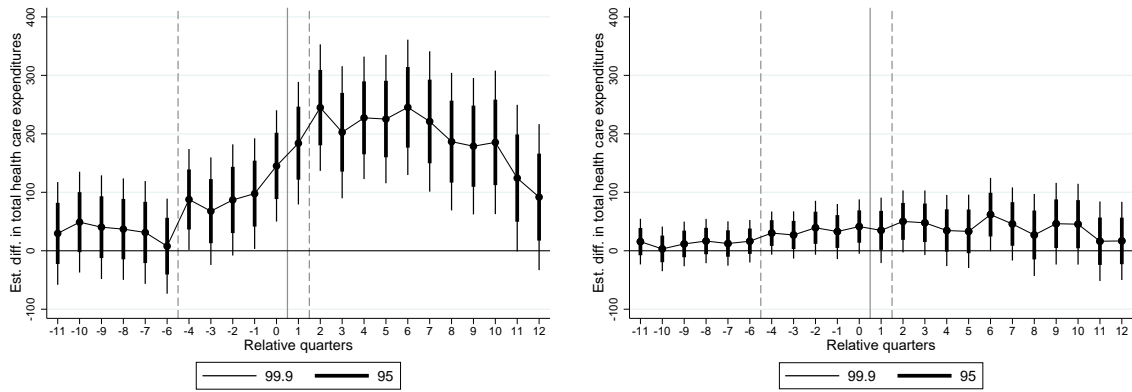
Note: Number of observations in all estimations: $N = 3,750,647$. There were only few observations with inpatient expenditures related to the treatment of diagnoses in ICD-10 Chapters 20 and 21, therefore no estimations were possible. Clustered standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

Table A.6: Estimated hospital related differences between treatment and control group

Rel. quarter	PCP hospital referral ¹ (1)	Outpat.dept visit (2)
<i>Pre-period</i>		
-11	0.001 (0.001)	0.010* (0.004)
-10	0.001 (0.001)	-0.019*** (0.004)
-9	0.002* (0.001)	-0.000 (0.004)
-8	0.002* (0.001)	0.003 (0.004)
-7	0.001 (0.001)	-0.003 (0.004)
-6	0.000 (0.001)	0.000 (0.004)
<i>Notification-period</i>		
-4	0.002* (0.001)	0.001 (0.004)
-3	0.001 (0.001)	0.001 (0.004)
-2	0.002* (0.001)	0.000 (0.004)
-1	0.002** (0.001)	0.004 (0.004)
0	0.001 (0.001)	0.004 (0.004)
<i>Post-period</i>		
1	-0.009*** (0.001)	0.008 (0.004)
2	-0.003*** (0.001)	0.014** (0.004)
3	-0.001 (0.001)	0.008 (0.004)
4	-0.001 (0.001)	0.004 (0.004)
5	0.001 (0.001)	-0.000 (0.004)
6	0.001 (0.001)	0.010* (0.005)
<i>Catch-up-period</i>		
7	0.000 (0.001)	0.005 (0.004)
8	0.000 (0.001)	-0.001 (0.005)
9	0.001 (0.001)	0.004 (0.005)
10	0.001 (0.001)	0.002 (0.005)
11	-0.001 (0.001)	-0.001 (0.005)
12	-0.000 (0.001)	-0.000 (0.005)
Obs.:	3,750,647	1,365,851
Mean d. v. pre	0.013	0.206
Mean d. v. note	0.013	0.215
Mean d. v. post	0.012	0.221
Mean d. v. catch	0.013	0.223

Estimation output for (1) hospital referral by the PCP and (2) outpatient department visits are shown. The dependent variables are indicators, which equals one if a referral or visit was observed and zero otherwise. Coefficients on sex-birth year-exit quarter and region dummies are not shown. ¹ In (1) the new PCP might not be correctly assigned to the patient in the beginning of the post-period (after the exit of the former PCP) due to the used patient-PCP assigning procedures, especially if the treated person refuses to see any GP after the exit of the old PCP (see Chapter 3.1). Therefore, the drop, beginning in $q = 1$, might only be technically and not causally related to the PCPs' exit. The mean of the dependent variable is displayed at the bottom of the Table. Clustered standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

Figure A.3: Total health care expenditures by risk type
 (a) Age ≥ 60 (b) Age < 60



Note: Estimation results, with 99.9% and 95% confidence interval, for total health care expenditures for individuals (a) above and (b) below the age of 60 are presented. Detailed estimation results are shown in Table A.7.

Table A.7: Estimated differences by risk-type (Figure A.3 and 3)

Rel. quarter	Total health care expenditures			
	Age		Pre-existing disease	
	≥ 60 (1)	< 60 (2)	diseases (3)	none (4)
<i>Pre-period</i>				
-11	29.7 (26.7)	15.6 (11.9)	57.2 (43.6)	10.9 (8.2)
-10	48.9 (26.2)	3.2 (11.6)	65.1 (42.5)	7.4 (8.0)
-9	40.3 (27.0)	11.7 (11.6)	44.4 (43.6)	16.2* (8.1)
-8	37.0 (26.4)	16.6 (11.5)	58.0 (42.8)	14.5 (7.9)
-7	31.3 (26.7)	12.4 (11.5)	35.6 (43.1)	15.6 (8.0)
-6	7.9 (24.7)	16.3 (11.0)	10.4 (39.7)	14.7 (7.8)
<i>Notification-period</i>				
-4	87.7*** (26.2)	30.3** (11.2)	109.5** (36.2)	31.6** (10.8)
-3	67.7* (28.0)	27.0* (12.3)	62.1 (39.5)	34.4** (11.4)
-2	86.9** (28.9)	39.3** (14.0)	117.9** (40.9)	35.8** (12.8)
-1	97.7*** (28.7)	32.9* (14.3)	163.2*** (41.5)	19.8 (12.6)
0	145.1*** (28.9)	41.4** (14.1)	171.2*** (41.4)	47.7*** (12.6)
<i>Post-period</i>				
1	184.0*** (31.9)	34.9* (17.0)	215.8*** (44.3)	45.6** (14.7)
2	244.9*** (32.9)	50.2** (16.1)	271.7*** (44.8)	68.9*** (14.4)
3	202.7*** (34.3)	47.8** (16.8)	224.3*** (46.7)	62.4*** (15.2)
4	227.4*** (31.8)	34.6 (18.5)	215.2*** (43.9)	68.3*** (15.7)
5	225.3*** (33.4)	33.2 (19.1)	226.3*** (45.2)	62.1*** (16.9)
6	245.3*** (35.2)	61.8** (19.1)	239.2*** (48.4)	91.5*** (16.5)
<i>Catch-up-period</i>				
7	221.1*** (36.5)	45.8* (19.0)	177.0*** (48.4)	86.6*** (16.4)
8	186.7*** (35.7)	27.0 (21.3)	134.0** (46.6)	66.6*** (19.0)
9	178.8*** (35.4)	46.3* (21.2)	188.7*** (48.7)	59.5*** (18.1)
10	185.4*** (37.3)	45.4* (21.0)	194.8*** (48.4)	60.3** (19.1)
11	124.3** (38.1)	16.3 (20.7)	56.4 (48.9)	47.6* (19.1)
12	91.8* (37.9)	16.8 (20.3)	84.1 (50.4)	21.9 (18.3)
Obs.:	1,444,540	2,306,107	943,475	2,807,172
Mean d. v.	945.3	369.4	1187.0	390.9

Note: This table shows the estimation results of Equation 1, comparing total health care expenditures of treatment and control individuals above the age of 60 (column 1), below the age of 60 (2), with pre-existing conditions (3), without pre-existing conditions (4). Coefficients on sex-birth year-exit quarter and region dummies are not shown. The mean of the dependent variable is displayed at the bottom of the Table. Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

Table A.8: Estimation results by risk type

Relative quarter	No pre-diseases						Pre-diseases					
	Inpatient exp.	Laboratory	Specialist fee	GP fee	PCP fee ¹	Any GP visit	Inpatient exp.	Laboratory	Specialist fee	GP fee	PCP fee ¹	Any GP visit
-11	11.0 (7.8)	0.1 (0.1)	-0.7 (1.3)	0.3 (0.3)	0.6** (0.2)	0.011*** (0.003)	63.0 (42.6)	0.1 (0.2)	4.4 (2.9)	-0.5 (0.6)	-0.3 (0.5)	0.008 (0.004)
-10	6.4 (7.7)	0.1* (0.1)	2.1 (1.3)	-0.0 (0.3)	0.3 (0.2)	0.004 (0.003)	69.0 (41.6)	-0.1 (0.2)	3.5 (2.9)	-0.4 (0.7)	0.1 (0.5)	0.007 (0.004)
-9	14.7 (7.7)	0.1 (0.1)	2.2 (1.3)	0.3 (0.3)	0.4 (0.2)	0.004 (0.003)	46.2 (42.9)	-0.2 (0.2)	4.3 (2.9)	-1.2 (0.6)	-0.8 (0.5)	0.005 (0.004)
-8	14.3 (7.7)	0.1 (0.1)	-0.1 (1.3)	-0.3 (0.3)	0.0 (0.2)	0.001 (0.003)	62.0 (42.1)	-0.1 (0.2)	2.1 (2.9)	0.1 (0.6)	0.1 (0.5)	0.002 (0.004)
-7	16.4* (7.7)	0.1 (0.1)	0.3 (1.3)	-0.0 (0.3)	0.1 (0.2)	0.004 (0.003)	35.8 (42.4)	-0.1 (0.2)	2.3 (2.9)	-0.2 (0.6)	-0.0 (0.5)	0.004 (0.004)
-6	12.4 (7.6)	0.1 (0.1)	1.4 (1.2)	0.2 (0.3)	0.3 (0.2)	0.005 (0.003)	6.3 (39.3)	-0.2 (0.2)	5.5* (2.8)	-0.6 (0.6)	-0.1 (0.5)	0.002 (0.004)
-4	31.7** (10.6)	0.1 (0.1)	-1.3 (1.3)	0.0 (0.3)	0.3 (0.2)	0.001 (0.003)	104.1** (35.8)	-0.3 (0.2)	-1.2 (2.7)	-0.7 (0.6)	0.0 (0.5)	0.003 (0.004)
-3	31.0** (11.1)	0.1 (0.1)	0.3 (1.3)	0.4 (0.3)	0.2 (0.2)	0.002 (0.003)	55.6 (38.9)	-0.1 (0.2)	3.6 (2.9)	-1.0 (0.6)	-0.6 (0.5)	-0.007 (0.004)
-2	33.7** (12.3)	0.1* (0.1)	1.5 (1.3)	-1.6 (2.3)	0.6** (0.2)	0.010*** (0.003)	103.1* (40.2)	-0.0 (0.2)	7.7** (2.9)	1.1 (0.6)	1.0* (0.5)	0.005 (0.004)
-1	16.8 (12.3)	0.1 (0.1)	-0.1 (1.3)	0.3 (0.3)	-0.1 (0.2)	0.002 (0.003)	146.1*** (40.6)	-0.0 (0.2)	4.5 (2.9)	0.9 (0.7)	-0.2 (0.5)	-0.005 (0.004)
0	44.0*** (12.3)	0.4*** (0.1)	-1.4 (1.3)	0.1 (0.3)	-0.9*** (0.2)	-0.005 (0.003)	154.3*** (39.7)	0.3 (0.2)	6.6* (2.9)	1.6* (0.7)	-0.8 (0.5)	-0.010** (0.004)
1	46.2*** (13.8)	0.4*** (0.1)	1.0 (1.3)	0.5 (0.3)	-19.2*** (0.3)	-0.007* (0.003)	215.0*** (42.8)	0.5** (0.2)	7.6** (2.9)	1.2 (0.7)	-40.2*** (0.6)	-0.017*** (0.004)
2	65.6*** (13.5)	0.6*** (0.1)	1.9 (1.3)	0.3 (0.3)	-7.2*** (0.3)	-0.013*** (0.003)	256.7*** (42.9)	0.6*** (0.2)	8.2** (3.0)	0.9 (0.7)	-14.3*** (0.6)	-0.017*** (0.004)
3	56.5*** (14.2)	0.7*** (0.1)	2.0 (1.3)	1.1*** (0.3)	-0.0 (0.3)	-0.012*** (0.003)	216.5*** (44.5)	0.7*** (0.2)	6.6* (2.9)	2.0** (0.7)	0.3 (0.6)	-0.008* (0.004)
4	62.1*** (14.7)	0.9*** (0.1)	0.4 (1.4)	0.9** (0.3)	0.7** (0.3)	-0.012*** (0.003)	202.2*** (41.3)	0.8*** (0.2)	10.3*** (3.0)	1.7* (0.7)	1.1 (0.6)	-0.014*** (0.004)
5	56.6*** (15.8)	0.7*** (0.1)	2.3 (1.4)	1.2*** (0.3)	0.7** (0.3)	-0.006* (0.003)	217.0*** (43.4)	0.9*** (0.2)	8.1** (3.1)	2.4** (0.7)	1.0 (0.6)	-0.009* (0.004)
6	84.2*** (15.5)	0.8*** (0.1)	3.6* (1.4)	1.7*** (0.4)	1.2*** (0.3)	-0.002 (0.003)	229.5*** (46.3)	1.0*** (0.2)	14.0*** (3.1)	1.2 (0.8)	0.6 (0.6)	-0.007 (0.004)
7	78.9*** (15.3)	0.8*** (0.1)	4.2** (1.5)	0.9* (0.4)	0.4 (0.3)	-0.004 (0.003)	181.0*** (46.0)	1.0*** (0.2)	14.5*** (3.2)	1.2 (0.8)	-0.4 (0.7)	-0.012** (0.004)
8	55.2** (18.0)	0.9*** (0.1)	3.6* (1.4)	0.9** (0.3)	0.6* (0.3)	-0.004 (0.003)	143.3** (44.1)	1.2*** (0.2)	12.1*** (3.0)	1.4 (0.8)	0.3 (0.7)	-0.006 (0.004)
9	54.9** (17.0)	0.8*** (0.1)	2.1 (1.5)	1.3*** (0.4)	0.6* (0.3)	0.002 (0.003)	196.1*** (45.2)	1.0*** (0.2)	14.1*** (3.1)	1.2 (0.8)	-0.3 (0.7)	-0.007 (0.004)
10	55.8** (18.2)	1.0*** (0.1)	5.1*** (1.4)	0.2 (0.3)	0.3 (0.3)	-0.004 (0.003)	199.8*** (45.8)	1.0*** (0.2)	18.5*** (3.1)	-1.1 (0.8)	-0.9 (0.7)	-0.002 (0.004)
11	42.4* (18.0)	0.7*** (0.1)	3.5* (1.4)	0.2 (0.4)	0.3 (0.3)	-0.002 (0.003)	73.1 (45.9)	1.1*** (0.2)	10.6*** (3.1)	-1.6* (0.8)	-1.6* (0.7)	-0.010* (0.004)
12	24.2 (18.0)	0.7*** (0.1)	3.3* (1.4)	-0.1 (0.3)	0.9** (0.3)	-0.005 (0.003)	108.1* (45.9)	0.7*** (0.2)	10.2** (3.1)	-2.3** (0.8)	-0.2 (0.7)	-0.012** (0.004)
Mean d. v.	223.4	2.4	90.6	29.2	26.2	0.628	838.2	3.9	136.3	50.8	45.0	0.837

Estimation output for inpatient hospital expenditures, laboratory expenditures, specialist fees, GP fees, PCP fees, any specialist visit (indicator), any GP visit (indicator) are shown. Coefficients on sex-birth year-exit quarter and region dummies are not shown. * p < 0.05, ** p < 0.01, and *** p < 0.001. ¹ The new PCP might not be correctly assigned to the patient in the beginning of the post-period (after the exit of the former PCP) due to the used patient-PCP assigning procedures, especially if the treated person refuses to see any GP after the exit of the old PCP (see Chapter 3.1). Therefore, the drop, beginning in q = 1, might only be technically and not causally related to the PCPs' exit.

