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Price sensitivity and demand for healthcare services

Investigating demand-side financial incentives using anonymised claims data from Switzerland

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Disclaimer

This report was commissioned externally by Groupe Mutuel Services AG. The interpretation of the results, the conclusions and the recommendations do not necessarily reflect the opinion of Groupe Mutuel Services AG. The contents of the report have been prepared with the greatest possible care. However, the authors do not guarantee the absolute accuracy, completeness and timeliness of the content provided. The authors have no conflicts of interest or material involvement with the methods or products used in this report. The Chair of Health Care Management at the University of St. Gallen has committed itself to comply with the applicable data protection law in the handling of the anonymised data, even after completion of the study.

Conflict of interest

The content of the study was developed independently by the authors, i.e., freedom of research and teaching was maintained at all times. The study was financed by the Groupe Mutuel Foundation and the third-party funds thus made available were used for the intended purpose. Finally, it should be noted that the purpose of this scientific report is to communicate and illustrate the results obtained. Accordingly, we present the contents and arguments in a precise and concise manner.

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Abstract

Background. Compulsory healthcare insurance in Switzerland entails a deductible system for cost-sharing between insurer and insuree up to a chosen deductible[1]. No study has so far tested the presence of price sensitivity for healthcare resources consumption after exceeding one's chosen deductible. We address this research gap by focusing on the effect of exceeding the deductible on insurees' healthcare consumption. We present three contributions: first, we determine the presence of price sensitivity for healthcare consumption; second, we identify whether this leads to a change in consumption for overuse-prone service groups; third, we explore whether supply side structures influence this change in consumption.

Methods. For our analyses we make use of a detailed and anonymized insuree-level dataset provided by the Groupe Mutuel. We included data for all insurees older than 25 that exceeded their deductible in 2018 and did not give birth between 2017 and 2019. We focus our analyses on the 2,500 deductible group[2] (sample size of 12,135 observations) and provide insights on the 300 deductible group (sample size of 212,249 observations) for a comparison. Our empirical strategy included three steps. First, to control for insurees' individual time-varying and constant characteristics, we ran fixed effects ordinary least square regressions of weekly healthcare expenditures on insuree characteristics. Second, on the residuals obtained from the fixed effect model (i.e., the unexplained healthcare expenditures variation), we ran insuree-level regression discontinuity in time models. Finally, we aggregated the obtained parameters by simple mean. Starting from an explorative specification of the dependent variable including all service groups, we specified our dependent variable in two additional ways: first, we excluded all complex services; second, we only included services for which we could find evidence in the literature that they might be overused. We used the first specification for patient subgroup analyses and sensitivity analyses. The second specification was used to explore potential supply-side structure effects, measured via the density of medical specialists per postal code.

Results. We find a positive difference between healthcare consumption before and after exceeding the deductible, however this increase in consumption is not significant. For insurees without

[1] Throughout this document, the English term "deductible" is adopted to translate the Swiss-German term "Franchise", and the English term "co-payment" is adopted to translate the Swiss-German term "Selbstbeteiligung".

[2] The term "deductible level" is employed in this document to indicate the amount of the deductible; the term "deductible group" is employed to indicate all those insurees who have chosen a certain deductible level.

continuous healthcare expenditures in the 12 weeks before exceeding the franchise, we find a weakly significant increase in subsequent healthcare expenditures, which is however not significant at 95% confidence level. When stratifying insurees based on retirement status, premium reduction, and number of chronic illnesses, we do not find significant effects on the healthcare consumption pattern for any of these subgroups. Finally, supply structures do not significantly influence healthcare consumption patterns after exceeding the deductible.

Conclusions. Our results show that, while there is an overall pattern indicating a higher consumption of healthcare resources after exceeding the deductible, this outcome is insignificant across all specifications. Our findings show that insurees are generally not price sensitive and that the deductible system does not create significant demand-side financial incentives for the consumption of healthcare resources. As cost-sharing solutions have been introduced to curb the rise of healthcare spending, our findings suggest that the deductible system is an effective cost-sharing solution for Switzerland.

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Management Summary

Background

Switzerland's compulsory health insurance includes various cost-sharing mechanisms for insurees (deductibles, co-payments, hospital contributions). The deductible level can be chosen by insurees within six levels (CHF 300-2,500 for adults). Since the introduction of the deductible system, it has been seen as a useful tool to increase cost awareness on the insuree's side. However, it has also been criticized for potentially delaying or preventing necessary care due to cost-sharing and for allowing exceeding the deductible to lead to inappropriate expansion of services. Increased utilization due to exceeding the deductible has not been tested in Switzerland to date. We address this research gap by analysing the effect of exceeding the deductible on healthcare consumption. This study contributes to answering the research questions in three ways: Firstly, we identify whether there is price sensitivity for healthcare consumption. Secondly, we determine whether this leads to a change in consumption for selected services. Thirdly, we examine whether structures on the supply side influence this change.

Data and Methods

We utilize detailed, anonymised data at the insuree level from Groupe Mutuel. We include all insurees over 25 years old enrolled in compulsory health insurance in 2017, 2018, and 2019, who exceeded their deductible in 2018 and did not give birth in any of the three years. We focus our analyses on the group with a deductible of CHF 2,500 (sample size of 12,135 observations) and provide comparative insights into the group with a deductible of CHF 300 (sample size of 212,249 observations). Information on the number of specialist doctors by medical specialty and postal code was provided by SASIS AG.

Our empirical strategy comprises three steps. Firstly, to control for time-varying and constant insuree characteristics, we conduct fixed effects regressions of weekly health expenditures. Subsequently, we use the residuals from the regression models (i.e., the unexplained variation in health expenditures) for each insure as dependent variables in a series of individual-level Regression Discontinuity in Time (RDiT) models. Finally, we average all RDiT parameters across all insurees. As a robustness check, we exclude expenditures two weeks before and after exceeding the deductible to not consider pre- and post-treatment-related expenses. Starting from an exploratory specification of the dependent variable encompassing all service groups, we specify our dependent variable in two additional ways: Firstly, excluding all complex services; secondly, considering only services prone to overuse. We use the first specification for analyses of patient subgroups

and sensitivity analyses. The second specification is employed to explore potential effects of structures on the supply side that can be measured by the density of specialist doctors per postal code.

Results

Our results show that insurees from the CHF 300 and CHF 2,500 deductible groups exhibit the highest annual cumulative expenditures. While there is no clear trend in the timing of health expenditures, there is a significant positive relationship between the deductible level and the week in which the deductible is exceeded, with insurees from higher deductible groups exceeding it later in the year. We observe a positive difference between healthcare consumption before and after reaching the CHF 2,500 deductible; however, this increase in consumption is not significant at a 95% confidence level. This result holds for the group with a CHF 300 deductible as well, where we observe overall higher healthcare expenditures but no significant increase in consumption after exceeding the deductible. For insurees without continuous healthcare expenditures in the 12 weeks before exceeding the deductible, we find a weakly significant increase in subsequent healthcare expenditures, though not at a 95% confidence level. When focusing on subgroups by pension status, premium reduction, and number of chronic illnesses, we do not find significant effects on healthcare consumption. Finally, supply-side structures do not significantly influence healthcare consumption after exceeding the deductible. Several sensitivity tests confirm the robustness of our results.

Conclusion

In summary, our results indicate an overall pattern suggesting higher consumption after exceeding the deductible, but this outcome is insignificant across all specifications of our model. Our findings suggest that the deductible system does not create significant demand-side financial incentives for the excessive consumption of healthcare resources. As cost-sharing systems in healthcare insurance have been introduced worldwide to curb the rise in healthcare expenditures, our results align with the view that the deductible system in Switzerland represents an effective means of introducing cost-sharing, thereby reducing market inefficiencies.

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Zusammenfassung

Hintergrund

Die obligatorische Krankenpflegeversicherung der Schweiz sieht verschiedene Kostenbeteiligungen der Versicherten (Franchise, Selbstbehalt, Spitalbeitrag) vor. Dabei kann die Höhe der Franchise innerhalb von 6 Stufen (CHF 300-2500 für Erwachsene) von den Versicherten gewählt werden. Seit Einführung des Franchise-Systems wird dieses einerseits als nützliches Instrument zur Steigerung des Kostenbewussteins auf Versichertenseite angesehen, andererseits aber auch kritisiert, dass die Kostenbeteiligung möglicherweise notwendige Versorgung verzögert bzw. verhindert sowie eine Überschreitung der Franchise zur unangemessenen Leistungsausweitung führen kann. Eine gesteigerte Inanspruchnahme bei Überschreitung der Franchise wurde für die Schweiz bisher nicht getestet. Wir adressieren diese Forschungslücke, indem wir den Effekt des Überschreitens der Franchise auf die Inanspruchnahme analysieren.