Table A.9: Probability of specialist and GP referrals

	No pre-diseases							Pre-diseases						
	Inpat. hosp. days	Out. dept. visit	GP hosp. referral	PCP hosp. referral ¹	GP spec. referral	PCP spec. referral ¹	Spec. w/o visit	Inpat. hosp. days	Out. dept. visit	GP hosp. referral	PCP hosp. referral ¹	GP spec. referral	PCP spec. referral ¹	Spec. w/o visit
-11	0.014 (0.014)	0.006 (0.005)	0.001 (0.001)	0.001 (0.001)	-0.003 (0.003)	-0.002 (0.002)	0.002 (0.004)	0.068 (0.072)	0.021* (0.011)	0.002 (0.003)	0.002 (0.003)	0.006 (0.005)	0.004 (0.005)	0.022*** (0.006)
-10	0.004 (0.013)	-0.018*** (0.005)	0.000 (0.001)	0.001 (0.001)	0.001 (0.003)	0.003 (0.002)	0.002 (0.003)	0.045 (0.072)	-0.023* (0.011)	0.004 (0.003)	0.002 (0.003)	0.009 (0.005)	0.012* (0.005)	0.011 (0.006)
-9	0.019 (0.013)	0.003 (0.004)	0.001 (0.001)	0.001 (0.001)	-0.001 (0.002)	-0.000 (0.002)	-0.001 (0.003)	0.036 (0.073)	-0.011 (0.011)	0.007* (0.003)	-0.004 (0.003)	0.009 (0.005)	0.010 (0.005)	0.008 (0.006)
-8	0.020 (0.013)	0.001 (0.005)	0.000 (0.001)	0.001 (0.001)	0.001 (0.003)	0.001 (0.002)	-0.005 (0.003)	0.063 (0.072)	0.008 (0.011)	0.003 (0.003)	-0.004 (0.003)	0.004 (0.005)	0.003 (0.005)	0.016** (0.006)
-7	0.024 (0.013)	-0.003 (0.005)	0.001 (0.001)	0.001 (0.001)	-0.001 (0.003)	-0.000 (0.002)	-0.005 (0.003)	0.002 (0.071)	-0.006 (0.010)	0.001 (0.003)	-0.000 (0.003)	0.002 (0.005)	0.001 (0.005)	0.005 (0.006)
-6	0.015 (0.013)	0.002 (0.004)	0.001 (0.001)	0.001 (0.001)	0.002 (0.002)	0.003 (0.002)	-0.003 (0.003)	-0.018 (0.067)	-0.005 (0.010)	-0.001 (0.003)	-0.000 (0.003)	0.012* (0.005)	0.013* (0.005)	0.017** (0.006)
-4	0.046** (0.017)	-0.001 (0.005)	0.001 (0.001)	0.001 (0.001)	-0.002 (0.003)	-0.000 (0.002)	-0.008* (0.003)	0.121* (0.061)	0.007 (0.010)	0.006* (0.002)	0.005* (0.002)	0.004 (0.005)	0.005 (0.005)	0.009 (0.006)
-3	0.043* (0.018)	-0.001 (0.005)	0.000 (0.001)	0.001 (0.001)	0.001 (0.003)	-0.000 (0.002)	-0.006 (0.003)	0.083 (0.065)	0.006 (0.010)	0.004 (0.002)	-0.004 (0.002)	-0.000 (0.005)	0.001 (0.005)	0.013* (0.006)
-2	0.048** (0.019)	0.004 (0.005)	0.000 (0.001)	0.000 (0.001)	0.001 (0.003)	0.003 (0.002)	-0.002 (0.003)	0.108 (0.065)	-0.010 (0.010)	0.006* (0.002)	0.005* (0.002)	0.008 (0.005)	0.008 (0.005)	0.016** (0.006)
-1	0.021 (0.019)	0.003 (0.005)	0.000 (0.001)	0.000 (0.001)	-0.001 (0.003)	-0.000 (0.002)	-0.006 (0.003)	0.215** (0.066)	0.007 (0.010)	0.008*** (0.002)	0.007** (0.002)	0.005 (0.005)	0.005 (0.005)	0.013* (0.006)
0	0.068*** (0.020)	0.003 (0.005)	-0.000 (0.001)	-0.000 (0.001)	0.003 (0.003)	-0.004 (0.002)	-0.007 (0.003)	0.192** (0.066)	0.006 (0.010)	0.006* (0.003)	0.006** (0.002)	0.011* (0.005)	-0.001 (0.005)	0.014* (0.006)
1	0.071*** (0.020)	0.008 (0.005)	-0.000 (0.001)	-0.006*** (0.001)	0.001 (0.003)	-0.074*** (0.002)	-0.002 (0.004)	0.242*** (0.068)	0.010 (0.010)	0.001 (0.003)	-0.017*** (0.002)	0.013* (0.005)	-0.126*** (0.005)	0.010 (0.006)
2	0.104*** (0.020)	0.013** (0.005)	-0.000 (0.001)	-0.002*** (0.001)	0.006* (0.003)	-0.030*** (0.002)	0.008* (0.004)	0.370*** (0.069)	0.018 (0.010)	0.004 (0.002)	-0.005* (0.002)	0.017** (0.005)	-0.049*** (0.005)	0.026** (0.006)
3	0.072*** (0.021)	0.012* (0.005)	-0.002* (0.001)	-0.001* (0.001)	0.012*** (0.003)	0.005* (0.002)	0.007* (0.004)	0.259*** (0.069)	-0.003 (0.010)	0.002 (0.003)	0.000 (0.002)	0.028*** (0.005)	0.017*** (0.005)	0.025*** (0.006)
4	0.098*** (0.022)	0.007 (0.005)	-0.001 (0.001)	-0.001 (0.001)	0.013*** (0.003)	0.009*** (0.003)	-0.000 (0.004)	0.252*** (0.068)	-0.002 (0.010)	0.003 (0.003)	0.001 (0.002)	0.033*** (0.005)	0.028*** (0.005)	0.026*** (0.006)
5	0.071*** (0.021)	0.001 (0.005)	-0.001 (0.001)	-0.001 (0.001)	0.017*** (0.003)	0.013*** (0.003)	-0.001 (0.004)	0.315*** (0.070)	-0.003 (0.010)	0.006* (0.003)	0.004 (0.002)	0.043*** (0.005)	0.038*** (0.005)	0.013* (0.006)
6	0.115*** (0.022)	0.011* (0.005)	0.001 (0.001)	0.001 (0.001)	0.023*** (0.003)	0.020*** (0.003)	0.005 (0.004)	0.244*** (0.070)	0.006 (0.010)	0.003 (0.003)	0.002 (0.002)	0.039*** (0.006)	0.034*** (0.005)	0.024*** (0.006)
7	0.087*** (0.022)	0.008 (0.005)	-0.001 (0.001)	-0.000 (0.001)	0.017*** (0.003)	0.015*** (0.003)	0.001 (0.004)	0.263*** (0.074)	-0.002 (0.010)	0.002 (0.003)	0.002 (0.002)	0.035*** (0.006)	0.026*** (0.005)	0.020** (0.006)
8	0.048* (0.023)	-0.002 (0.005)	0.000 (0.001)	0.000 (0.001)	0.019*** (0.003)	0.017*** (0.003)	0.004 (0.004)	0.167* (0.070)	0.000 (0.010)	0.002 (0.003)	-0.000 (0.002)	0.046*** (0.006)	0.042*** (0.005)	0.032*** (0.006)
9	0.053* (0.023)	0.004 (0.005)	-0.000 (0.001)	-0.000 (0.001)	0.019*** (0.003)	0.018*** (0.003)	-0.003 (0.004)	0.226** (0.070)	0.004 (0.010)	0.007** (0.003)	0.005* (0.002)	0.041*** (0.006)	0.038*** (0.005)	0.027** (0.006)
10	0.079*** (0.023)	0.001 (0.005)	0.000 (0.001)	0.001 (0.001)	0.022*** (0.003)	0.019*** (0.003)	-0.002 (0.004)	0.219** (0.070)	0.004 (0.011)	0.002 (0.003)	0.001 (0.002)	0.041*** (0.006)	0.038*** (0.005)	0.026*** (0.006)
11	0.063** (0.023)	0.002 (0.005)	-0.000 (0.001)	-0.001 (0.001)	0.018*** (0.003)	0.016*** (0.003)	0.002 (0.004)	0.052 (0.072)	-0.010 (0.010)	0.000 (0.003)	-0.001 (0.002)	0.038*** (0.006)	0.033*** (0.005)	0.017** (0.006)
12	0.033 (0.023)	0.005 (0.005)	-0.001 (0.001)	-0.001 (0.001)	0.016*** (0.003)	0.020*** (0.003)	-0.001 (0.004)	0.086 (0.072)	-0.016 (0.011)	0.002 (0.003)	-0.001 (0.002)	0.040*** (0.006)	0.048*** (0.005)	0.022*** (0.006)
Mean dept. var.	0.347	0.175	0.008	0.006	0.154	0.128	0.429	1.458	0.345	0.041	0.032	0.245	0.205	0.525

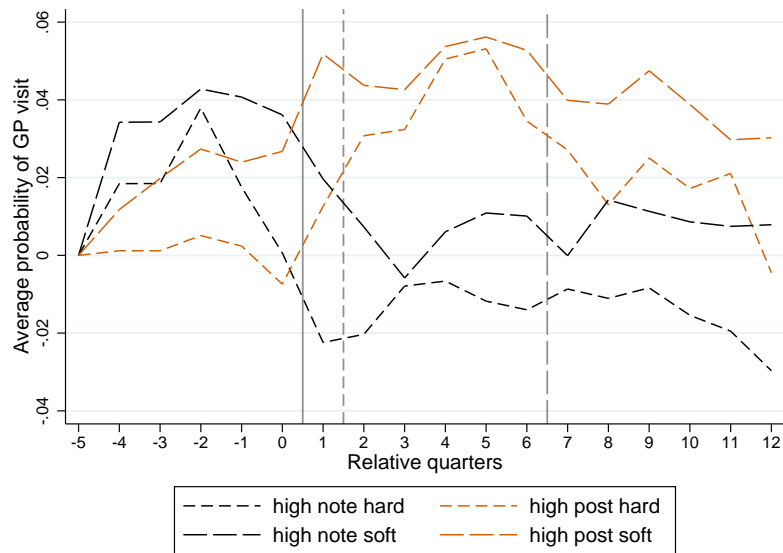
Estimation output by risk type for inpatient hospital days, outpatient department visits, hospital referrals by any GP, hospital referral by the PCP, specialist referral by any GP, specialist referral by the PCP, and specialist visits without referral are shown. Observations no pre-diseases: 2,807,172 (outpatient dept. visits 1,029,999); pre-diseases: 943,475 (outpatient dept. visits 335,852). Coefficients on sex-birth year-exit quarter and region dummies are not shown. * p < 0.05, ** p < 0.01, and *** p < 0.001. ¹ The new PCP might not be correctly assigned to the patient in the beginning of the post-period (after the exit of the former PCP) due to the used patient-PCP assigning procedures, especially if the treated person refuses to see any GP after the exit of the old PCP (see Chapter 3.1). Therefore, the drop, beginning in q = 1, might only be technically and not causally related to the PCPs' exit.

Table A.10: Estimation results for cumulative mortality

Rel. quarter	Delta size		Risk type ($\Delta = 20$)		Practice location ($\Delta = 20$)	
	$\Delta = 12$	$\Delta = 20$	Low	High	Rural	Urban
	(1)	(2)	(3)	(4)	(5)	(6)
1	0.000 (0.000)	0.001** (0.000)	-0.000 (0.000)	0.003*** (0.001)	0.001 (0.000)	0.001* (0.001)
2	-0.000 (0.000)	0.001** (0.000)	0.000 (0.000)	0.004** (0.001)	0.001 (0.001)	0.001* (0.001)
3	-0.000 (0.000)	0.001** (0.001)	0.000 (0.000)	0.004* (0.002)	0.001* (0.001)	0.001 (0.001)
4	-0.000 (0.000)	0.002** (0.001)	0.001 (0.001)	0.004* (0.002)	0.001 (0.001)	0.001 (0.001)
5	-0.000 (0.001)	0.002** (0.001)	0.001 (0.001)	0.005* (0.002)	0.002* (0.001)	0.002 (0.001)
6	0.001 (0.001)	0.003*** (0.001)	0.002* (0.001)	0.006** (0.002)	0.003*** (0.001)	0.002 (0.001)
7	0.000 (0.001)	0.003*** (0.001)	0.001 (0.001)	0.005* (0.002)	0.003* (0.001)	0.003* (0.001)
8	0.001 (0.001)	0.004*** (0.001)	0.002* (0.001)	0.006* (0.003)	0.004*** (0.001)	0.003* (0.001)
9	0.001 (0.001)	0.004*** (0.001)	0.002* (0.001)	0.006* (0.003)	0.003** (0.001)	0.003* (0.002)
10	0.001 (0.001)	0.004*** (0.001)	0.002 (0.001)	0.008** (0.003)	0.003** (0.001)	0.004** (0.002)
11	0.000 (0.001)	0.004*** (0.001)	0.002* (0.001)	0.007* (0.003)	0.004** (0.001)	0.004** (0.002)
12	0.001 (0.001)	0.005*** (0.001)	0.002* (0.001)	0.008** (0.003)	0.004** (0.001)	0.006** (0.002)
13	0.001 (0.001)	0.005*** (0.001)	0.002* (0.001)	0.011*** (0.003)	0.004** (0.001)	0.006*** (0.002)
14	0.002 (0.001)	0.006*** (0.001)	0.003* (0.001)	0.011*** (0.003)	0.004** (0.001)	0.007*** (0.002)
15	0.002* (0.001)	0.007*** (0.001)	0.003** (0.001)	0.012*** (0.003)	0.005** (0.002)	0.008*** (0.002)
16	0.003** (0.001)	0.007*** (0.001)	0.003** (0.001)	0.013*** (0.003)	0.005** (0.002)	0.008*** (0.002)
17	0.002* (0.001)	0.007*** (0.001)	0.004** (0.001)	0.012*** (0.004)	0.004** (0.002)	0.009*** (0.002)
18	0.002* (0.001)	0.007*** (0.001)	0.003** (0.001)	0.013*** (0.004)	0.004** (0.002)	0.009*** (0.002)
19	0.002* (0.001)	0.007*** (0.001)	0.003** (0.001)	0.013*** (0.004)	0.005** (0.002)	0.009*** (0.002)
20	0.001 (0.001)	0.007*** (0.001)	0.003* (0.001)	0.013*** (0.004)	0.005** (0.002)	0.008*** (0.002)
21	0.001 (0.001)	0.007*** (0.001)	0.003* (0.001)	0.013** (0.004)	0.005** (0.002)	0.009*** (0.002)
22	0.001 (0.001)	0.007*** (0.001)	0.003* (0.001)	0.014*** (0.004)	0.006** (0.002)	0.007** (0.003)
23	0.001 (0.002)	0.007*** (0.002)	0.003* (0.001)	0.014*** (0.004)	0.006** (0.002)	0.007** (0.003)
24	-0.001 (0.002)	0.007*** (0.002)	0.003* (0.002)	0.012** (0.005)	0.006** (0.002)	0.005 (0.003)
Obs.:	4,674,458	3,724,955	2,821,445	903,510	2,084,718	1,426,580
Mean d. v.	0.037	0.039	0.024	0.084	0.035	0.044

Estimation output for cumulative mortality rate are shown. The lines (in (1) prior 13; in (2)-(6) prior 21) indicate the exit of the control groups PCPs. Coefficients on sex-birth year-exit quarter and region dummies are not shown. * p < 0.05, ** p < 0.01, and *** p < 0.001.

Figure A.4: GP visits for patients with high inpatient expenditures by transition type



Note: The Figure shows the average probability of a GP visit relative to basis quarter $q = -5$ for patients with above average inpatient expenditures in the notification-period with a soft (black long dash) and hard (black short dash) transition, and patients with above average inpatient expenditures in the post-period with a soft (orange long dash) and hard (orange short dash) transition.

Table A.11: Estimation results for health care utilization and cumulative mortality

Rel. quarter	Low inpatient expenditures				High inpatient expenditures			
	GP visit	GP spec. referral	Spec. w/o referral	Cumu. mortality	GP visit	GP spec. referral	Spec. w/o referral	Cumu. mortality
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
-11	0.009** (0.003)	-0.000 (0.003)	0.001 (0.004)		-0.003 (0.005)	0.004 (0.006)	0.020** (0.007)	
-10	0.002 (0.003)	0.002 (0.002)	0.001 (0.004)		-0.003 (0.005)	0.010 (0.006)	0.017* (0.007)	
-9	0.001 (0.003)	-0.002 (0.002)	-0.002 (0.003)		-0.005 (0.005)	0.009 (0.006)	0.002 (0.006)	
-8	0.002 (0.003)	0.001 (0.002)	0.002 (0.004)		-0.008 (0.005)	0.004 (0.006)	0.008 (0.007)	
-7	0.005 (0.003)	-0.003 (0.002)	-0.003 (0.004)		-0.003 (0.004)	0.011 (0.006)	-0.002 (0.006)	
-6	0.009** (0.003)	0.001 (0.002)	0.003 (0.004)		-0.003 (0.004)	0.011 (0.006)	0.013* (0.006)	
-4	0.005 (0.003)	-0.000 (0.002)	-0.001 (0.004)		-0.007 (0.004)	0.007 (0.006)	0.002 (0.006)	
-3	0.006* (0.003)	0.003 (0.002)	0.002 (0.004)		-0.007 (0.004)	0.013* (0.006)	-0.010 (0.006)	
-2	0.011*** (0.003)	-0.001 (0.002)	0.004 (0.004)		-0.001 (0.004)	0.009 (0.006)	0.013 (0.007)	
-1	0.006* (0.003)	-0.001 (0.002)	-0.001 (0.003)		-0.005 (0.005)	0.001 (0.006)	0.001 (0.007)	
0	-0.001 (0.003)	0.004 (0.002)	0.003 (0.004)		-0.013** (0.005)	0.006 (0.006)	0.007 (0.007)	
1	-0.011*** (0.003)	0.000 (0.003)	0.002 (0.004)		-0.017*** (0.005)	0.007 (0.006)	0.010 (0.007)	
2	-0.016*** (0.003)	0.001 (0.003)	0.016*** (0.004)	0.000 (0.000)	-0.018*** (0.005)	0.026*** (0.006)	0.013 (0.007)	-0.002 (0.001)
3	-0.018*** (0.003)	0.007* (0.003)	0.013*** (0.004)	0.001** (0.000)	-0.018*** (0.005)	0.020*** (0.006)	0.018** (0.007)	-0.003*** (0.001)
4	-0.018*** (0.003)	0.011*** (0.003)	0.007 (0.004)	0.001*** (0.000)	-0.019*** (0.005)	0.025*** (0.006)	0.014* (0.007)	-0.002* (0.001)
5	-0.012*** (0.003)	0.014*** (0.003)	0.003 (0.004)	0.001*** (0.000)	-0.013** (0.005)	0.032*** (0.006)	0.013 (0.007)	0.000 (0.001)
6	-0.010** (0.003)	0.019*** (0.003)	0.011** (0.004)	0.001*** (0.000)	-0.015** (0.005)	0.036*** (0.006)	0.015* (0.007)	0.000 (0.001)
7	-0.014*** (0.003)	0.009** (0.003)	0.005 (0.004)	0.001*** (0.000)	-0.021*** (0.005)	0.031*** (0.006)	0.006 (0.007)	0.002 (0.001)
8	-0.012*** (0.003)	0.016*** (0.003)	0.011** (0.004)	0.002*** (0.000)	-0.024*** (0.005)	0.031*** (0.006)	0.022** (0.007)	0.004** (0.001)
9	-0.008* (0.003)	0.015*** (0.003)	0.005 (0.004)	0.003*** (0.000)	-0.020*** (0.005)	0.026*** (0.006)	0.014* (0.007)	0.004*** (0.001)
10	-0.010** (0.003)	0.016*** (0.003)	0.007 (0.004)	0.003*** (0.000)	-0.016** (0.005)	0.032*** (0.006)	0.027*** (0.007)	0.006*** (0.001)
11	-0.016*** (0.003)	0.010*** (0.003)	0.007 (0.004)	0.003*** (0.000)	-0.026*** (0.005)	0.021*** (0.006)	0.012 (0.007)	0.007*** (0.001)
12	-0.025*** (0.003)	0.012*** (0.003)	0.010** (0.004)	0.004*** (0.000)	-0.030*** (0.005)	0.028*** (0.006)	0.014* (0.007)	0.009*** (0.001)
Obs.:	2,695,584	2,695,584	2,695,584	1,320,453	795,890	795,890	795,890	388,880
Mean dept. var.	0.596	0.143	0.429	0.001	0.815	0.242	0.529	0.006

Estimation output for (1)/(5) GP visits, (2)/(6) specialist visits with GP referral, (3)/(7) specialist visits without referral, and (4)/(8) cumulative mortality are shown. Coefficients on sex-birth year-exit quarter and region dummies are not shown. $q = 1$ is the reference quarter in the cumulative mortality estimations. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

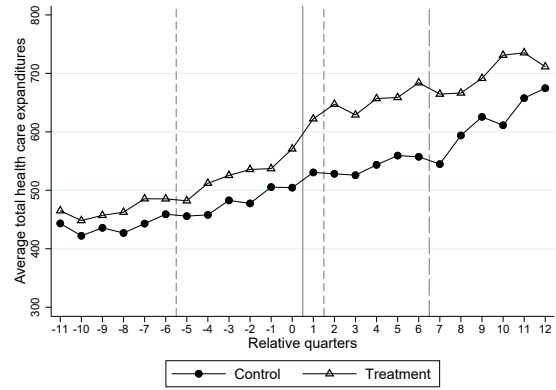
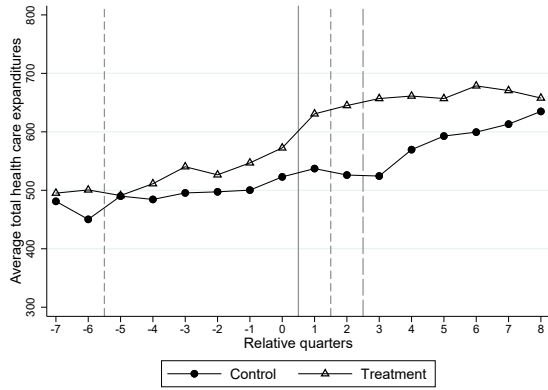
A.2 Varying the definition of treatment and control groups

A.2.1 Size of Δ

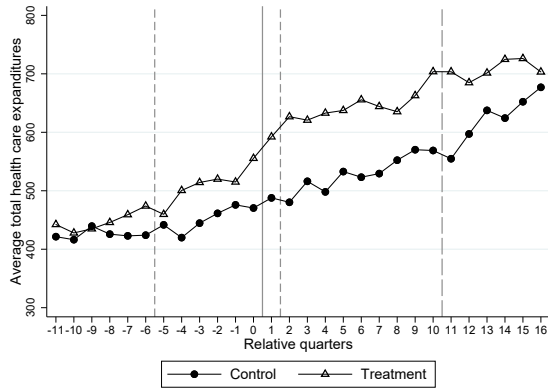
The control group is defined by the size of Δ . Δ is the sum of quarters in the post- and catch-up-periods. Since the length of the catch-up-period is set at n quarters, which equals the duration of the notification-period, the length of the post-period is calculated by $\Delta - n$. Therefore, the larger Δ , the longer the post-period and also the distance between the exits of the treatment PCPs and control group PCPs. n is 5 quarters and assumed to be equal for all PCPs. Figure A.5 presents the average total expenditure for the treatment group and different control groups, which are varying by the size of Δ . Each figure corresponds to a different size of Δ . The dashed line at $q = -5$ marks the assumed beginning of the treatment group PCPs exit processes (see also Chapter 3 in the article). The solid line at $q = 0$ and the dashed line in $q = 1$, denote the end of the last active quarter of the treatment- group PCPs. The long dashed line on the right indicates the beginning of the control-group PCP exit process.

As can be seen in the Figures A.5a to A.5d, the total expenditure begin drifting apart already some quarters prior to the actual exit of the treatment-group PCPs and converges just before the exit of the control-group PCPs. The largest differences between the treatment and control groups are observed in the post-period. This pattern is observed within any sample (and any Δ size) shown in Figure A.5. If a small Δ is chosen, for example $\Delta = 8$, the post-period becomes very short, as the PCPs of the control group already start the exit process in relative quarter $q = 3$. An analysis of the effects of the exit is thus only possible for a few quarters and, therefore, limits the study of long term effects. If on the other hand, a larger Δ is chosen, for example $\Delta \geq 16$, the number of observations decreases considerably, since patients in the control group must stay with their PCPs from $t - n - s$ to $t + \Delta$, which becomes a long period, when Δ becomes large. Similarly, a long observation period, given by a large Δ , and the limited data collection period from 2005 to 2017 (see Chapter 3) restrict the number of observed exits to a few quarters. The number of observed individuals decreases from 225,338 (treated: 113,853) when using $\Delta = 8$ to 87,825 (treated: 37,532) when using $\Delta = 20$. A small number of observations may not allow for precise heterogeneity analyses, which are desirable, to filter out groups and regions that are particularly affected by an exit. Since all Δ variations presented in Figure A.5 reveal the same pattern, $\Delta = 12$ is chosen

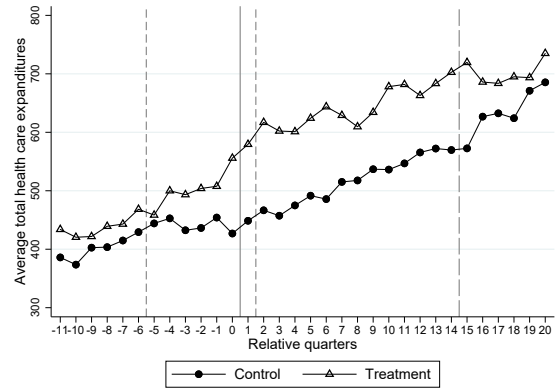
Figure A.5: Average total expenditures of treatment and control group with different sizes of Δ
(a) $\Delta = 8$ (b) $\Delta = 12$