Diese Studie trägt in dreierlei Hinsicht zur Beantwortung der Forschungsfrage bei: Erstens bestimmen wir die Preissensitivität für die Inanspruchnahme; Zweitens identifizieren wir, ob dies zu einer Veränderung der Inanspruchnahme bei ausgewählten Leistungen führt; Drittens untersuchen wir, ob Strukturen auf der Angebotsseite diese Veränderung beeinflussen.

Daten und Methoden

Wir nutzen detaillierte, anonymisierte Daten auf Versichertenebene der Groupe Mutuel. Eingeschlossen wurden alle Versicherten über 25 Jahre, die in den Jahren 2017, 2018 und 2019 in der obligatorischen Krankenversicherung eingeschrieben waren, 2018 ihre Franchise überschritten haben und in keinem der drei Jahre eine Geburt hatten. Wir konzentrieren unsere Analysen auf die Gruppe mit einer Franchise von CHF 2.500 (Stichprobengröße von 12.135 Beobachtungen) und liefern zu Vergleich Einblicke in die Gruppe mit einer Franchise von CHF 300 (Stichprobengröße von 212.249 Beobachtungen). Informationen zur Anzahl der Fachärzte nach Fachrichtung und Postleitzahl wurden von der SASIS AG bereitgestellt. Unsere empirische Strategie umfasst drei Schritte. Erstens führen wir zur Kontrolle für zeitlich veränderliche und konstante Merkmale der Versicherten Regressionen mit fixen Effekten der wöchentlichen Gesundheitsausgaben durch. Die Residuen des Regressionsmodells (d. h. der nicht erklärten Variation der Gesundheitsausgaben) für jeden Versicherten verwenden wir anschliessend für ein Regression Discontinuity in Time (RDiT)-Modell. Schließlich mittelten wir alle RDiT-Parameter über alle Versicherten. Als Robustheitscheck schliessen wir Ausgaben zwei Wochen vor und nach Überschreiten der Franchise aus, um Vor- und Nachsorgebezogene Ausgaben nicht zu berücksichtigen. Ausgehend von einer

explorativen Spezifikation der abhängigen Variable, die alle Dienstleistungsgruppen umfasste, spezifizierten wir unsere abhängige Variable auf zwei weitere Arten: Erstens schliessen wir alle komplexen Leistungen aus; Zweitens berücksichtigen wir nur für eine Ausweitung anfällige Leistungen. Wir verwenden die erste Spezifikation für Analysen von Patientenuntergruppen und Sensitivitätsanalysen. Die zweite Spezifikation wird eingesetzt, um potenzielle Effekte von Strukturen auf der Angebotsseite zu erkunden, die über die Dichte von Fachärzten pro Postleitzahl gemessen werden können.

Ergebnisse

Unsere Ergebnisse zeigen, dass Versicherte aus den Gruppen mit einer Franchise von CHF 300 und CHF 2.500 die höchsten jährlichen kumulativen Ausgaben aufweisen. Während es keinen klaren Trend zum Zeitpunkt der Gesundheitsausgaben gibt, besteht eine deutliche positive Beziehung zwischen der Höhe der Franchise und der Woche, in der die Franchise überschritten wird, wobei Versicherte aus Gruppen mit höherer Franchise diese später im Jahr überschreiten. Wir stellen einen positiven Unterschied zwischen dem Gesundheitsverbrauch vor und nach Erreichen der Franchise von CHF 2.500 fest, jedoch ist dieser Anstieg des Verbrauchs nicht signifikant auf einem Konfidenzniveau von 95 %. Dieses Ergebnis gilt auch für die Gruppe mit einer Franchise von CHF 300, bei der wir insgesamt höhere Gesundheitsausgaben feststellen, aber keinen signifikanten Anstieg des Verbrauchs nach Überschreiten der Franchise. Für Versicherte ohne kontinuierliche Gesundheitsausgaben in den 12 Wochen vor Überschreiten der Franchise stellen wir einen schwach signifikanten Anstieg der anschließenden Gesundheitsausgaben fest, jedoch nicht auf einem Konfidenzniveau von 95 %. Bei der Unterteilung der Versicherten nach Rentenstatus, Prämienreduktion und Anzahl chronischer Krankheiten finden wir keine signifikanten Effekte auf die Inanspruchnahme. Schließlich beeinflussen die Angebotsstrukturen die Inanspruchnahme nach Überschreiten der Franchise nicht signifikant. Mehrere Sensitivitätsprüfungen bestätigen die Robustheit unserer Ergebnisse.

Fazit

Zusammenfassend zeigen unsere Ergebnisse, dass es zwar insgesamt ein Muster gibt, das auf eine höhere Inanspruchnahme nach Überschreiten der Franchise hindeutet, dieses Ergebnis jedoch in allen Spezifikationen unseres Modells insignifikant ist. Unsere Ergebnisse legen nahe, dass das Franchise-System keine signifikanten nachfrageseitigen finanziellen Anreize für eine übermäßige Inanspruchnahme schafft. Da Kostenbeteiligungsmodelle in der Krankenversicherung weltweit eingeführt wurden, um den Anstieg der Gesundheitsausgaben einzudämmen, sind unsere Ergebnisse im Einklang mit der Ansicht, dass das Franchise-System für die Schweiz eine wirksame

Möglichkeit zur Einführung von Kostenbeteiligung darstellt und somit Marktineffizienzen verringert.

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Abbreviations

ATE	Average treatment effect
LATE	Local average treatment effect
DRG	Diagnosis-Related Group
GP	General practitioner
ICD-10	10th revision of the International Statistical Classification of Diseases and Related Health Problems
OLS	Ordinary least squares
PCG	Pharmaceutical cost group
RDD	Regression Discontinuity Design
RDiT	Regression Discontinuity in Time

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1 Introduction

Since 1996 the compulsory healthcare insurance in Switzerland has entailed a deductible[3] system. In this system, all insurees have to co-pay the costs of their annual treatments up to a chosen deductible. In Switzerland, insurees older than 25 years can choose a deductible of CHF 300, 500, 1,000, 1,500, 2,000 or 2,500. The higher the chosen deductible, the lower the insurance premium for the insuree. In addition, once the deductible has been reached, the insuree must pay 10% of the covered treatment costs as co-payment, up to a threshold of CHF 700. Once this threshold has been exceeded, the insuree will not have to share any further treatment costs incurred for the rest of the calendar year.

The introduction of this type of insurance systems worldwide has been accompanied by contrasting effects. On one hand, they have been hailed as a useful tool to increase efficiency in markets through demand-side cost sharing [1]. Demand-side cost sharing is a financial tool which has been introduced in many countries with the aim to decrease the ever-growing demand of healthcare services [2], ideally improving the utility of provided services [3, 4]. Such strategies aim to reduce the incentives for unnecessary healthcare services demand by shifting part of the service costs to out-of-pocket payments by the insurees [5]. Deductibles and co-payments are examples of such strategies, which are often used in countries with a social health insurance system, like Switzerland [6, 7].

On the other hand, cost-sharing insurance contracts have also been described as harmful to social welfare. This is due the fact that deductible-based insurance contracts lead to discrete price jumps, thus generating time-varying incentives for healthcare consumption. They could, for instance, produce an incentive to delay care for (potential) health problems, increasing the overall cost burden of treatment on society due to worse health problems and more costly treatments in the long-term [8]. At the same time, the fact that the insuree pays only a small amount of health care expenses as soon as the deductible is reached, or none at all after the maximum co-payment, leaves an incentive for moral hazard: After exceeding their deductible, insurees might decide to use services that are not beneficial in their individual context leading to unnecessary consumption of healthcare resources [9–11]. In addition, or alternatively, beneficial healthcare consumption from the upcoming calendar year might be "shifted" to the current calendar year to avoid paying for

[3] Throughout this document, the English term "deductible" is adopted to translate the Swiss-German term "Franchise", and the English term "co-payment" is adopted to translate the Swiss-German term "Selbstbeteiligung".

these services in the next calendar year [12]. Supply side structures, such as a relatively high density of service providers in a certain area, could reinforce or amplify this effect by providing easier access to healthcare services creating supply-side induced healthcare consumption [13].

Knowledge on the presence, size, and nature of moral hazard in response to different types of health insurance contracts is critical for the optimal design of health insurance contracts, as well as for worldwide policy endeavours to reduce the high and growing healthcare spending levels. Therefore, the effects of different forms of health insurance contracts on consumption behaviour has been studied at length by recent literature, using a variety of natural experiments. The RAND Health Insurance Experiment in the United States, which employed an expensive randomised control trial to investigate health insurance consumption and is still a gold standard for current research, found a reduction in services (in particular, physician visits and hospitalizations) induced by cost-sharing, without adverse effects on the participants' health [9, 14, 15].

A number of studies have found evidence for price sensitivity leading to a reduction in overall healthcare consumption for insurees that are below the deductible in high-deductible health plans [16–18]. Similar results hold for Switzerland, where the yearly deductible led to a reduction in healthcare spending of 27% for consumers with the highest deductible, especially concerning inpatient care and prescription drugs [19]. On the other hand, consumers with high deductible levels have been shown to spend approximately 29% more (mainly GP or specialist visits and drugs) if they were enrolled in a low deductible health plan [20].

Recent literature has focused on determining specific treatments which are responsible for these consumption effects based on changes in deductible levels. In the Netherlands, a study detected highest price sensitivity for physiotherapy visits and general practitioner visits, lowest for specialist visits and prescription drugs, while hospital care demand was not affected [21]. However, findings on changes in consumption composition are mixed and suggest high heterogeneity [22–25]. In general, current evidence indicates that both useful and nonessential care is reduced when consumers face a higher cost-sharing burden of healthcare consumption [1, 26].

The objective of our analysis is to identify whether insurees are price-sensitive with regards to healthcare services consumption after exceeding their deductible in Switzerland. Additionally, we aim at exploring the extent to which such healthcare services consumption after exceeding the deductible is mediated by structures on the supply-side, measured through the geographical density of general practitioners (GPs) and medical specialists.

Overall, there is mixed evidence from the literature on the presence of price sensitivity for healthcare consumption for insurees in different deductible levels[4] and for different healthcare services. Furthermore, limited literature has explored the effect of exceeding the deductible on healthcare expenditures, and to the best of our knowledge no similar study has so far been conducted for Switzerland.

We aim to address the research gap by answering the following research questions:

1) Are insurees price sensitive with respect to healthcare services consumption?
2) Does price sensitivity differ for healthcare services prone to overuse?
3) Is the consumption of healthcare services influenced by the level of healthcare supply availability?

Regarding potential identification strategies that have been employed in the literature, three main types of quasi-natural experiments can be identified. The design of such studies is dependent on the type of health insurance system. The two most common approaches are, however, only relevant for the US setting, where health insurance is provided by the employer. The first consist in exploiting a mandatory change in employer insurance policy, for example the change from full to partial insurance. However, due to the foreseeable one-time shock, consumers are likely to change consumption behaviour around this event. Furthermore, this setting could lead to biased results due to the difference in behaviour between more and less experienced healthcare users [16]. The second potential approach, instead, compares spending within one employer between fully and partially insured employees. This setting, however, could lead to individual-level selection bias [27]. A third approach can instead be applied in all countries with partial health insurance, such as Switzerland. It consists in the comparison of spending for insurees within a health plan while above or below the deductible. However, it also presents some sources of bias. First, when the comparison is between high deductible insurees who reached the deductible and high deductible insurees who did not reach the deductible, there could be a sampling problem: insurees exceeding the deductible may not be comparable to those who did not exceed their deductible in terms of their consumption decisions and healthcare needs. A second bias comes from the non-randomness of reaching the deductible and the presence of follow-up costs after the treatment that lead to exceeding the deductible. Finally, consumers might decide to increase annual consumption while above the deductible and intertemporarily substitute consumption that would have normally taken place in the following years [28].

[4] The term "deductible level" is employed in this document to indicate the amount of the deductible; the term "deductible group" is employed to indicate all those insurees who have chosen a certain deductible level.

To answer our research questions, we apply the third presented empirical strategy, consisting of the comparison of insurees below and above the deductible, and refine it through our methodology to reduce the above-mentioned biases. In particular, we focus on insurees who exceeded their annual deductible, and compare their healthcare spending before and after exceeding the deductible. To effectively control for patients' characteristics, we apply a three-step methodology consisting in a fixed effects ordinary least square regression model, followed by a regression discontinuity in time (RDiT) model, and the aggregation of the final results through simple mean. Furthermore, we specify our dependent variable, the weekly healthcare expenditures, in three different ways according to the healthcare service groups of interest. We implement several robustness checks to address potential biases, such as anticipation effects, follow-up treatment expenditures, delayed billing, and end-of-the-year expenditures. Finally, we are able to exploit a unique anonymised dataset composed of individual bills for all insurees of a Swiss health insurance that exceeded their deductible in a predefined calendar year (2018). This extensive dataset allows us to implement a set of analyses and robustness checks to support the reliability of our findings.

In this study we present three core contributions. First, we determine the presence of price sensitivity for healthcare consumption; second, we identify whether this leads to a change in consumption for overuse-prone service groups; third, we explore whether supply side structures influence this change in consumption.

This document is structured as follows. In the methods section, we outline the dataset and the empirical approach. In the results section, we show the descriptive statistics and figures; then we present the main results; finally, we show the results of the sensitivity analyses. The contributions and limitations of this paper are presented in the discussion section, and the document concludes with a research outlook and implications for the healthcare system.

2 Data & Methods

2.1 Data

The main analyses in this study are based on anonymised claims data from Groupe Mutuel health insurance bills from 2017 to 2019. Our final sample size consists of 371,206 insurees. Insurees are included according to the following criteria:

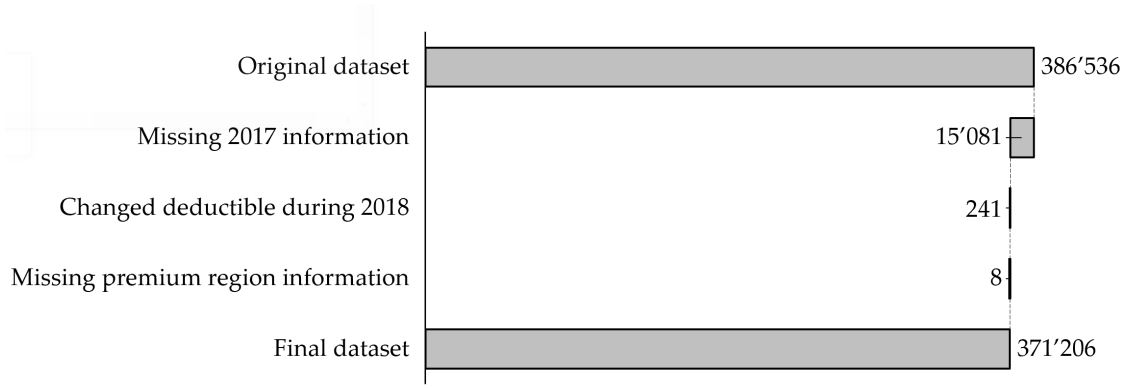
- Inclusion criteria. Insurees that had healthcare expenses higher than their deductible in 2018 and were enrolled in the Groupe Mutuel compulsory health insurance during 2017, 2018 and 2019. In this way we can analyse the healthcare consumption patterns of insurees exceeding their deductible over the course of one year, 2018. Furthermore, we observe insurees one year prior and post the year of interest to understand whether there were changes in insurees' insurance contract. Due to the effects of the Covid-19 pandemic and resulting potential biases for our estimates, we focus our analyses on the years preceding the pandemic. Thus, our year of interest is 2018 and we additionally include 2017 and 2019 in the observation period.
- Exclusion criteria. Insurees that were 25 years old or younger and those who gave birth in 2017, 2018, or 2019. We exclude insurees that are 25 years old or younger because they pay a different, lower, monthly premium, and might not yet be independent from their parents' healthcare consumption decisions. We exclude insurees giving birth because birth-related treatments are not affected by the deductible system.

The data contains the individual items of each bill received or submitted during the observation period for each insuree. For each bill, the date of treatment, billing date, the billing amount in CHF, the tariff used to bill the item and the tariff code are available. In addition, insuree level information include age, nationality (Swiss or non-Swiss), premium region, three-digit postal code, deductible group, premium reduction, and pharmaceutical cost group (PCG) codes. If insurees decreased (increased) their deductible level from 2017 to 2018, this might indicate that they were expecting more (less) healthcare expenses. Thus, we included the level of insurees' previous year's deductible in our model as a control variable. We also included insurees' PCGs from 2017 in our model as control variable accounting for the presence of chronic conditions. Furthermore, we extracted information from SASIS AG on the number of medical specialists available by medical specialty and by postal code, divided by the population in that postal code. This information

was used to gain a measure of supply availability for each type of healthcare services considered in the analyses.

In 2018, 386,416 of insurees enrolled in the Groupe Mutuel compulsory health insurance satisfied our inclusion and exclusion criteria. Of these, 15,081 were not present in the 2017 dataset, therefore their observations were removed, leaving 371,330 insurees in both 2018 and 2017. 241 insurees that changed their deductible plan during the year and 8 for which there was no premium region information were further removed. This delivered observations for 371,206 insurees, which are the object of our analyses. See **Figure 1** for an illustration.

Figure 1. Data cleaning process



2.2 Methods

This section describes the empirical framework and presents the methods used for the estimation of the causal effect of exceeding the deductible threshold on the subsequent healthcare consumption.