(c) $\Delta = 16$



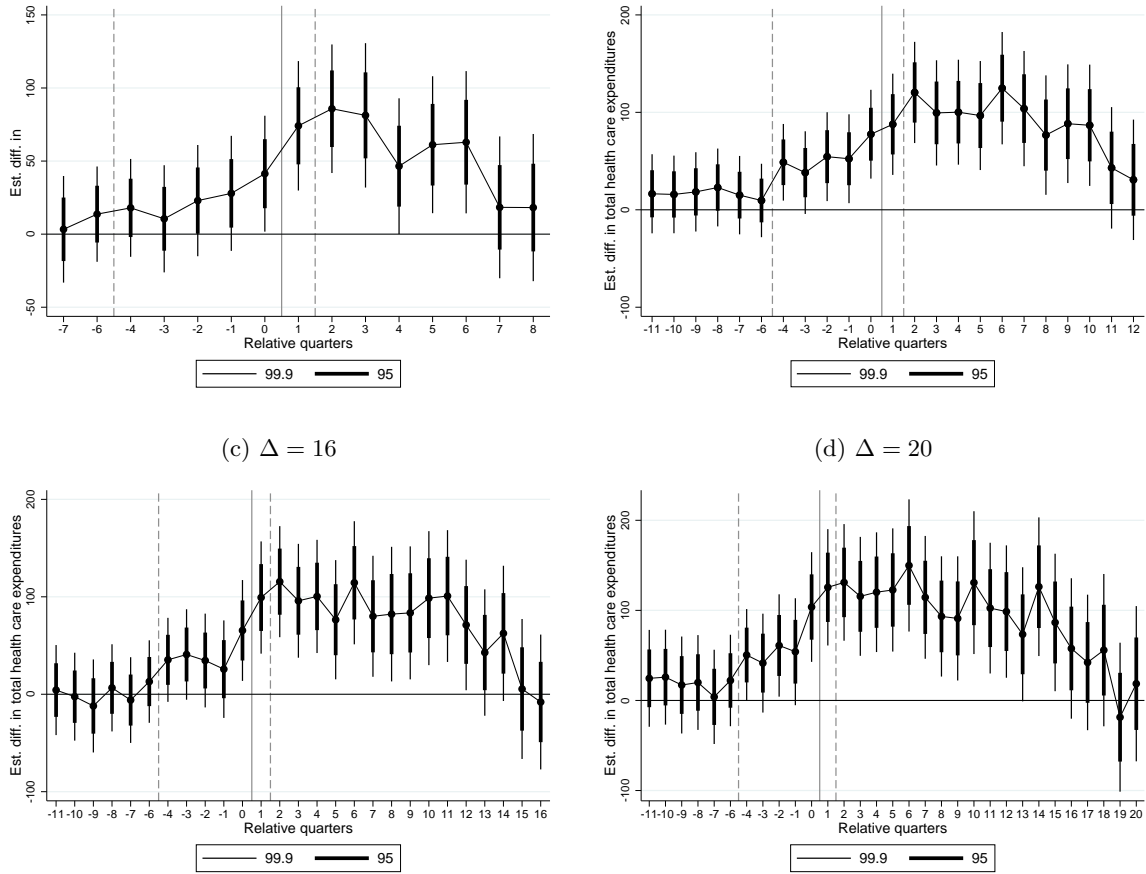
(d) $\Delta = 20$



Note: The triangles (circles) corresponds to the average total health care expenditures of the treatment (control) group. Quarters are relative to the leaving quarter of the treatment group PCPs. The post-period starts in relative quarter $q > 0$. At this point the physician has left the local health care system in case of hard transition and non transition. Given a soft transition, the exiting PCP stops working by the end of $q = 1$. The long-dashed line (left) marks the begin of the exit process of the control groups PCPs in $t + \Delta - n = p$ ($(\Delta = 8) p = 2$, $(\Delta = 12) p = 6$, $(\Delta = 16) p = 10$, $(\Delta = 20) p = 14$) of the PCPs in the control group. Number of distinct treated/control individuals: $(\Delta = 8)$ 113,853/111,485; $(\Delta = 12)$ 79,339/78,532; $(\Delta = 16)$ 54,700/62,849; $(\Delta = 20)$ 37,532/50,293.

for the main analysis, to ensure a reasonable length of the pre- and post-period and a large sample size. However, I additionally show the estimation results, following an adaptation for each sample of Model 1, for the other Δ -variants in Figure A.6. Again, all results show the same expenditure differences pattern between the treatment and the respective control groups. The total health care expenditures begin to diverge some quarters prior to the actual exit of the treatment-group PCPs and start convergence some quarters after the treatment-groups PCPs exit or with the beginning of the exit process of the control group PCPs. Most importantly, none of the shown estimation results in A.6 show significant differences between the treatment and control group at the 5% level in the pre-period.

Figure A.6: Average total expenditures of treatment and control group with different sizes of Δ
 (a) $\Delta = 8$ (b) $\Delta = 12$



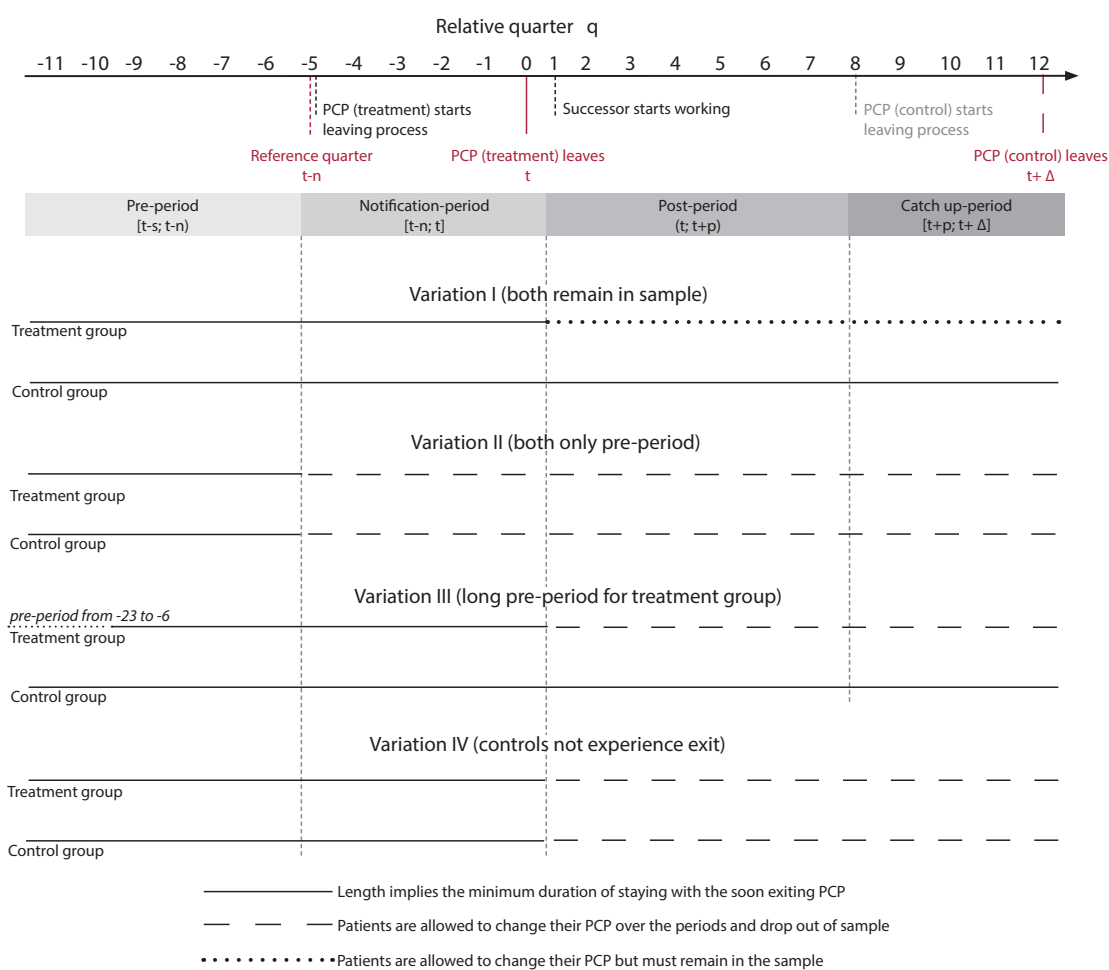
Note: The estimated differences in total health care expenditures and the respective confidence intervals for each relative quarter between the treatment and control groups are shown. The estimation follows model in 1, whereas the exit of the control group PCPs is different in each figure. Detailed estimation output is available upon request.

A.2.2 Minimum duration of physician-patient relationship

This chapter presents alternative models, to the main specification. All variations are illustrated in Figure A.7.

Variation I: In the main specification, individuals in the treatment group are allowed to drop out of sample with the beginning of the post-period. Therefore, the results also include estimated differences for individuals who may change the insurance status or may die in the periods after the physician exit. This has a potential rising effect on the differences in health care expenditures, since a drop out of sample might be related to the individual health status. In variation I, this condition is changed: Treatment individuals in this sample are supposed to stay with their leaving PCP from $q = -11$ to $q = 0$ and are supposed to be alive and remain insured with the UA regional health insurance from $q = 1$ to $q = 12$. The

Figure A.7: Alternative definitions of treatment and control groups

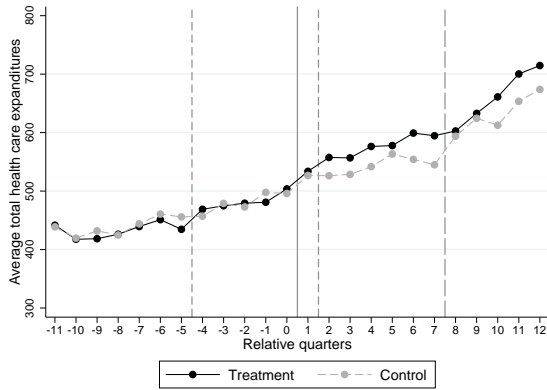


control group is defined as in the main specification. Average expenditures and estimated differences are shown in Figures A.8a and A.8b. The results show a significant difference in total health care expenditures between the control and new defined treatment group. The point estimates in the notification-period are lower in comparison the the main specification (see Figure 2b) but also statistical significant. In relative quarter $q = 0$ the result in the main analysis show increased total expenditures for the treatment group of € 78.9*** (s.e. 14.1), whereas in variation I the estimated difference is € 51.7*** (s.e. 14.0). Again, the largest differences between the treatment and control group are observed in the post-period. Hence, the results in the main specification are not only caused by patients who die in the post-period or people who drop out of the sample for other reasons but also by patients who remain insured and stay alive between $q = 1$ to $q = 12$.

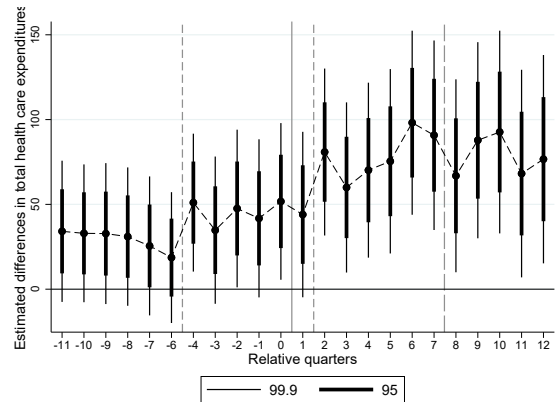
Variation II: This variation estimates the intention to treat effect (ITT) since patients

Figure A.8: Estimation results for different treatment and control group definitions

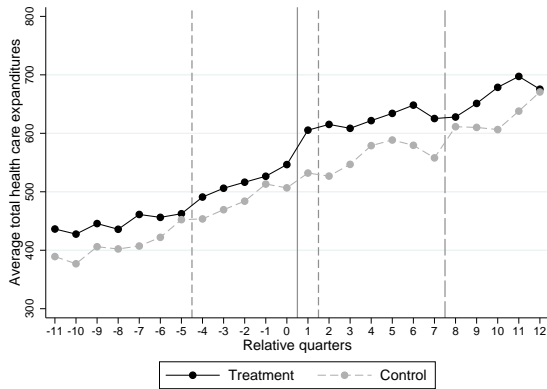
(a) Variation 1: Average total health care expenditures



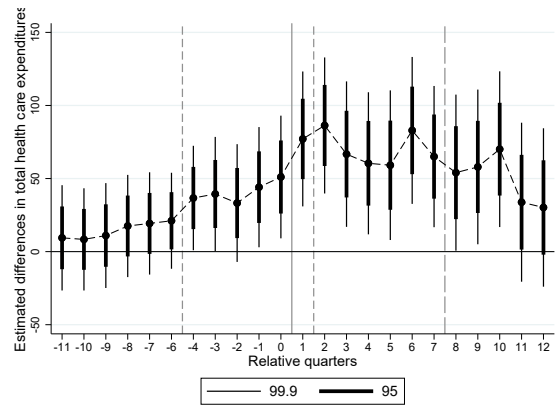
(b) Variation 1: Estimated differences in total health care expenditure



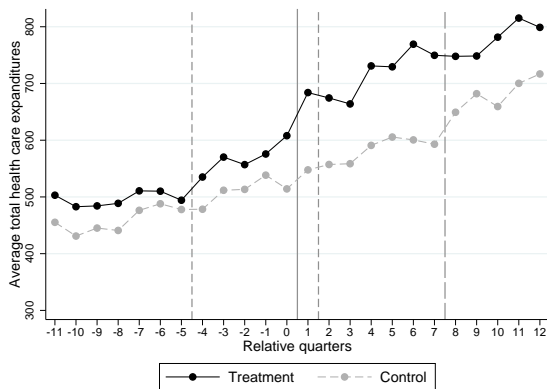
(c) Variation 2: Average total health care expenditures



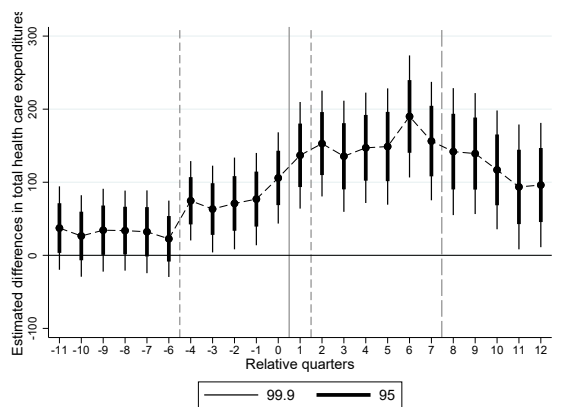
(d) Variation 2: Estimated differences in total health care expenditure



(e) Variation 3: Average total health care expenditures



(f) Variation 3: Estimated differences in total health care expenditure



Note: In (a), (c) and (e) the average total health care expenditures for each treatment and control group and in (b), (d) and (f) the estimated differences in total health care expenditures, with 99.9% (and 95%) confidence interval, between the treatment and control groups are shown. Detailed estimation results are available upon request. Means (Observations): (b) 568.9 (3,914,568); (d) 526.9 (4,560,299); (f) 632.4 (2,531,907); Estimated coef. in $q = 0$ and robust standard errors: (b) 47.2*** (13.3); (d) 51.4*** (12.2); (f) 108.3*** (21.1), where * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

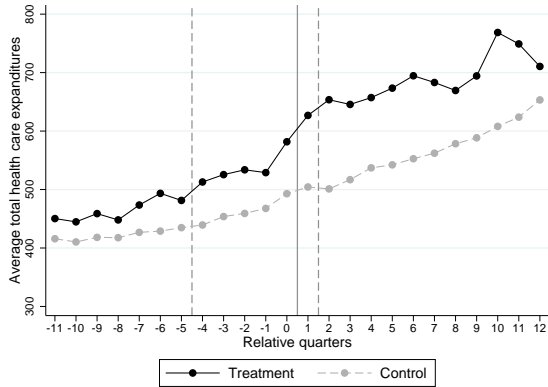
can change their PCP before the actual exit and thus, before treatment. Patients in this sample only needed to stay with the soon-exiting physician in the pre-period, from $q = -11$ to $q = -6$. The treatment group PCP leaves in relative quarter $q = 0$ and the control group PCP leaves in relative quarter $q = 12$. This allows treatment patients to respond to the upcoming exit, e.g. with a PCP change, during the notification-period and lowers the requirements for the control group substantially, as the control-group individuals are now also allowed to change their PCP or drop out of sample after $q > -6$. Results for total health care expenditures are shown in Figure A.8c and A.8d and reveal the same pattern as in the main analysis (see Chapter 6). Patients whose family physician leaves the local health care system have significantly higher total expenditures with the start of the exit preparations (in the notification-period). The expenditure difference disappears only when the physicians of the control group start preparing for their exit.