Empirical framework

The term "average treatment effect" (ATE) in the literature refers to the expected effect of an explanatory variable (treatment) on the dependent variable (outcomes) [29, 30]. In this framework, each individual has a potential outcome with and without treatment. Each individual also has a treatment status, denoted by a dummy variable which equals one for the treated and zero for the non-treated. In the context of this study, the treatment is understood as the period after having exceeded the deductible.

Several studies from the literature have focused on the comparison between insurees that exceeded their deductible and insurees that did not exceed their deductible in a given year. Instead,

in order to identify the ATE of exceeding the deductible on the subsequent healthcare consumption, we considered only those insurees that exceeded their deductible in 2018 and compared their spending before exceeding their deductible to their spending after exceeding the deductible. The reasons for this choice lie first of all in the need for a reliable control group; secondly, in the need to tackle the potential sampling bias stemming from the comparison of different individuals. In order to be able to compare individuals that exceeded their deductible (treatment group) and those who did not (control group) in a given year, reliable information on healthcare expenditures for both groups are necessary.

However, as of 2018, the responsibility of submitting certain healthcare bills still fell on the insurees themselves. This meant that, if an insuree had not exceeded the annual deductible, they would not have an incentive to submit their healthcare bills to the health insurer, as these would not have been reimbursed. Thus, the dependent variable for this control group might be biased downward. Regarding the comparison of different individuals, there would be instead a sample bias, in so far as insurees that exceeded their deductible in one year might be systematically different from insurees that did not exceed their deductible. This would make the two groups incomparable in terms of consumption decisions and healthcare needs.

Regression Discontinuity Design and Regression Discontinuity in Time Design

Following the reasoning from the previous section, we implemented a Regression Discontinuity Design (RDD) approach. An RDD is a quasi-experimental design that allows to determine the effects of interventions by comparing observations close to each other on the two sides of a given threshold (the treatment of interest). In this way, it is possible to estimate the local ATE (LATE, which is the ATE specific to the group in the "local" area of the variation, i.e., close to the threshold) in cases where randomization of observations is unfeasible [31]. The RDD has expanded rapidly in economics as it requires milder assumptions and provides potentially more credible causal inferences than other natural experiment designs [32]. In this study, we chose a specific and increasingly popular application of the RDD, the Regression Discontinuity in Time (RDiT) design, where time is the running variable, and the treatment occurs at the moment of the discontinuity [32]. In our analysis, this moment is the point in time in 2018 when an insuree exceeds her deductible.

The main identifying assumption needed to guarantee the reliability of our method is that all relevant variables besides the treatment variable and outcome variable are continuous at the point of discontinuity. We check for this by running a series of fixed effects ordinary least squares (OLS) regressions prior to the RDiT models, in a three-step methodology that we explain below. Another important assumption needed for our analysis is that there are no anticipatory effects around the

threshold. When time is the running variable, it is generally not possible to test for strategic behavior around the threshold [32]. We deal with this problem in several ways. First of all, we implement a donut-RDiT, which consists in a robustness check involving repeated estimation with the exclusion of some data points around the threshold [33]. We address the problem of anticipatory behaviour on the side of the insurees by taking into consideration a donut of 2 weeks before and after the threshold. The donut-RDiT analysis also helps to address the fact that each treatment causing the exceeding of the deductible is most likely preceded and followed by some other necessary treatments. Through a 2-week before and after donut, we aim to exclude such treatments from our analysis. We also deal with this problem by repeating our baseline analysis on a subsample of healthcare expenditures from which we exclude the ones that are most likely to present such an issue, such as inpatient treatments, identified by Swiss Diagnosis-Related Groups (DRG) codes.

Another way to isolate the effect of anticipatory behaviours is to look at the different deductible groups and their healthcare expenditure patterns. Our hypothesis is that insurees in the 300 deductible group expect to exceed the deductible already at the beginning of the calendar year, while insurees in the 2,500 deductible group do not normally expect to exceed their deductible. We can therefore limit the problem of anticipatory behaviour by focusing on the 2,500 deductible group.

One additional potential issue for any RDD is that other potential changes triggered by the threshold could potentially impact the dependent variable and cause a bias in the analysis. In our case, such changes would be, for example, additional money transfers triggered by exceeding the deductible, or the inclusion in the disability registry. However, we are not aware of such instances for Switzerland.

In a RDiT setting, time-varying treatment effects should also be taken into consideration. In our setting, it could be the case that time-varying treatment effects are in place. However, as our results summarize the average effect of exceeding the deductible on the subsequent healthcare expenses for the whole period taken into consideration, we are confident that such time-varying effects are not relevant to our research question.

Finally, time-series data are likely to exhibit serial dependence [32], which could lead to biases if not accounted for. We address this problem by conducting an analysis of the auto-regressive behaviour of expenditures, and by including one lag of the healthcare expenditures in our list of controls. **Appendix 1** shows a detailed analysis of the auto-regressive elements in our model. As the results of this analysis show that the auto-regressive correlation is low and the subsequent lags rapidly decrease in magnitude, we decided to introduce only one lag of the dependent variable in the model.

Empirical strategy

As previously mentioned, our empirical strategy consists of three steps. The first step consists in running a series of **fixed effects OLS regressions**, one for each deductible group and for each model. Fixed effects regression is a statistical regression model in which the intercept is allowed to vary freely across individuals or groups. It is usually applied to panel data to control for any individual-specific attributes that do not vary across time [34]. In our case, we use it to control for the constant characteristics of each insuree. The dependent variable are the weekly healthcare expenditures in 2018 at insuree level, as determined by the treatment date. The independent variables are a set of time-varying and constant variables characterizing the insurees.

The fixed effects OLS regression is defined as follows:

$$Y_t = \beta_R R_t + \beta_{RL} R_t L + \beta_{Y_{t17}} Y_{t17} + Y_{t-1} + \beta_A A + \beta_N N + \beta_L L + \beta_{F_{17}} F_{17} + \beta_{\Delta F} \Delta F + \beta_{Y_{17}} Y_{17} + \beta_{D_{17}} D_{17} + \beta_{P_{17}} P_{17} + \beta_{P_{18}} P_{18} + e_t$$

The model is estimated at insuree level, therefore a subscript i for each term is assumed and was omitted to keep the notation lighter. The dependent variable Y_t represents the weekly healthcare expenditures accrued by an insuree in week t.

The first four terms represent the time-varying variables with reference time t. R_t represents whether the insuree received a premium reduction in a given week. $R_t L$ is the interaction term between receiving a premium reduction and the place of living, defined as the premium region. We include this interaction term to account for the fact that the extent of the premium reduction differs between premium regions. Y_{t17} are the weekly expenses in 2017 and Y_{t-1} are the one-week lagged healthcare expenses in 2018. This variable was included to account for the potential autoregressive component.

The following variables are the constant variables. A represents the age of the insuree, N the nationality denoted as dummy variable (Swiss or non-Swiss), and L the premium region. F_{17} is the insuree's deductible level in 2017, and ΔF is a dummy variable representing whether the insuree changed her deductible level between 2017 and 2018. Y_{17} represents the total expenses an insuree accrued in 2017 and D_{17} whether she exceeded her deductible in 2017. P_{17} and P_{18} are a series of dummy variables for the PCG codes assigned to an insuree in 2017 and 2018, respectively. These variables identify whether the insuree bought a certain amount of chronic illness medication, allowingto infer the presence of any of the 34 different possible chronic illness groups. For a full list of the PCG codes used in the analysis see **Appendix 2**.

From the fixed effects regressions, we saved the residuals e_t, representing the variation in expenditures that cannot be explained by the fixed effect model. These residuals are then used as

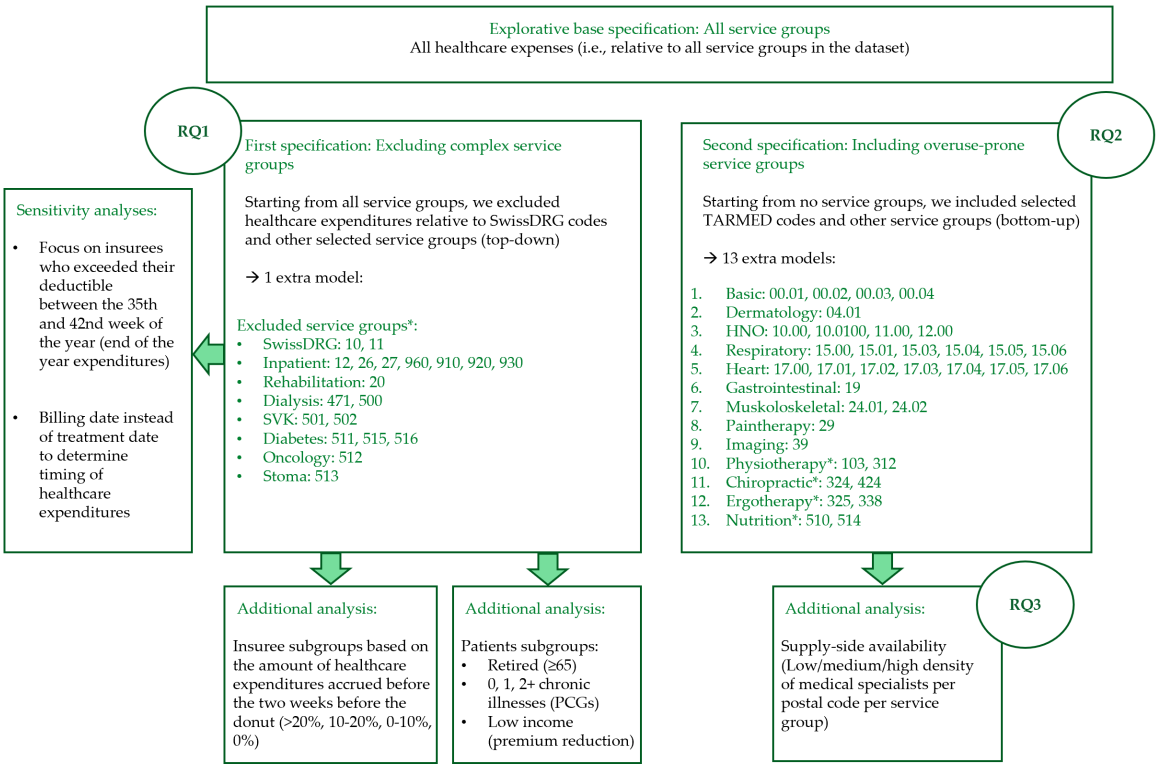
dependent variable in the second step of our analysis, which consists of running a series of **RDiT models at insuree level**. The RDiT regression we implemented is defined as follows:

$$e_t = \tau_0 \mathbb{I}_{\{0 \leq t-T \geq 12\}} + u_t$$

where e_t is regressed on the treatment variable $\mathbb{I}_{\{0 \leq t-T \geq 12\}}$ which equals one in the 12 weeks after the week in which the deductible was exceeded, and zero in the 12 weeks before. The week of exceeding the deductible was determined based on the treatment date.

Once we obtained the RDiT estimates for each insuree, our third step consisted in **the aggregation of the results by simple mean**. The final output is the mean RDiT parameters for each model. Therefore, our coefficient of interest is τ_0, representing the average effect of exceeding the deductible threshold on the insurees' subsequent healthcare expenditures. For example, an estimation of $\tau_0 = 350.31$, if significant, would imply that on average insurees spend 350.31 CHF more per week as a result of exceeding their deductible.

Figure 2. Description of our methodology according to different specifications of the dependent variable and linked to the three research questions (RQ)



*These codes come from the Swiss health insurer and provider classification of tariffs provided by Groupe Mutuel. For more details, see Appendix 3.

We specified the dependent variable in three different ways, according to the healthcare service groups of interest. In an **explorative base specification**, all healthcare expenses per insuree from our dataset are included in the dependent variable. However, as mentioned above, it is important to consider a potential dynamic effect influencing the observed healthcare consumption. This effect consists in the fact that a treatment leading to reaching the deductible level most likely needs pre- and follow-up treatments around the period the deductible is exceeded. Furthermore, in our analysis we are interested in exploring the effect on healthcare services that insurees voluntarily decide to consume. For these reasons, we built a first **specification excluding all complex services**, i.e., all SwissDRG tariffs and other acute somatic care inpatient treatments, chronic disease treatments or rehabilitative services which are unlikely to be overused by insurees, given their level of urgency and necessity. This specification aims at answering our first research question (Are insurees price sensitive with respect to healthcare services consumption?).

On the first model, we implemented an additional insuree subgroup analysis for the 2,500 deductible group. We considered four subgroups of insurees depending on the amount of healthcare expenditures accrued before the two weeks before the week in which the deductible is exceeded (i.e., before the start of the donut in the donut-RDiT analysis). The first group is composed by insurees that had more than 20% of their healthcare expenditures before the start of the donut; the second group contains insurees having between 10 and 20% of their healthcare expenditures before the start of the donut; the third group includes insurees between 0 and 10% of their expenditures before the start of the donut; and the forth group is composed by insurees that had 0% of their healthcare expenditures before the start of the donut. Our hypothesis is that insurees that exhibited a relevant share of their expenditures before the start of the donut (between 10 and 20% or more than 20%) might anticipate that they will reach their deductible during the course of the year, and thus start modifying their healthcare consumption already in the period before the reaching of the deductible. Thus, we assume that they are rather price insensitive or anticipate reaching their deductible level. On the other hand, insurees that had minimal healthcare expenditures before the start of the donut (0% or between 0 and 10%) are hypothesized to reach their deductible because of sudden and unexpected healthcare expenditures that lead them to reach the deductible. We assume this group to show limited anticipating behaviour and to be more price sensitive, thus being the relevant group for our research questions.

The second **specification included only overuse-prone healthcare services** in the dependent variable. We selected these healthcare services based on current literature including mostly imaging and other diagnostic services [16]. As a result, we obtained 13 models, as shown in **Figure 2**. We

use the results from these 13 models to answer our second research question (Does price sensitivity differ for healthcare services prone to overuse?).

To answer our third research question (Is the consumption of healthcare services influenced by the level of healthcare supply availability?), we exploit information on the number of medical specialists by postal code that was made available by SASIS AG. For every three-digits postal code in our sample, we identify whether there is low, medium, or high density of each medical specialty in the 13 models. To do so, we look at the distribution of medical specialist divided by the population and separate it in terciles. In this way, we obtain a categorical variable with three possible values (low, middle, and high) for the supply availability level for each postal code and each medical specialty. We subsequently match this information with the 13 models presented above. We finally calculate the average RDiT for each supply availability level and each medical specialty. This allows us to explore the differential effects that exceeding the deductible has on excess expenditures for specific healthcare services.

Besides the main analyses described above we carry out additional subgroup analyses, which can be found in the Appendix. We take into consideration three patients' subgroups:

- Retired (≥ 65) vs. non-retired insurees: We hypothesize that retired people have more time availability to consume healthcare services
- Premium reduction vs. no premium reduction in 2018: A premium reduction indicates lower socio-economic status and the presence of more stringent budget constraints.
- (Multiple) chronic diseases vs. no chronic disease of the patient: We expect insurees with chronic illnesses to have a higher expected healthcare consumption.

Finally, we conduct two sensitivity analyses, whose results are presented in the results section:

- Focus on year-end spending: Following the concern that we might not capture healthcare expenses accrued at the end of the calendar year for those insurees that exceeded their deductible at the beginning of the year, we perform a sensitivity analysis in which we focus only on those insurees that exceeded their deductible between the 35th and the 42nd week of the year. In this way, we can isolate insurees with potential overuse at the end of the calendar year, just before the new year deductible reset.
- Use of billing date instead of treatment date: We use the billing date both for determining when the deductible was exceeded and for the subsequent treatments. This is done to account for the fact that the billing of a healthcare expense can happen several months after the treatment has taken place, and insurees not realizing that they surpassed their deductible.

3 Results

In this section, we show descriptive statistics and figures to provide an overview of our sample's characteristics, healthcare expenses distribution and timing across deductible levels. Then, we present the results of our main models, of the subgroup analyses, and of the supply availability analysis. Finally, we show that our results are robust to two sensitivity analyses.

3.1 Descriptive results

Table 6. Descriptive statistics

Deductible levels	300	500	1,000	1,500	2,000	2,500	Total
Sample size	212,249	111,566	14,084	17,997	3,175	12,135	
Weekly healthcare expenses [CHF] (Dependent Var.)							
Mean (SD)	164 (864)	140 (751)	122 (937)	140 (806)	159 (896)	163 (965)	154 (835)
Median (IQR)	0 (0 - 316,000)	0 (0 - 360,000)	0 (0 - 540,000)	0 (0 - 128,000)	0 (0 - 101,000)	0 (0 - 220,000)	0 (0 - 540,000)
Yearly Total Consumption in 2017 [CHF]							
Mean (SD)	8,290 (14000)	6,880 (12,600)	5,660 (11,400)	5,900 (11,400)	6,330 (11,400)	5,160 (10,500)	7,530 (13,300)
Median [Min, Max]	3,970 [2.55 - 1,060,000]	3,350 [2.55 - 1,600,000]	2,620 [8.60 - 463,000]	2,670 [4.60 - 371,000]	2,930 [7.60 - 248,000]	2,200 [2.65 - 323,000]	3,580 [2.55 - 1,600,000]
Yearly Total Consumption in 2018 [CHF]							
Mean (SD)	8,510 (14,200)	7,290 (12,500)	6,370 (11,900)	7,290 (12,600)	8,250 (11,400)	8,460 (12,700)	8,000 (13,500)
Median [Min - Max]	4,050 [0 - 1,100,000]	3,530 [0 - 868,000]	3,250 [0 - 546,000]	3,810 [9.55 - 346,000]	4,590 [686 - 150,000]	4,980 [88.3 - 377,000]	3,900 [0 - 1,100,000]
Retirement age [age]							
>= 65	38.30%	41.50%	25.30%	27.40%	23.70%	16.10%	37.40%
Mean (SD)	59.2 (15.7)	60.8 (14.6)	54.6 (14.4)	55.9 (14.0)	54.2 (13.8)	51.2 (13.2)	59.1 (15.3)
Swiss citizenship							
Yes	66.8%	64.4%	66.3%	70.5%	67.9%	65.1%	66.2%
Changed Deductibles Between 2017/2018							
no	96.20%	98.70%	90.10%	92.90%	62.90%	79.70%	95.70%
Deductible level in the previous year (2017) [CHF]							