Variation III: In the main analysis, by definition, the control group must stay with the same physician for a total of six years (from $q = -11$ to $q = 12$) and the treatment group for only three years (from $q = -11$ to $q = 0$) prior to the PCP exits. Thus, patients in the control group may differ from those in the treatment group by characteristics other than the time of PCP exit. In variation III, the pre-period for the treatment group is extended. Thus, both groups are with their PCP for at least six years prior to the exit. The treatment group must stay with their PCP from $q = -23$ to $q = 0$ and the control group from $q = -11$ to $q = 12$. The overlapping pre-period ($q = -11$ to $q = -6$) tests the parallel trend assumption. Results for this sample (in Figures A.8e and A.8f) are again very similar to the results of the main analysis.

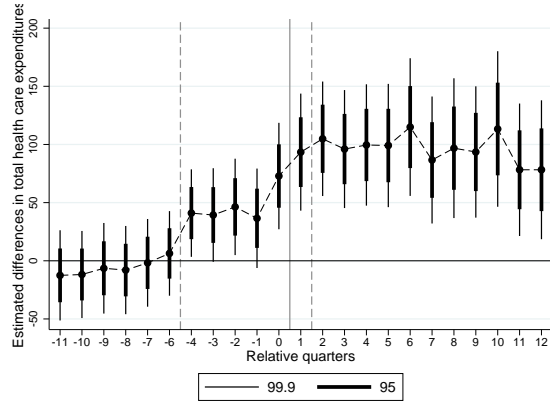
Variation IV: In the last modification of the main specification, only the control group is changed, transforming the estimation model from the main analysis to a simple event study. The treatment group is defined as in the main analysis in the paper. In contrast, people in the control group experience *no* PCP exit between $q = -11$ and $q = 20$. The control group is therefore also referred to as *not treated*. The treatment as well as the control group are consistently with their PCP from $q = -11$ to $q = 0$. The treatment-group PCP leaves the local health care system in $q = 0$. The control-group PCP either leaves the health system much later ($\Delta > 20$) or patients change physicians before the actual exit. Figure A.9 compares the total health care expenditures of the treatment and control group. The

Figure A.9: Estimation results for different treatment and control group definitions

(a) Variation 4: Average total health care expenditures



(b) Variation 4: Estimated differences in total health care expenditure



Note: In (a) the average total health care expenditures for the treatment and the control group and in (b) the estimated differences in total health care expenditures, with 99.9% (and 95%) confidence interval, between the treatment and control groups are shown. Detailed estimation results are available upon request. Mean: 421.0; Estimated coef. in $q = 0$ and robust standard errors: 64.8*** (11.3), where * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$; $N = 17,300,935$

results in the notification- and post-period follow the same pattern as those in the main analysis: E.g., in $q = 0$ the coefficient in the main analysis is 78.9*** (s.e. 14.1), while and the coefficient in variation IV 93.4***(s.e. 15.3): or in $q = 6$ the coefficient in the main analysis is 126.7*** (s.e. 17.9) and the coefficient in variation IV is 115.0*** (s.e. 18.0). In contrast to the main specification, expenditure convergence is not observed. Presumably, this is because the control-group physicians leave the local health care system later, $\Delta > 20$, and therefore do not start the exit process between $q = \Delta - n$ and $q = \Delta$.

All variations of treatment and control groups presented in this chapter show comparable results as the main specification in the article. Therefore, the results in the article are robust and the specification seem to has only a small effect on the coefficient size. The conclusions are the same in each variation: Once the exit process starts, patient's health care spending increases. The differences between the treatment and control group continue to increase in the post-period and only decrease when the control-group physician starts the exit process.

A.3 Movers

Figure A.10: Illustration of stayers, movers, the control group, and the defined periods

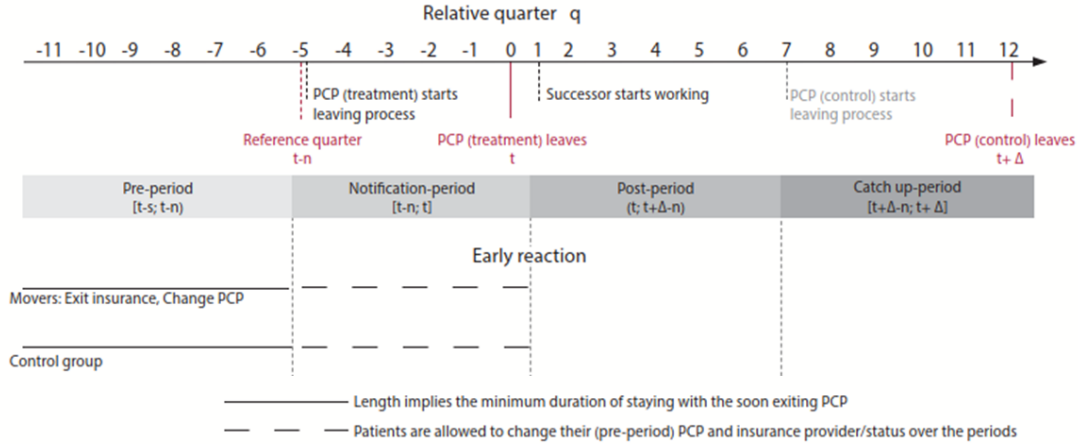


Illustration of new sample: *Early reaction*. In the new sample there is a three years time lag ($\Delta = 12$) between the exits of the pre-period PCPs of the treatment and control groups. t denotes the quarter of the treatment groups PCPs exits, s is the duration of the pre-period, n is defined as the duration of the notification-period and $\Delta - n$ describes the length of the post-period.

In this chapter, I take a closer look at those patients who change their PCP or their insurance status *before* the actual exit of their family physician, since such behaviors, if not random, might be early reactions to the PCPs' announcement of the upcoming leave. I investigate, whether there is any relationship between the planned exit of the PCP and patients' switch to new PCPs or switch to new insurance provider prior to the actual exit.

Therefore, I distinguished between people whose pre-period PCP exits in $q = 0$ (treatment group) and people whose pre-period PCP leaves in $q = 12$ (control group) (see figure A.10). Both groups stay with their soon-leaving PCPs in the pre-period $q = -11$ to $q = -6$ and might change their primary GP (outcome 1) or insurance provider (outcome 2) in the notification-period, between $q = -5$ and $q = 0$. With this sample the probability of PCP switch and insurance provider change³⁰ caused by the pre-period PCPs exit notification is estimated. Since patients might be insecure about future health care provision, they might look for another PCP already in the notification-period. Such observed behavior could be caused by the patients fear of potential future treatment disruption. Likewise, exiting PCPs may initiate PCP changes. To the exiting PCP and the patients the successor and thus the

³⁰The second outcome is studied for the sake of completeness. Since in Austria health insurance membership is residence and work related, an effect on the insured status would only be observable if, for example, because of the upcoming PCP exit, patients move to or start working in other federal states or the notification of the exit has an influence on the job patients hold (e.g. blue or white collar worker, civil servant, military service, out of labor force due to health issues or retirement). Therefore, the effect of the announcement of the PCP exit on insured status may not be zero but is expected to be rather negligible.

quality of the successor is unknown during the notification-period. Therefore, the exiting PCP might convince patients to switch to other GPs, whose quality is known to the soon-leaving PCP. This behavior would correspond to PCPs' desire to provide appropriate health care for their patients. However, only healthier patients may be able to switch to new physicians. If changing physicians involves longer travel distance to health care, patients will only take this burden if they are (physically) able to do so. Particularly, a greater travel distance to health care could be deterrent for vulnerable groups. Therefore, some might expect no change in behavior among vulnerable individuals. In addition, the soon-leaving PCP reduces the number of patient encounters during the notification-period because of time restrictions (e.g., preparing for the handover of the practice and patients) or because of hands-off behavior of the physician, as a negative patient feedback may not matter anymore when the exit from the local health care system is near. The discussed potential reactions to the imminent exit are opposing in patients' decision of staying with the soon-leaving PCP. In order to study the underlying reasons of patients' decision, I additionally conduct a heterogeneity analysis. Given the data limitations, it is not possible to clearly determine which motives causally influences behavior changes, but the estimation results can at least provide some insights. The following model is used for the analysis:

$$Stay_{itq} = \alpha T_{it} + \sum_{l=-5}^{l=0} \delta_l I\{q = l\} + \sum_{l=-4}^{l=0} \beta_l T_{it} \times I\{q = l\} + \lambda_{it} + u_{itq} + v_{iq}, \quad (3)$$

where the outcome variable $Stay_{itq}$, firstly, indicates, whether the individual i in relative quarter q with a (pseudo-) treatment in t switches from her/his pre-period PCP to another PCP in the observed relative quarter during the notification-period ($Stay_{itq} = 0$), or not ($Stay_{itq} = 1$); and, secondly, the outcome variable $Stay_{itq}$ indicates, whether the individual remains member of the UA Regional Health Insurance Fund in the respective quarter in the notification-period ($Stay_{itq} = 1$), or not ($Stay_{itq} = 0$). T indicates whether the individual belongs to the treatment group ($T = 1$), where the pre-period PCP leaves in relative quarter $q = 0$, or to the control group ($T = 0$), where the pre-period PCP leaves in relative quarter $q = 12$. All other variables are such as in the paper in Model 1 (see Chapter 4 in the article).

Figure A.11a presents the estimation results. Accordingly, patients, whose PCPs exit in $q = 0$, do not have a noteworthy increased probability of changing their insurance provider (estimates on the solid line). In contrast, the likelihood of changing physicians is positive

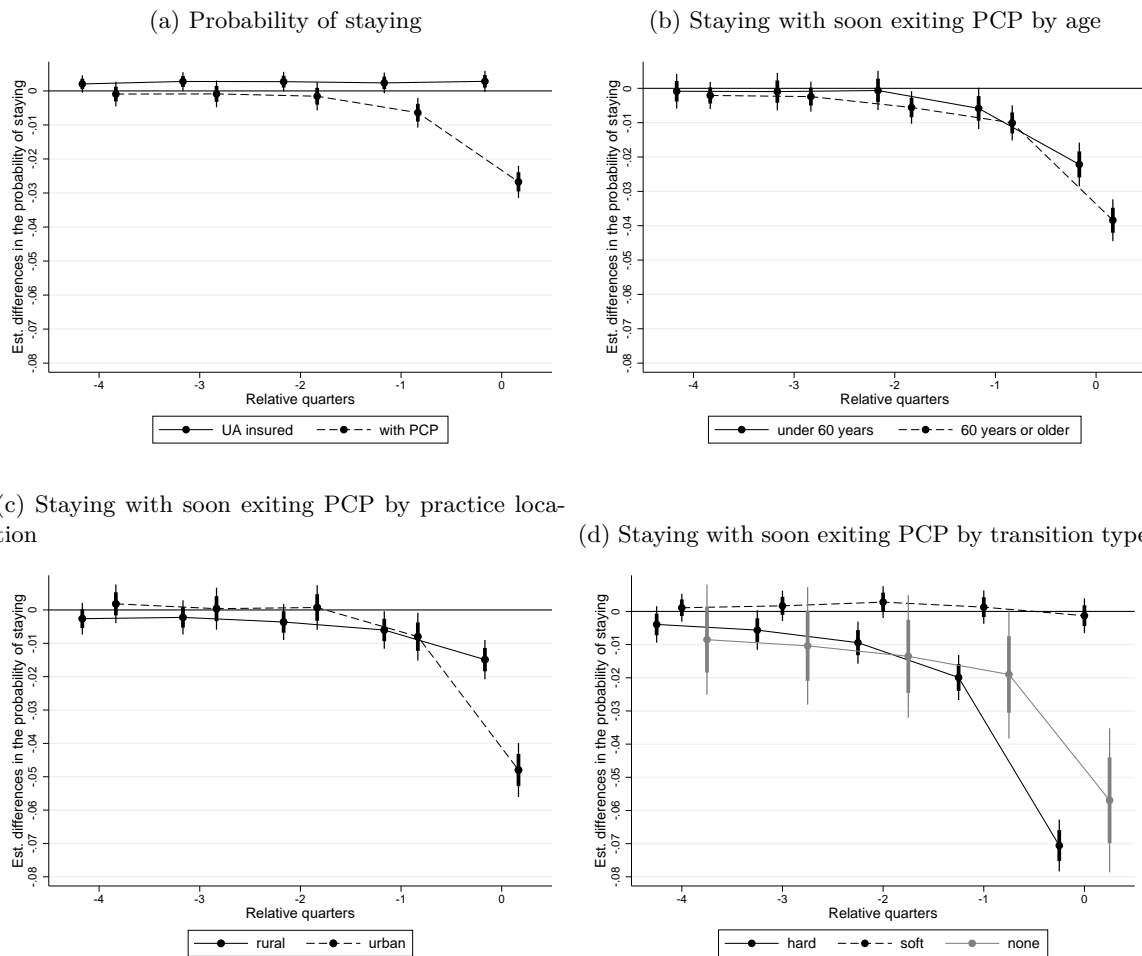
and highly significant (estimates on the dash line). The probability to switch from the pre-period PCP to a new PCP in relative quarter $q = 0$ is 2.7 percentage points higher for patients whose pre-period PCP exits the local health care system in $q = 0$ in comparison to patients whose pre-period PCP exits in $q = 12$. Figure A.11b additionally presents results for different age groups. Both, older and younger patients, are more likely to switch to new PCPs as their pre-period PCP's exit approaches. There is no strong difference observable between both age classes³¹. When the sample is divided by practice location (urban vs. rural), it appears that in both groups the likelihood of staying with the exiting pre-period PCP is significantly reduced near the actual exit quarter; and point estimates are larger when physician's practice is located in an urban ($> 10,000$ inhabitants) area. This result is not surprising, as the number of physicians in urban area is usually higher and switching is, therefore, associated with less costs for patients.