300	96.20%	0.30%	5.70%	1.90%	5.70%	4.40%	55.60%
500	1.20%	98.70%	2.10%	1.00%	1.90%	1.70%	30.60%
1,000	0.40%	0.20%	90.10%	3.70%	5.40%	2.40%	4.00%
1,500	0.90%	0.40%	0.80%	92.90%	23.30%	9.80%	5.70%
2,000	0.20%	0.10%	0.30%	0.10%	62.90%	1.90%	0.70%
2,500	1.10%	0.40%	1.00%	0.50%	0.90%	79.70%	3.40%
Exceeded Deductibles in 2017							
no	4.20%	7.30%	22.50%	33.00%	36.10%	49.00%	8.90%
Premium Reduction in 2018							
yes, not whole year	6,554 (3.1%)	3,420 (3.1%)	348 (2.5%)	381 (2.1%)	57 (1.8%)	244 (2.0%)	11,004 (3.0%)
yes, whole year	74,308 (35.0%)	23,000 (20.6%)	2,439 (17.3%)	2,732 (15.2%)	912 (28.7%)	2,498 (20.6%)	105,889 (28.5%)
Number of Chronic Illnesses in 2018							
1	32.30%	32.20%	26.10%	27.30%	26.50%	23.70%	31.40%
>=2	12.80%	10.40%	6.00%	5.80%	6.60%	4.60%	11.20%
Number of Chronic Illnesses in 2017							
1	30.30%	29.60%	22.10%	22.90%	21.90%	17.10%	28.90%
>=2	11.00%	8.50%	5.00%	4.10%	4.80%	3.30%	9.40%

Note: numbers were rounded to the first decimal point.

Table 1 shows descriptive statistics by deductible level. The variables age, number of chronic illnesses, and premium reduction are simplified in **Table 1** to ease the interpretation and to reflect the grouping made for the insuree subgroups analysis. A full list of descriptives for these variables can be found in **Appendix 4**.

Around 57% of insurees in our sample were enrolled in the 300 deductible level and 3.2% in the 2,500 deductible level in 2018. These percentages reflect the fact that our sample only includes those insurees that exceeded their deductible in 2018.

The highest average weekly healthcare expenditures occurred among individuals with deductible levels of 300 and 2,500 (CHF 164 and 163, respectively).

Yearly total consumption increased from 2017 to 2018 for all deductible levels. This can be partially explained with the fact that the insurees from 2018 are only those that exceeded their deductible, while the same is not true for 2017. Insurees from the 300 deductible level exhibited the highest yearly consumption in both periods, reaching CHF 8,290 in 2017 and 8,510 in 2018.

In the 2,500 deductible group, 83.9% insurees were represented by non-retired individuals. That represented the highest share among the different deductible levels.

In our dataset, 95.7% insurees in 2018 were in the same deductible group as in 2017. The biggest share of insurees (37.1%), who switched their plan in 2017, was enrolled in the 2,000 deductible plan in 2017. One fifth of the insurees of the 2,500 deductible group also decided to change to another plan. For the 300 deductible group only 3.8% of individuals changed their plan.

91.1% of insurees exceeded their deductible level in 2017. This number is as expected lower than the number of "exceeders" in 2018, which is 100% according to our sample selection. Based on the data, the largest number of "exceeders" occurred in the 300 deductible level, and the smallest in the 2,500 deductible level.

The majority of insurees (68.5%) did not receive a premium reduction in 2018, while 28.5% received it for the whole year. The largest share of premium reductions (35%) was observed among insurees enrolled in the 300 deductible plan. 21.57% of insurees in the 2,500 plan received a premium reduction as well.

Finally, according to the dataset, most of the insurees did not suffer from a chronic disease based on the PCG classification (57.4%). Approximately 31.4% of insurees had one chronic disease, while the remaining part of the sample suffered from two or more chronic conditions based on the PCG classification.

Figure 3 shows the trend in the cumulative healthcare expenditures throughout the calendar year 2018 across the different deductible levels. We observe here that the 300 and 2,500 deductible groups present the highest cumulative expenses. It is of interest to observe that the healthcare expenditures of the two groups end up converging to a similar level at the end of the year. Additionally, we see how the 500 and 1,500 deductible level present the same trend in their cumulative healthcare expenditures.

Figure 3. Cumulative average healthcare expenditures by deductible level in 2018

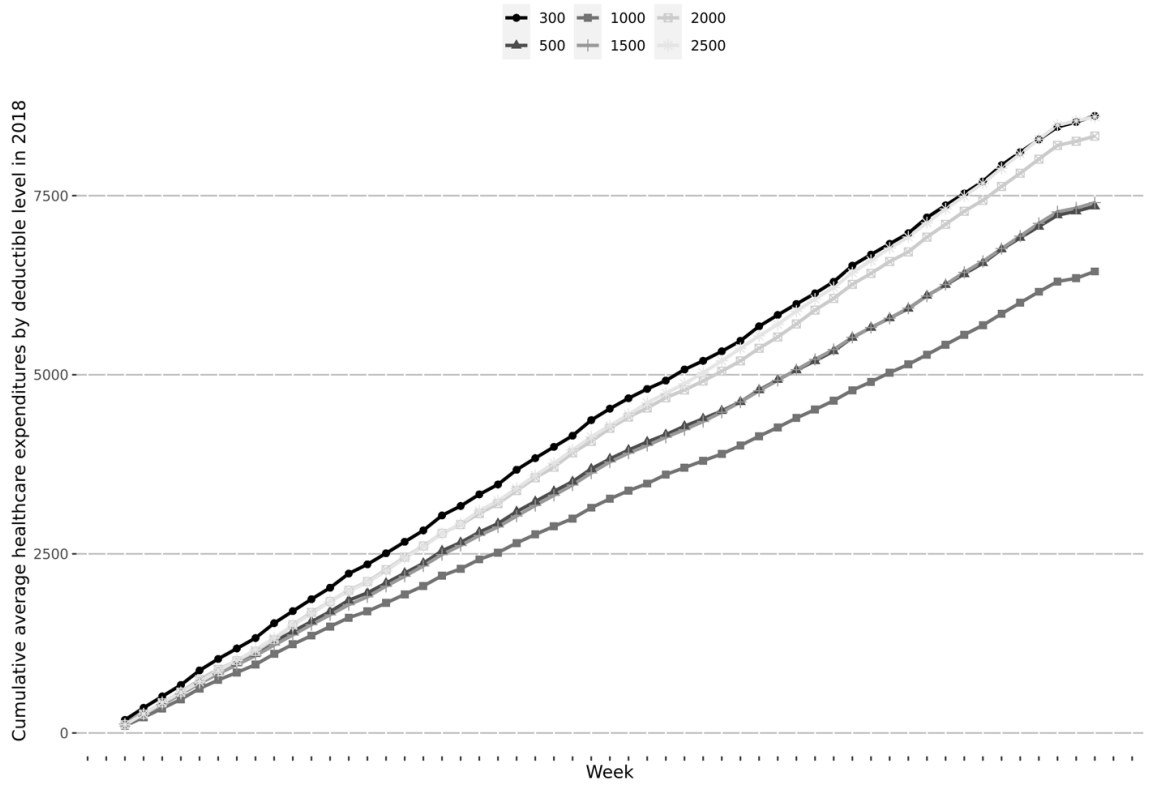
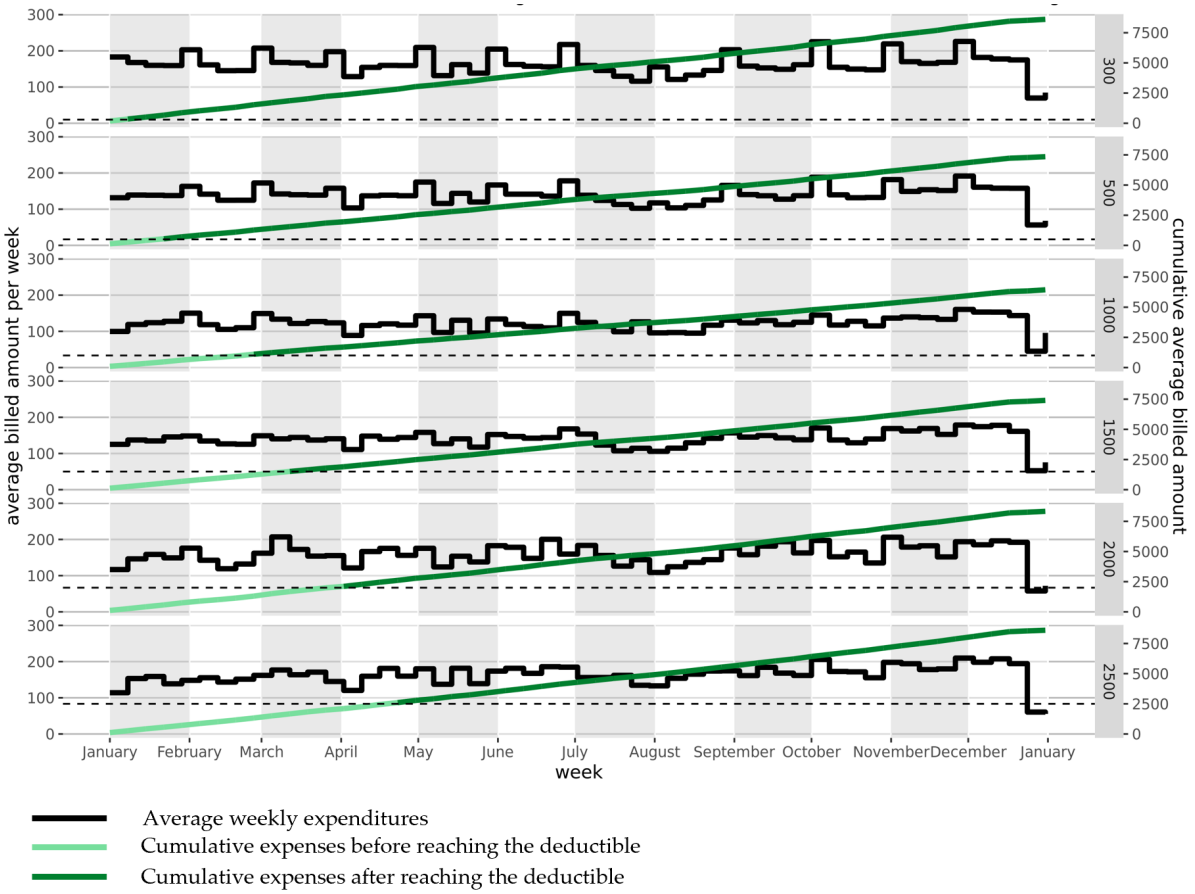