Finally, the treatment group is split according to the transition type³² (hard, soft and none). Physicians of the treatment group who leave in relative quarter t and who operate in urban areas hand over the patients via a soft transition in 75% and a hard transition in 25% of all observed transitions, whereas leaving physicians in rural areas hand over the patients via a soft transition in 57% and a hard transition in 36% (see Table A.12 in Chapter A.4 in the Web Appendix). Since there seem to be selection into transitions types, given the location of the practice, I additionally control in these estimations for the location of the physician practice (urban vs. rural) (Figure A.11d). From Figure A.11d it is evident, that patients are more likely than the control-group people to change their physician in the notification-period when there is no successor (*no transition*). Thus, patients do not wait until the last active quarter of the PCP before seeking a new physician or being referred to one. From Figure in A.1d, it can be inferred that the exit process is markedly longer for physicians without a successor than for PCPs who have a successor. Retiring physicians seem to operate longer when no successor can be found. Patients are probably aware that it is difficult to find a successor for this position and may try to avoid the uncertainty of a physician search in the post-period by starting looking for a new PCP earlier and therefore switch before the actual exit of the PCP. Of course, this switch may also be initiated by the

³¹The results for patients with low and high pre-period total health care expenditures mirror these findings. Again, no strong difference is evident between the two groups.

³²If the entire sample is split according to the transition type, the results are almost the same as those shown in Figure A.11d. Detailed estimation outputs are available upon request.

Figure A.11: Probability of staying with the exiting PCP and of being insured by the Upper Austrian Health Insurance fund in the notification-period



Note: (a) Shows the estimated differences, with 99.9% confidence interval, between the treatment and control groups for the probability of staying with the UA Regional Health Insurance Fund (solid line) and the probability of staying with the soon-exiting PCP during the notification-period (dashed line). (b)-(d) Estimate the probability of staying with the leaving PCP for different sub-samples: In (b) the sample is split by the age in relative quarter $q = 0$ and in (c) the sample is split by the practice location (urban vs rural) and in (d) the treatment group is split according to the transition type. Means in (a): Staying insured with UA Regional Health Insurance Fund sample $\mu = 0.970$, Staying with the leaving PCP sample $\mu = 0.939$. Detailed estimation outputs are available upon request.

exiting PCP. Further analysis investigating whether the switches are induced by the exiting PCP by referrals or are related to the number of position advertisements of these contracted positions do not provide additional insights³³. Another interesting aspect is the substantial estimation differences between the hard and soft transition. Patients whose pre-period PCPs work together with the successors in the first quarter of the post-period are *not* more likely than the control-group people to change physicians in the notification-period. In contrast, patients whose pre-period PCP have a successor, but the predecessor and the successor

³³Results are available upon request

never work together, have a significant increase in the likelihood of switching. Patients and physicians often do not know during the notification-period who will become the successor and may try to reduce the risk of a strong disruption (i.e., successors' limited information on patients past health issues) by selecting other suitable physicians before the exit. Overall, it seems that patients are more likely to switch if the soon exiting physician is operating in an urban area and more likely to stay with the soon-leaving PCP if the takeover by the succession is accompanied by the predecessor.

A.4 Extended heterogeneity and continuity of care

Table A.12: Descriptive statistics over PCPs

	Treat (1)	Control (2)
<i>Successor and transition characteristics for contracted positions in rural areas</i>		
Average number of job ads ²	1.8	1.8
Successor's average experience (scores) ¹	35.1	37.2
Hard transition	35.8	41.3
Soft transition	56.7	58.8
No transition	7.5	0.0
<i>Successor and transition characteristics for contracted positions in urban areas</i>		
Average number of job ads ²	1.3	1.4
Successor's average experience (scores) ¹	40.7	40.4
Hard transition	25.0	29.8
Soft transition	75.0	68.1
No transition	0.0	2.1

Note: ¹ For three positions of the treatment group and for ten positions of the control group and ² for 3 positions of the treatment group and for 5 positions of the control group and all positions without a successor there was no information available.

In the first part of the extended heterogeneity analysis, the sample is separated according to the location of the practice (urban and rural). Rural areas are zip-code based regions with less than ten thousand inhabitants. Table A.13 and A.14 show the estimation results for several selected outcomes following Model 1. The observed total expenditure growth in the notification period is almost exclusively observable in rural areas and are caused by the rise in inpatient spending. Again, the probability of receiving inpatient treatment due to a PCP referral is significantly increased for patients whose PCP is active in the rural area and leaves at the end of the notification-period. In contrast, patients whose soon-leaving PCPs operate in urban areas experience an significant increase in inpatient expenditures only after the PCP exit. The probability of an outpatient department visit is not significantly increased in neither of the two samples during the anticipatory-period. This again emphasizes the strong role of leaving PCPs in rural areas in terms of the induced increase in inpatient spending during notification-period. Only in the post-period do patients in rural regions significantly increase their outpatient visits. Surprisingly, the same is not observed in urban areas. However, in urban areas the increase in specialist visits (with and without GP referral) in the post-period among the treated patients is stronger than in rural areas (see Table A.14).

The different results in urban and rural areas may have various reasons. On the one hand, due to the comparatively lower (extended) access to health care, such as the limited number of other GPs or specialists, the disruption caused by the PCP exit may be seen as more severe by physicians and patients in rural areas than in urban areas. Patients in

urban areas have the possibility to change their PCPs or to substitute with other health care services (e.g., specialists, outpatient department) more easily due to the broader supply than patients in rural areas. Leaving PCP from rural areas may therefore rather tend to refer patients to the hospital to ensure patients at least receive extended care during the PCP exit than in urban areas. In urban areas, such behavioral adjustment of the PCP would not be necessary because of the given access to extended health care services. In addition, the observed difference between urban and rural areas may also be because of other physician characteristics, for example value of interpersonal relationship with patients, which also previously influenced the selection of physicians into areas (urban or rural) or influenced the PCPs' valuation of patients perceived health care disruption. In any case, it appears that the previously observed increased services in the notification-period is mainly caused by the leaving PCPs working in rural areas.

As can be seen in Table [A.12](#), contracted positions in rural regions have to be advertised considerably more often than in urban regions. The number of patients and therefore the potential income for contracted physicians is limited in rural areas, which may have an impact on the attractiveness of the position. In addition, the average qualifications (scores) of successful applicants in rural areas are much lower than in urban areas. Thus, it takes more efforts to refill rural positions and only comparatively less experienced physicians seem to be willing to take these positions. The additional analysis of PCP exits on patients' health care utilization by variation in successor experience (scores) and number of job advertisements for the vacant position, provides no further insights. The results are available upon request.

Despite access to extended health care, the disruption perceived by patients and physicians might also vary with the type of transition. Physicians who choose a soft transition over a hard transition to hand over the contracted position and patients to the successor, potentially act different during the exit process, than PCPs who choose a hard transition over a soft transition. In the case of a hard transition, the physician stops working and the successor begins working, whereas in a soft transition, the predecessor and the successor work together for at least one quarter. The soft transition, therefore, provides an opportunity for physicians to exchange in person detailed and personal information about patients and previous treatments. Thus, it can be expected that given a soft transition, the increase in services in the notification-period may not occur or may occur to a lesser extent, as the leaving physician

has the opportunity to inform the successor about patients and thus counteract the expected disruption in care. On the other hand, physicians who choose a soft transition over a hard transition may be in principle more aware of the potential disruption and choose due to this concern a soft transition. In this case, one can also expect that patients experiencing a soft transition have a larger rise in expenditures in the notification-period than persons whose PCP chooses a hard transition. Since the leaving physicians can decide independently on the type of transition, the transition type is of course highly selective. Not only the previously mentioned location (urban or rural) of the practice plays a role, but also the reason for the exit. While 61.7% of leaving PCPs who retire choose a soft transition, it is only 21.1% of exiting physicians who change to another position in UA. The majority of position switchers, i.e., 73.7%, choose a hard transition³⁴. In addition, other unobserved characteristics of the physicians can significantly influence the decision for a transition model: e.g., whether the physician plans to hand over the patient records to the successor, whether there is a time pressure for the transfer, or how soon the retirement is desired, personal teamwork preferences, or trust in the competence of the successor. Also the health status of patients may influence the decision of transition type. An analysis of the impact of the transition model on patients' health care spending is thus biased and inconsistent. The interpretation of the estimation results is therefore limited. The results show, that in both transition types individual health care spending increases significantly in the notification-period. Again, the results are driven by the rise in inpatient expenditures. Physician fees and drug spending in the notification-period and the post-period is significantly larger among the treated individuals given the soft transition, whereas nothing similar can be observed in the hard transition sample. Results are available upon request.

If the position cannot be successfully filled, patients experience a drop in medical supply. In this case, the disruption in physician supply is clearly noticeable for patients. This drop comes as no surprise to either the patients nor the leaving physicians, since the positions are advertised several times prior to the exit of the PCP. This can lead to various behavioral adjustments on both sides. On the one hand, patients change PCPs before the actual exit of the leaving PCP to minimize the subsequent disruption and to switch while the leaving PCP is still active and may be available for possible queries. These people are defined as

³⁴*Retire*: Hard trans. 34.3%, soft trans. 61.7% and no trans. 4%; *Relocation in UA*: Hard trans. 73.7%, soft trans. 21.1% and no trans. 5.3%; *Other*: Hard trans. 21.9%, soft trans. 71.9%, no trans. 6.3%.

movers (*change PCP movers*), for further details on this group see Chapter A.3 in the Web Appendix. On the other hand, for patients who stay with their soon-leaving PCP until the actual exit, service utilization may increase even more before the exit, because of the anticipation of greater disruption and stronger uncertainty about subsequent health care. To test whether there are strong differences for patients with and without a successor, I estimate the following model:

$$Y_{igt} = \alpha S_{it} + \sum_{l=-11}^{l=0} \delta_l I\{q = l\} + \sum_{\substack{l=0 \\ l \neq -5}}^{l=0} \beta_l S_{it} \times I\{q = l\} \gamma + \lambda_{it} + u_{igt} + v_{igt} \quad (4)$$

where Y_{igt} denotes the health outcome for individual i in relative quarter q with physician exit quarter in t . The variable S_{it} is the transition type indicator and equals 1 ($S_{it} = 1$) if the patients' PCP, who exit at t , has not successor and equals 0 ($S_{it} = 0$) if the patients' PCP, who exit at t , finds a successor. The model is estimated only for the rural area, since only PCP exits without successor in rural areas in the treatment group are observed. Since physicians cannot choose to have no successor the selection bias described above shouldn't be a problem, but still there might be omitted variable bias. Therefore, the results present rather correlation than a causal relationship. The estimation results are presented in Table A.16. Somewhat surprisingly, there are only little differences in the notification-period between patients with and without a successor. Only after exit do patients, whose PCP left without a successor, have lower spending on GPs and specialists than patients whose PCP position got successfully filled. As a result, spending on prescription drugs also decreases. These correlations are observable even after some quarters after the exit.

Given the selection into transition models, it is unfortunately not possible to analyze exactly how the transition types affect the actual disruption in health care due to the exit of the PCP. Some of the PCPs change the transition model between the first (unsuccessful) and the second position advertisement. Often a soft transition is chosen firstly by the leaving PCP and if no successor is found, the leaving PCP chooses a hard transition for the second position advertisement. The change implies, for example, that physicians want to retire at a certain point in time and do not want to postpone this if there are no applicants. This unintentional transition type change would leave room for further investigation, as presumably the unobserved characteristics of physicians in a soft transition and an unintentional

hard transition are comparable (though not the observable other characteristics of the position). However, the number of multiple position advertisements is already very low in the observed period and those with transition type changes are again somewhat reduced. This analysis is therefore omitted here with the reference that this should be a subject of future investigations.

Table A.13: Estimated differences by practice location

Rel. quarter	Rural				Urban			
	Total expend. (1)	Inpat. hosp. expend. (2)	Physician fees (3)	Exp. pres. drugs (4)	Total expend. (5)	Inpat. hosp. expend. (6)	Physician fees (7)	Exp. pres. drugs (8)
<i>Pre-period</i>								
-11	25.8 (15.6)	28.4 (15.3)	0.3 (1.4)	-2.9 (1.9)	25.6 (22.6)	23.9 (22.0)	1.6 (2.1)	0.1 (3.3)
-10	23.9 (15.0)	27.9 (14.6)	-0.8 (1.4)	-3.2 (2.2)	21.5 (22.7)	15.5 (22.1)	5.3** (2.0)	0.7 (3.6)
-9	33.3* (15.4)	33.7* (15.0)	1.3 (1.4)	-1.7 (1.9)	10.4 (22.9)	8.8 (22.3)	3.7 (2.0)	-2.2 (4.1)
-8	26.4 (15.1)	29.8* (14.8)	-0.6 (1.4)	-2.8 (1.7)	36.7 (22.3)	33.2 (21.9)	0.1 (2.1)	3.3 (2.6)
-7	20.7 (14.8)	22.8 (14.5)	-0.7 (1.5)	-1.4 (1.9)	26.9 (23.5)	24.9 (23.2)	1.7 (2.1)	0.4 (3.1)
-6	19.4 (14.5)	20.4 (14.2)	0.1 (1.4)	-1.1 (2.0)	8.7 (20.9)	0.3 (20.7)	5.3** (2.0)	3.1 (2.5)
<i>Notification-period</i>								
-4	52.2*** (14.4)	52.2*** (14.2)	-2.1 (1.4)	2.1 (2.1)	56.8* (23.1)	53.3* (22.9)	0.9 (2.0)	2.6 (1.8)
-3	42.8** (15.9)	41.9** (15.6)	0.6 (1.4)	0.2 (2.0)	43.8 (24.3)	34.6 (23.7)	2.1 (2.1)	7.2* (3.6)
-2	62.5*** (17.1)	58.2*** (16.7)	2.6 (1.5)	1.7 (2.3)	46.7 (26.0)	40.6 (25.0)	-0.8 (5.3)	6.9* (3.5)
-1	77.2*** (17.6)	69.5*** (17.2)	1.8 (1.5)	5.8* (2.7)	23.1 (25.1)	18.9 (24.6)	1.6 (2.1)	2.6 (3.9)
0	110.9*** (17.2)	104.2*** (16.8)	0.2 (1.5)	6.5* (2.6)	35.2 (25.5)	29.4 (24.2)	3.1 (2.1)	2.7 (7.2)
<i>Post-period</i>								
1	99.7*** (18.8)	95.8*** (18.4)	2.9 (1.5)	1.0 (2.8)	72.5* (30.9)	79.2** (26.9)	3.0 (2.2)	-9.7 (14.7)
2	124.1*** (18.7)	119.1*** (18.2)	1.6 (1.5)	3.5 (3.2)	113.8*** (30.2)	108.6*** (26.1)	6.7** (2.1)	-1.5 (14.6)
3	104.6*** (20.3)	98.2*** (19.6)	2.8 (1.5)	3.6 (3.7)	90.8** (30.8)	87.3** (26.8)	5.5* (2.2)	-2.0 (14.4)
4	111.7*** (18.7)	101.3*** (17.9)	2.8 (1.6)	7.6* (3.8)	104.0** (33.5)	104.3*** (28.7)	2.4 (2.2)	-2.7 (16.7)
5	104.5*** (20.7)	99.6*** (20.1)	3.1* (1.6)	1.8 (3.6)	99.1** (32.6)	93.1** (28.5)	4.3 (2.2)	1.6 (15.4)
6	125.7*** (20.5)	119.9*** (20.0)	3.2* (1.6)	2.6 (3.6)	124.4*** (35.0)	114.3*** (30.6)	10.5*** (2.3)	-0.4 (16.6)
<i>Catch-up-period</i>								
7	122.1*** (21.6)	115.2*** (20.9)	5.3** (1.7)	1.7 (3.6)	90.4** (34.6)	91.3** (29.8)	7.7** (2.5)	-8.6 (17.2)
8	96.6*** (21.3)	90.4*** (20.5)	4.6** (1.6)	1.6 (4.0)	65.0 (38.1)	61.0 (33.7)	5.3* (2.2)	-1.3 (17.1)
9	101.7*** (21.4)	93.1*** (20.6)	4.1* (1.6)	4.6 (4.1)	70.6 (37.4)	85.0** (31.7)	5.2* (2.4)	-19.6 (19.1)
10	91.7*** (22.0)	91.8*** (21.3)	2.9 (1.6)	-3.1 (3.8)	91.2* (38.0)	89.8** (33.5)	10.5*** (2.3)	-9.2 (17.2)
11	48.9* (23.7)	50.9* (22.8)	0.3 (1.6)	-2.3 (4.6)	38.1 (35.2)	40.2 (30.1)	6.2** (2.3)	-8.4 (17.6)
12	54.7* (22.7)	59.6** (21.9)	0.4 (1.6)	-5.3 (4.3)	-2.2 (36.0)	12.5 (30.9)	3.5 (2.4)	-18.2 (17.4)
Obs.:	2,282,155	2,282,155	2,282,155	2,282,155	1,317,635	1,317,635	1,317,635	1,317,635
Mean d. v.	554.9	354.3	108.2	92.5	657.4	421.2	126.6	109.6