Figure 4 shows the average weekly and cumulative expenses for the different deductible levels. The plot shows that insurees from the 300 deductible group exceed their deductible earlier in the calendar year compared to the 2,500 deductible group, and in general a negative correlation between the timing of the exceeding of the deductible and the deductible levels is observable, with insurees from lower deductible groups exceeding their deductible earlier than insurees from higher deductible groups. On the other hand, there is no clear trend in the timing of the average expenditures throughout the calendar year, except for a small summer and winter drop.

Figure 4. Average and cumulative weekly healthcare expenditures by deductible level in 2018



3.2 Regression results

Main results

Table 2 shows the results[5] of the donut-RDiT for all three specifications of the dependent variable relative to the 2,500 deductible group. The results of the RDiT analysis without donut are shown in the **Appendix 5**. We observe a consistent picture for all three specifications of the dependent variable: the mean estimate is positive for all but one model specifications ("Chiropractic"), it is insignificant across all specifications.

More in detail, the results for the "All service groups" specification show the results of the first exploratory specification, where all service groups are included. We see that the mean estimate is positive in this specification, but not significant. By comparing the donut estimate with the no-donut estimate in **Appendix 5**, one can notice how the estimate decreases in magnitude in the donut analysis. This suggests that the donut is successful in excluding the follow-up treatments from the analysis. By looking at the "Exclude service groups" specification results, we see that there is a positive difference between the healthcare consumption before and after reaching the deductible, however this difference is also not significant. We note the same effect in the donut analysis on the mean estimates as in the "All service groups" model. Finally, we show the results for the 13 extra models created using the second specification of the dependent variable. Apart from the mean estimates in the donut analysis for the "Chiropractic" service group, which are negative and not significant, all the other estimates are positive, though not significant. We note that the "Gastrointestinal" cost group presents a higher mean estimate with respect to the other cost groups, followed by "Pain therapy" and "Physiotherapy".

Table 7. RDiT results for the 2,500 deductible group with donut for the three specifications of the dependent variable (All service groups, Excluding complex service groups, Including over-use-prone service groups)

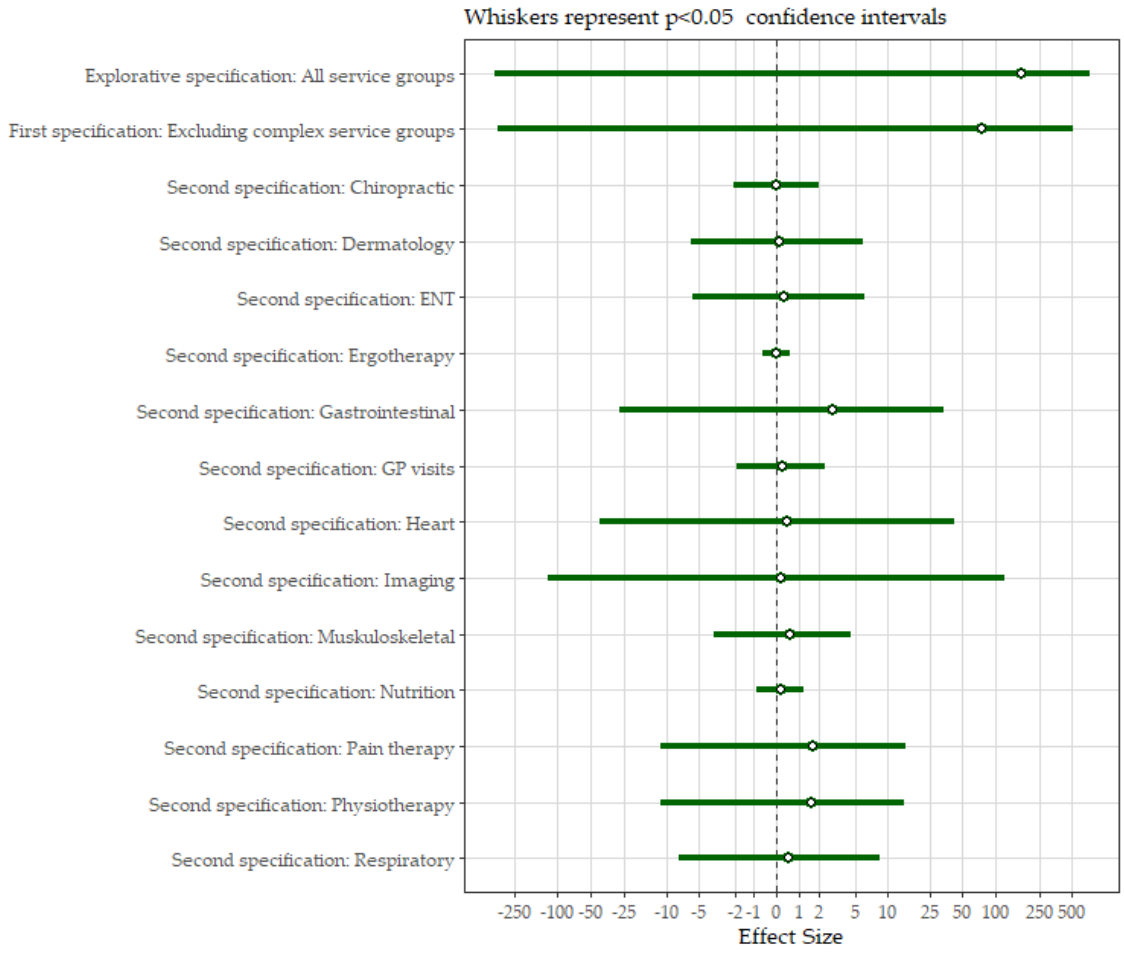
Specification	Mean estimate	Lower bound	Upper bound	N	SE	P-value
Explorative specification: All service groups	170.30	-378.88	719.48	5480	280.20	0.27
First specification: Excluding complex service groups	75.13	-356.63	506.90	5481	220.29	0.37
Second specification: Chiropractic	-0.02	-2.08	2.04	5587	1.05	0.51

[5] For a better understanding of the presented results, we provide an example. The mean estimate for the specification of healthcare expenditures for all service groups means that on average, an insuree exceeding the 2,500 deductible spent CHF 75.13 more after exceeding the deductible as compared to before exceeding it. The lower and upper bounds indicate the range of values the mean might actually fall into with a 95% probability, i.e., the average insuree might spend between CHF 356.63 less and CHF 506.90 more after exceeding the deductible. As this range includes both negative and positive values, the mean estimate is insignificant. This is also represented by the p-value of 0.37. This p-value means that the range of the mean estimate is consistently positive with a probability of only 63% (100% - 37%), i.e., less than 95%.