Estimation output for (1)/(5) total expenditures, (2)/(6) inpatient hospital expenditures, (3)/(7) physician fees and (4)/(8) expenditures for prescribed drugs are shown. The mean of the dependent variable in the notification-period is presented. Coefficients on sex-birth year-exit quarter and region dummies are not shown. * p < 0.05, ** p < 0.01, and *** p < 0.001.

Table A.14: Estimated differences by practice location

Rel. quarter	Rural						Urban					
	GP spec. referral ¹ (1)	PCP spec. referral ¹ (2)	Spec. w/o referral (3)	GP hosp. referral (4)	PCP hosp. referral ¹ (5)	Outpat. dept. visit (6)	GP spec. referral (7)	PCP spec. referral ¹ (8)	Spec. w/o referral (9)	GP hosp. referral (10)	PCP hosp. referral ¹ (11)	Outpat. dept. visit (12)
-11	0.000 (0.003)	0.000 (0.003)	0.008* (0.004)	0.001 (0.001)	0.002 (0.001)	0.043*** (0.005)	-0.004 (0.004)	-0.004 (0.004)	0.010 (0.005)	0.002 (0.001)	0.001 (0.001)	-0.027*** (0.008)
-10	0.001 (0.003)	0.000 (0.003)	-0.002 (0.004)	0.001 (0.001)	0.001 (0.001)	-0.026*** (0.006)	0.004 (0.004)	0.006 (0.004)	0.016** (0.005)	0.002 (0.001)	0.002 (0.001)	-0.004 (0.008)
-9	0.001 (0.003)	0.001 (0.003)	0.001 (0.004)	0.003* (0.001)	0.003* (0.001)	0.000 (0.005)	-0.001 (0.004)	-0.002 (0.004)	0.003 (0.005)	0.002 (0.001)	0.001 (0.001)	-0.003 (0.008)
-8	0.003 (0.003)	0.003 (0.003)	-0.003 (0.004)	0.001 (0.001)	0.002 (0.001)	0.006 (0.006)	0.001 (0.004)	0.002 (0.004)	0.008 (0.005)	0.003 (0.001)	0.002 (0.001)	-0.005 (0.008)
-7	0.001 (0.003)	-0.000 (0.003)	-0.004 (0.004)	0.001 (0.001)	0.001 (0.001)	-0.002 (0.005)	-0.000 (0.004)	-0.000 (0.004)	0.003 (0.005)	-0.000 (0.001)	-0.001 (0.001)	-0.007 (0.008)
-6	0.003 (0.003)	0.003 (0.003)	-0.003 (0.004)	0.000 (0.001)	0.000 (0.001)	-0.001 (0.005)	0.008 (0.004)	0.009* (0.004)	0.009 (0.005)	0.000 (0.001)	0.001 (0.001)	0.008 (0.007)
-4	-0.002 (0.003)	-0.002 (0.003)	-0.006 (0.004)	0.002* (0.001)	0.003** (0.001)	0.002 (0.005)	0.005 (0.004)	0.005 (0.004)	-0.000 (0.005)	0.002 (0.001)	0.002 (0.001)	0.003 (0.007)
-3	0.001 (0.003)	0.001 (0.003)	-0.003 (0.004)	0.002 (0.001)	0.002 (0.001)	0.003 (0.005)	0.001 (0.004)	0.002 (0.004)	0.002 (0.005)	0.002 (0.001)	0.001 (0.001)	-0.002 (0.007)
-2	0.002 (0.003)	0.002 (0.003)	0.001 (0.004)	0.001 (0.001)	0.002* (0.001)	0.003 (0.005)	0.006 (0.004)	0.007 (0.004)	0.004 (0.005)	0.003* (0.001)	0.002 (0.001)	0.000 (0.008)
-1	0.005 (0.003)	0.003 (0.003)	-0.002 (0.004)	0.002 (0.001)	0.003* (0.001)	0.005 (0.005)	-0.004 (0.004)	-0.006 (0.004)	0.000 (0.005)	0.003* (0.001)	0.002 (0.001)	0.002 (0.007)
0	0.010*** (0.003)	-0.001 (0.003)	-0.005 (0.004)	0.002* (0.001)	0.003** (0.001)	0.010 (0.006)	-0.003 (0.004)	-0.013*** (0.004)	0.003 (0.005)	0.001 (0.001)	0.000 (0.001)	-0.008 (0.008)
1	0.001 (0.003)	-0.099*** (0.003)	-0.000 (0.004)	0.001 (0.001)	-0.009*** (0.001)	0.011 (0.006)	0.012** (0.004)	-0.096*** (0.004)	-0.000 (0.005)	-0.000 (0.001)	-0.008*** (0.001)	0.004 (0.008)
2	0.006* (0.003)	-0.042*** (0.003)	0.006 (0.004)	0.002* (0.001)	-0.001 (0.001)	0.017** (0.006)	0.015*** (0.004)	-0.048*** (0.004)	0.019*** (0.005)	-0.000 (0.001)	-0.005*** (0.001)	0.012 (0.008)
3	0.012*** (0.003)	0.000 (0.003)	0.012** (0.004)	-0.000 (0.001)	-0.000 (0.001)	0.015** (0.006)	0.023*** (0.004)	0.011** (0.004)	0.008 (0.005)	-0.001 (0.001)	-0.002 (0.001)	-0.003 (0.008)
4	0.016*** (0.003)	0.010*** (0.003)	0.004 (0.004)	0.001 (0.001)	0.000 (0.001)	0.009 (0.006)	0.022*** (0.004)	0.013** (0.004)	0.006 (0.005)	-0.002 (0.001)	-0.003* (0.001)	-0.009 (0.008)
5	0.022*** (0.003)	0.016*** (0.003)	-0.002 (0.004)	0.001 (0.001)	0.001 (0.001)	0.003 (0.006)	0.030*** (0.004)	0.024*** (0.004)	0.009 (0.005)	0.000 (0.001)	0.000 (0.001)	-0.006 (0.008)
6	0.025*** (0.003)	0.020*** (0.003)	0.001 (0.004)	0.001 (0.001)	0.002 (0.001)	0.012* (0.006)	0.032*** (0.004)	0.025*** (0.004)	0.022*** (0.005)	0.001 (0.001)	-0.000 (0.001)	0.004 (0.008)
7	0.021*** (0.003)	0.015*** (0.003)	0.002 (0.004)	0.001 (0.001)	0.001 (0.001)	0.006 (0.006)	0.025*** (0.005)	0.018*** (0.005)	0.009 (0.006)	-0.001 (0.002)	-0.001 (0.001)	0.004 (0.008)
8	0.027*** (0.003)	0.021*** (0.003)	0.007 (0.004)	0.002 (0.001)	0.001 (0.001)	-0.002 (0.006)	0.026*** (0.004)	0.021*** (0.004)	0.015** (0.005)	-0.000 (0.001)	-0.001 (0.001)	-0.003 (0.008)
9	0.025*** (0.003)	0.020*** (0.003)	0.003 (0.004)	0.002 (0.001)	0.002 (0.001)	0.004 (0.006)	0.027*** (0.004)	0.022*** (0.004)	0.005 (0.005)	0.001 (0.001)	-0.000 (0.001)	0.002 (0.008)
10	0.023*** (0.003)	0.019*** (0.003)	-0.003 (0.004)	0.002 (0.001)	0.002 (0.001)	0.005 (0.006)	0.036*** (0.004)	0.031*** (0.004)	0.013* (0.005)	-0.001 (0.001)	-0.001 (0.001)	-0.005 (0.008)
11	0.020*** (0.003)	0.017*** (0.003)	-0.002 (0.004)	0.001 (0.001)	0.000 (0.001)	-0.001 (0.006)	0.029*** (0.004)	0.024*** (0.004)	0.014** (0.005)	-0.002 (0.001)	-0.002 (0.001)	-0.008 (0.008)
12	0.024*** (0.003)	0.031*** (0.003)	0.001 (0.004)	-0.000 (0.001)	-0.000 (0.001)	-0.002 (0.006)	0.022*** (0.004)	0.030*** (0.004)	0.008 (0.005)	-0.001 (0.001)	-0.001 (0.001)	-0.003 (0.008)
Obs.:	2282155	2282155	2282155	2282155	2,282,155	865,503	1,317,635	1,317,635	1,317,635	1,317,635	1,317,635	451,124
Mean d. v.	0.176	0.165	0.428	0.017	0.014	0.210	0.181	0.170	0.501	0.015	0.011	0.230

Estimation output for (1)/(7) specialist visit from GP referral, (2)/(8) specialist visit from PCP referral, (3)/(9) specialist visit without referral, (4)/(10) treatment in a hospital due to GP referral, (5)/(11) treatment in a hospital due to the PCP referral and (6)/(12) outpatient department visits are shown are shown. The dependent variables hospital referrals and outpatient department visit are indicators, which equals one if a referral or visit was observed and zero otherwise. The mean of the dependent variable is presented. Coefficients on sex-birth year-exit quarter and region dummies are not shown. * p < 0.05, ** p < 0.01, and *** p < 0.001. ¹ The new PCP might not be correctly assigned to the patient in the beginning of the post-period (after the exit of the former PCP) due to the used patient-PCP assigning procedures, especially if the treated person refuses to see any GP after the exit of the old PCP (see Chapter 3.1). Therefore, the drop, beginning in q = 1, might only be technically and not causally related to the PCPs' exit.

Table A.15: Estimation output for hard vs. soft transition

Rel. quarter	Soft transition				Hard transition			
	Total exp. (1)	Inpat. exp. (2)	Physician fees (3)	Exp. pres. drugs (4)	Total exp. (5)	Inpat. exp. (6)	Physician fees (7)	Exp. pres. drugs (8)
<i>Pre-period</i>								
-11	30.7 (16.1)	28.8 (15.7)	1.7 (1.5)	0.3 (2.1)	12.1 (21.1)	19.2 (20.6)	-1.2 (2.0)	-6.0 (3.2)
-10	33.4* (15.5)	28.8 (15.1)	4.7*** (1.4)	-0.1 (2.1)	-0.0 (21.3)	8.2 (20.6)	-3.1 (2.0)	-5.2 (4.1)
-9	25.2 (16.0)	21.2 (15.7)	2.5 (1.4)	1.4 (2.1)	28.5 (21.2)	32.7 (20.5)	3.0 (2.0)	-7.2 (4.1)
-8	19.0 (15.7)	18.9 (15.4)	-1.0 (1.5)	1.1 (1.9)	37.9 (20.7)	40.6* (20.4)	0.6 (2.0)	-3.3 (2.1)
-7	12.4 (15.9)	10.1 (15.6)	1.3 (1.5)	1.1 (2.0)	36.0 (21.0)	42.6* (20.6)	-2.6 (2.0)	-4.0 (2.8)
-6	2.7 (14.6)	-4.0 (14.5)	3.8** (1.4)	2.8 (1.9)	33.9 (20.2)	39.1* (19.8)	-1.8 (1.9)	-3.3 (2.8)
<i>Notification-period</i>								
-4	44.2** (15.3)	41.0** (15.1)	-0.6 (1.4)	3.8* (1.8)	62.1** (20.8)	64.4** (20.5)	-2.0 (2.0)	-0.3 (2.5)
-3	46.3** (16.7)	41.0* (16.4)	2.7 (1.5)	2.7 (2.1)	33.7 (22.1)	31.2 (21.5)	-1.5 (2.0)	4.0 (3.5)
-2	62.2*** (17.7)	55.6** (17.2)	2.1 (3.1)	4.5* (2.3)	51.7* (24.5)	48.5* (24.0)	0.3 (2.1)	2.8 (3.6)
-1	64.8*** (17.3)	57.0*** (16.9)	1.5 (1.5)	6.2* (2.7)	36.9 (25.7)	33.0 (25.1)	2.2 (2.1)	1.6 (3.9)
0	79.5*** (17.4)	67.2*** (17.0)	2.0 (1.5)	10.3*** (2.5)	71.9** (24.9)	75.8** (23.4)	0.3 (2.1)	-4.1 (7.6)
<i>Post-period</i>								
1	89.8*** (19.3)	77.3*** (19.0)	3.6* (1.5)	8.9*** (2.6)	93.1** (30.6)	117.1*** (25.7)	2.4 (2.1)	-26.4 (16.3)
2	136.4*** (19.3)	117.7*** (18.7)	5.5*** (1.5)	13.2*** (3.4)	88.0** (30.1)	106.0*** (25.4)	0.0 (2.1)	-18.1 (15.6)
3	103.3*** (19.6)	89.2*** (19.0)	5.1*** (1.5)	9.0** (3.3)	102.7** (32.8)	109.5*** (28.4)	3.0 (2.2)	-9.8 (15.9)
4	117.5*** (20.0)	100.6*** (19.5)	3.4* (1.5)	13.4*** (3.2)	74.1* (31.3)	83.3*** (24.8)	2.7 (2.2)	-11.9 (18.5)
5	111.8*** (20.8)	101.0*** (20.2)	3.5* (1.6)	7.4* (3.3)	79.4* (32.8)	81.6** (27.7)	4.7* (2.2)	-6.9 (17.0)
6	149.0*** (21.6)	130.9*** (21.1)	8.0*** (1.6)	10.0** (3.6)	82.2* (33.0)	94.5*** (27.3)	1.4 (2.2)	-13.7 (18.1)
<i>Catch-up-period</i>								
7	139.1*** (22.0)	125.5*** (21.3)	8.6*** (1.7)	5.0 (3.7)	58.2 (34.5)	70.9* (28.8)	3.1 (2.4)	-15.8 (18.4)
8	112.2*** (21.7)	101.3*** (21.0)	4.5** (1.6)	6.4 (4.0)	30.4 (38.0)	33.9 (32.8)	5.5* (2.3)	-9.0 (18.5)
9	105.4*** (22.3)	99.3*** (21.5)	4.6** (1.7)	1.5 (4.0)	57.5 (36.4)	68.2* (29.6)	4.6* (2.3)	-15.4 (20.4)
10	120.2*** (23.5)	108.2*** (22.8)	7.8*** (1.6)	4.2 (4.0)	20.9 (34.8)	39.7 (29.2)	1.7 (2.2)	-20.5 (18.2)
11	82.0*** (23.4)	72.7** (22.5)	3.4* (1.6)	5.8 (5.1)	-12.0 (35.9)	4.4 (30.2)	3.5 (2.3)	-19.9 (18.5)
12	55.4* (23.1)	52.4* (22.2)	2.3 (1.7)	0.7 (4.7)	-0.9 (35.3)	27.7 (29.3)	2.0 (2.3)	-30.5 (18.5)
Mean	599.8	384.0	116.5	99.3	578.5	368.2	111.8	98.4

Estimation output for (1)/(5) total health care expenditures, (2)/(6) inpatient hospital expenditures, (3)/(7) physician fees and (4)/(8) expenditures for prescribed drugs are shown. The number of observations are $N = 2,399,529$ (soft) and $N = 1,227,022$ (hard). The mean of the dependent variable is shown at the bottom of the Table. Coefficients on practice location, sex-birth year-exit quarter (t) and region dummies are not shown. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

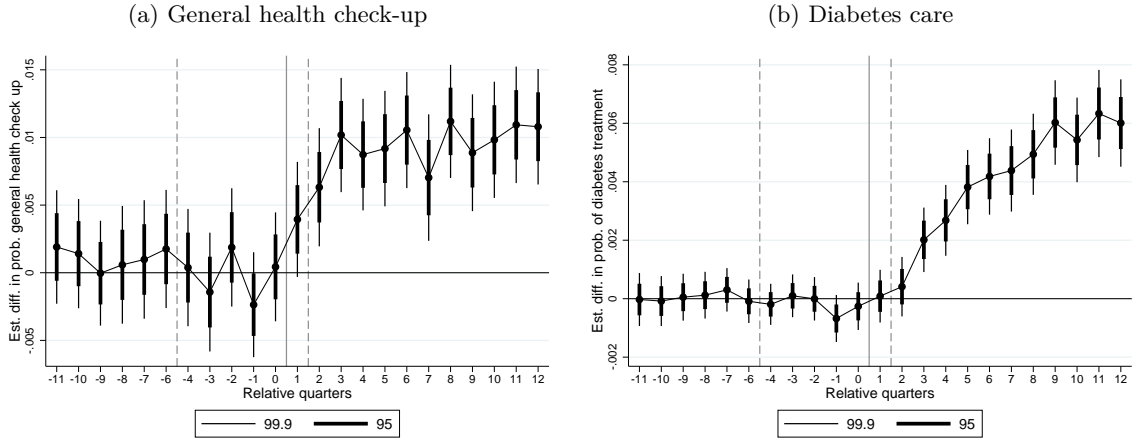
Table A.16: Estimation output for hard/soft vs no transition

Rel. quarter	Hard/soft ($R_{it} = 0$) vs. no transition ($R_{it} = 1$)							
	Total exp. (1)	Inpat. exp. (2)	Exp. pres. drugs (3)	Laboratory (4)	Physician fee (5)	Any GP fee (6)	Any hosp. referral (7)	Out. dept. visit (8)
<i>Pre-period</i>								
-11	-20.2 (50.7)	-23.0 (49.3)	3.7 (5.4)	-0.3 (0.2)	-0.9 (4.5)	-0.8 (1.0)	0.009 (0.007)	-0.001 (0.011)
-10	34.6 (49.7)	40.0 (48.5)	-1.7 (5.2)	-0.3 (0.2)	-3.7 (4.3)	1.0 (1.0)	0.006 (0.007)	0.003 (0.011)
-9	-34.6 (49.3)	-30.9 (48.2)	-3.1 (4.7)	0.1 (0.2)	-0.6 (4.5)	-0.2 (0.9)	0.003 (0.007)	0.008 (0.011)
-8	1.8 (51.9)	2.8 (50.7)	-2.3 (4.8)	-0.1 (0.2)	1.2 (4.9)	-0.6 (1.0)	-0.002 (0.007)	-0.003 (0.011)
-7	-31.7 (51.2)	-26.6 (50.0)	-5.9 (6.1)	-0.1 (0.2)	0.8 (4.6)	-1.4 (1.0)	0.002 (0.007)	0.002 (0.010)
-6	-10.0 (49.2)	-13.5 (48.7)	-2.8 (5.8)	0.0 (0.2)	6.3 (4.4)	0.3 (0.9)	-0.000 (0.007)	0.001 (0.010)
<i>Notification-period</i>								
-4	66.8 (57.3)	71.5 (56.5)	-5.7 (7.1)	0.1 (0.2)	1.0 (4.5)	-0.2 (1.0)	0.008 (0.007)	-0.008 (0.010)
-3	16.7 (53.2)	17.2 (52.0)	-0.6 (6.8)	-0.2 (0.2)	0.0 (4.8)	-1.2 (1.0)	0.004 (0.007)	-0.012 (0.010)
-2	-106.8* (52.4)	-101.1* (50.8)	-3.5 (8.2)	0.3 (0.2)	-2.2 (4.7)	-0.1 (1.0)	-0.005 (0.007)	-0.006 (0.011)
-1	-58.9 (60.8)	-55.7 (59.0)	-5.8 (9.5)	0.1 (0.2)	2.6 (4.8)	0.9 (1.0)	0.000 (0.007)	-0.003 (0.010)
0	39.1 (66.9)	42.2 (65.5)	0.1 (7.2)	0.7*** (0.2)	-3.2 (5.1)	-1.9 (1.1)	0.001 (0.007)	-0.010 (0.011)
<i>Post-period</i>								
1	-89.2 (58.1)	-75.0 (56.5)	-9.6 (7.8)	0.2 (0.2)	-4.6 (4.7)	-4.9*** (1.1)	-0.007 (0.007)	-0.004 (0.011)
2	-0.7 (68.3)	10.0 (66.9)	-16.9* (8.4)	0.1 (0.3)	6.1 (5.1)	-0.9 (1.2)	-0.009 (0.007)	0.003 (0.011)
3	-59.2 (67.9)	-25.0 (65.2)	-23.4* (11.6)	-0.1 (0.3)	-10.8* (4.8)	-3.9** (1.2)	-0.002 (0.007)	0.004 (0.011)
4	-1.0 (73.7)	35.5 (71.1)	-30.5* (12.1)	-0.3 (0.2)	-6.0 (5.1)	-3.5** (1.2)	0.000 (0.007)	-0.004 (0.011)
5	-48.1 (76.2)	-22.5 (74.0)	-18.3 (11.8)	-0.3 (0.2)	-7.4 (5.0)	-3.8** (1.2)	0.000 (0.007)	-0.001 (0.011)
6	-90.0 (76.4)	-74.1 (74.1)	-15.4 (11.3)	-0.7** (0.3)	-0.6 (5.5)	-4.1*** (1.2)	-0.006 (0.007)	-0.001 (0.011)
7	-192.2** (62.2)	-183.3** (59.6)	-4.6 (11.1)	-0.4 (0.3)	-4.3 (5.4)	-3.9** (1.2)	-0.013 (0.007)	-0.001 (0.011)
8	-93.2 (73.6)	-64.4 (71.0)	-27.4 (14.9)	-0.4 (0.3)	-1.4 (5.9)	-6.1*** (1.2)	-0.004 (0.007)	0.011 (0.011)
9	-89.2 (83.8)	-76.0 (76.9)	1.8 (26.4)	-0.7** (0.3)	-15.0** (5.6)	-6.4*** (1.2)	-0.011 (0.007)	-0.005 (0.011)
10	-0.6 (88.5)	21.4 (86.4)	-20.2 (15.5)	-0.6* (0.3)	-1.9 (5.7)	-2.0 (1.2)	-0.005 (0.007)	0.005 (0.011)
11	-83.7 (67.7)	-39.2 (65.4)	-33.8** (11.0)	-0.7* (0.3)	-10.7* (5.1)	-5.2*** (1.1)	-0.000 (0.007)	0.009 (0.011)
12	-14.5 (73.9)	15.4 (70.9)	-22.1 (12.5)	-0.7* (0.3)	-7.7 (5.8)	-5.1*** (1.2)	-0.004 (0.007)	0.014 (0.011)
Mean d. v.	626.2	412.2	100.1	2.8	113.9	35.5	0.070	0.217

Estimation output for (1) total health care expenditures, (2) inpatient hospital expenditures, (3) expenditures for prescribed drugs, (4) laboratory fees (5) physician fees, (6) GPs fees, (7) hospital referral by any physician and (8) outpatient department visit are shown. The number of observations is $N = 359,412$. The dependent variables hospital referrals and outpatient department visit are indicators, which equals one if referral or visit was observed and zero otherwise. Coefficients on practice location, sex-birth year-exit quarter (t) and region dummies are not shown. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

A.5 Preventative health care services

Figure A.12: Total health care expenditures by risk type



Note: Estimation results, with 99.9% and 95% confidence interval, for (a) general health check-up and (b) preventative diabetes care are shown. Both outcomes are binary response variables indicating whether a patient received these services in the respective quarter (= 1), or not (= 0). Detailed estimation results presented in Table A.17.

For many patients a new PCP also means being exposed to a new treatment style. The influence of the successor or new PCP is particularly noticeable in the use of preventive services in the post-period. Figure A.12 shows the estimation results for the probability of a general health check up and diabetes care following estimation model 1. The results show that with the beginning of the post-period the probability to participate in a general health check up increases remarkably. In fact, in comparison to the post-period mean of 3.8%, the estimated effect (e.g. $\beta_6 = 0.011$) corresponds to an increase of 28.9%. The same applies to outpatient diabetes care. Patients whose PCP exit, have a significantly higher probability of being treated due to diabetes by up to 0.4 percentage points (in $q = 6$) in the post-period. This corresponds to an increase of almost 57.1% compared to the post-period mean of $\mu_{post}^{diabetes} = 0.007$. Given these results, it can be concluded that the successors or new PCPs seem to have a sizable impact on the use of preventive services in the post-period³⁵. Although a general health check up, unlike diabetes care (Riedl, Robausch, and Berghold, 2016), has no direct impact on the health status of patients, this examination can serve to provide successor or new PCPs with a summary health report on the new patients under their care (Hackl et al., 2015). The results from this examination can be used to

³⁵The results are the same for persons who stay with the successor and patients who change to another GP/PCP.

identify potential diseases and/or determine future treatment plans and allows physicians to fill potential information gaps about the health status of their patients. Thus, diabetes care and general health check-up are expected to positively influence patients' health status. Also, Simonsen et al. (2021) find significant increase in the detection rates of chronic conditions in the post-exit period and therefore conclude that the change to a new PCP can even improve the health status of patients (Simonsen et al., 2021).

Table A.17: Probability of receiving preventative care

	Diabetes care	General health check-up
<i>Pre-period</i>		
-11	-0.000 (0.000)	0.002 (0.001)
-10	-0.000 (0.000)	0.001 (0.001)
-9	0.000 (0.000)	-0.000 (0.001)
-8	0.000 (0.000)	0.001 (0.001)
-7	0.000 (0.000)	0.001 (0.001)
-6	-0.000 (0.000)	0.002 (0.001)
<i>Notification-period</i>		
-4	-0.000 (0.000)	0.000 (0.001)
-3	0.000 (0.000)	-0.001 (0.001)
-2	-0.000 (0.000)	0.002 (0.001)
-1	-0.001** (0.000)	-0.002* (0.001)
0	-0.000 (0.000)	0.000 (0.001)
<i>Post-period</i>		
1	0.000 (0.000)	0.004** (0.001)
2	0.000 (0.000)	0.006*** (0.001)
3	0.002*** (0.000)	0.010*** (0.001)
4	0.003*** (0.000)	0.009*** (0.001)
5	0.004*** (0.000)	0.009*** (0.001)
6	0.004*** (0.000)	0.011*** (0.001)
<i>Catch-up-period</i>		
7	0.004*** (0.000)	0.007*** (0.001)
8	0.005*** (0.000)	0.011*** (0.001)
9	0.006*** (0.000)	0.009*** (0.001)
10	0.005*** (0.000)	0.010*** (0.001)
11	0.006*** (0.000)	0.011*** (0.001)
12	0.006*** (0.000)	0.011*** (0.001)
Obs.	3,717,789	3,750,647
Mean d. v.	0.006	0.037

Estimation output for (1) preventative diabetes care and (2) general health check-ups are shown. Coefficients on sex-birth year-exit quarter and region dummies are not shown. * p < 0.05, ** p < 0.01, and *** p < 0.001.