Second specification: Dermatology	0.09	-5.82	6.01	5565	3.02	0.49
Second specification: ENT	0.30	-5.63	6.22	5784	3.02	0.46
Second specification: Ergotherapy	0.00	-0.60	0.60	2730	0.30	0.50
Second specification: Gastrointestinal	2.96	-27.12	33.03	5374	15.34	0.42
Second specification: GP visits	0.26	-1.85	2.36	5507	1.07	0.41
Second specification: Heart	0.43	-41.37	42.22	5074	21.32	0.49
Second specification: Imaging	0.16	-122.23	122.55	5415	62.44	0.50
Second specification: Musculoskeletal	0.54	-3.47	4.55	5311	2.05	0.40
Second specification: Nutrition	0.16	-0.91	1.22	2859	0.54	0.39
Second specification: Pain therapy	1.64	-11.51	14.80	5670	6.71	0.40
Second specification: Physiotherapy	1.58	-11.58	14.75	2677	6.72	0.41
Second specification: Respiratory	0.50	-7.72	8.72	5304	4.19	0.45

Figure 5 provides a visual illustration of the logged effect sizes of the different models using the results from the donut-RDiT regressions.

Figure 5. RDiT effect sizes compared for the 2,500 deductible group for the three specifications of the dependent variable, with donut



We find similar results for the 300 deductible group, as shown in **Appendix 6**. While all the mean estimates are positive and non-significant, the magnitude for the specification including all

healthcare expenditures is the largest, followed by the specification of healthcare expenditures for overuse-prone service groups. With respect to results for the 2,500 deductible group, the specification including all healthcare expenditures shows a lower mean estimate. The model following the first specification (i.e., excluding selected service groups) shows instead a higher mean estimate. Among the 13 specifications focusing on selected service groups, "Imaging" is the service group with the highest mean estimates, followed by "Gastrointestinal" and "Heart".

Subgroup analyses results

Table 3 shows the results of the insuree subgroup analysis based on the specification of healthcare expenditures excluding complex service groups. We focus here on the amount of healthcare expenditures that insurees have accrued before the start of the donut (more than 20%; between 10 and 20%; between 0 and 10%; 0%). While the mean estimates are insignificant at 95% confidence interval, we notice that the estimates for the insuree subgroups composed of those insurees that spent 0% of their healthcare expenditures before the start of the donut come close to statistical significance (p-value of 0.07).

Table 3. Insuree subgroup analysis based on the specification of healthcare expenditures excluding complex service groups, with donut-RDiT results for the 2,500 deductible group, depending on the share of healthcare expenditures accrues before the start of the donut

Share of healthcare expenditures before start of the donut	Mean estimate	Lower bound	Upper bound	N	SE	P-value
More than 20%	46.89	-381.39	475.17	4755	218.52	0.42
Between 10 and 20%	260.11	-194.45	714.67	726	231.92	0.13
Between 0 and 10%	352.99	-191.59	897.57	438	277.85	0.10
0%	292.37	-96.83	681.57	210	198.57	0.07

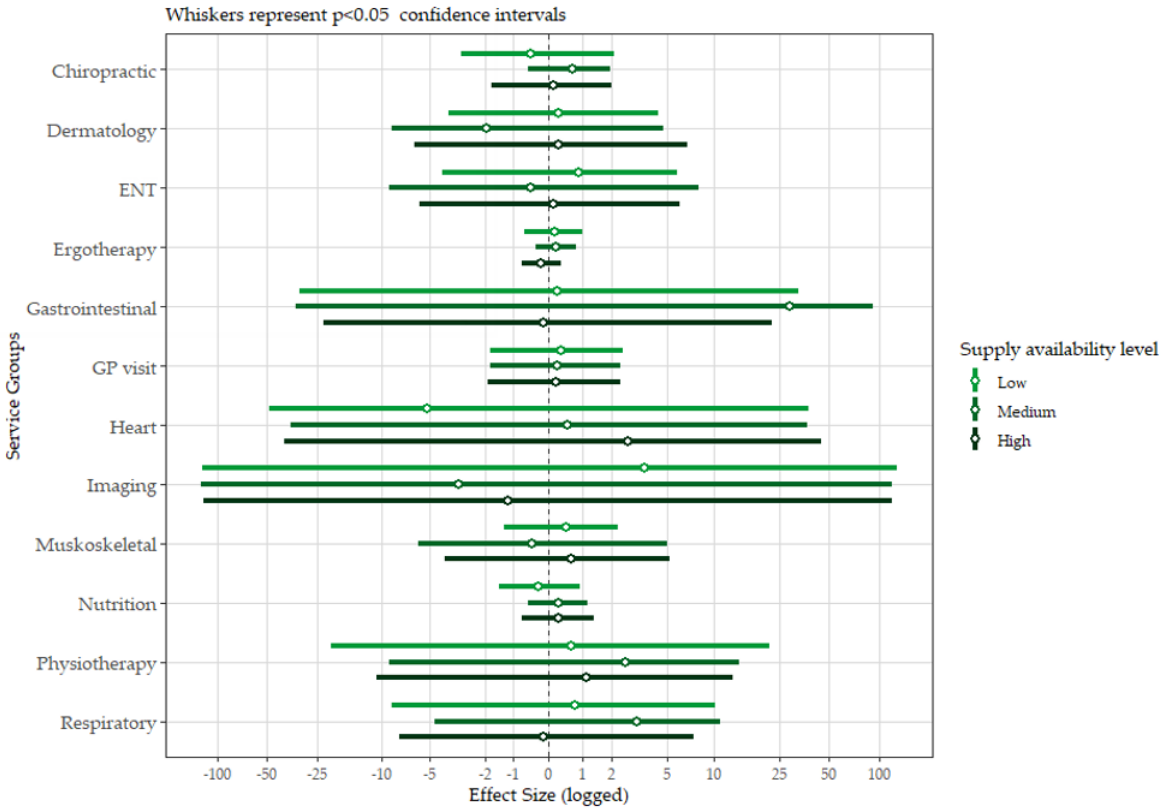
In **Appendix 7**, we show the result of an additional patient subgroup analysis conducted by grouping the insurees according to three different variables: the dummy variable "retirement age", the dummy variable "premium reduction", and the categorical variable "number of chronic illnesses". While all the mean estimates are positive, we did not find that a specific subgroup of patients significantly increased their healthcare consumption after exceeding the deductible. We do observe a higher mean estimate for insurees older than the legal retirement age compared to

the non-retired, for insurees with multiple chronic illnesses, and for insurees with no premium reduction.

Supply availability analysis results

Figure 6 shows the logged results of our sub-research question on whether supply availability influences the healthcare consumption after exceeding the deductible. We do not find a significant increase in healthcare consumption for any level of supply availability. For the service groups "Nutrition" and "Heart", we observe an increasingly positive relationship between supply availability level and healthcare expenditures per insuree. However, we do not observe this relationship for any other service group. **Appendix 8** shows that the majority of postal codes present a high availability of each medical specialty.

Figure 6. RDiT effect sizes compared for the 2,500 deductible group by supply availability level of medical specialties, with donut



Sensitivity analyses results

Table 4 shows the results of the sensitivity analysis based on the first specification of healthcare expenditures. In this sensitivity analysis we divide insurees into two groups, those who exceeded their deductible between the 35th and 42nd week of the year, and those who exceeded their

deductible before that. While we observe a slightly higher mean estimate for the former group, the estimate still is insignificant.

Table 8. Sensitivity analysis based on the specification of healthcare expenditures excluding complex service groups, with donut-RDiT results for the 2,500 deductible group for insurees exceeding the deductible at the end of the year

Week of exceeding the deductible	Mean estimate	Lower bound	Upper bound	N	SE	P-value
35th – 42nd week	79.86	-332.49	492.21	956	10.39	0.35
Before the 35th week	74.13	-361.73	509.99	4,525	222.38	0.37

Finally, **Table 5** shows the results of the sensitivity analysis using the billing date instead of the treatment date. This sensitivity analysis is also based on the first specification of healthcare expenditures excluding complex service groups. The mean estimate is slightly higher than in the main model (75.13), yet it remains insignificant.

Table 9. Sensitivity analysis based on the specification of healthcare expenditures excluding complex service groups with donut-RDiT results for the 2,500 deductible group using billing date instead of treatment date

Mean estimate	Lower bound	Upper bound	N	SE	P-value
80.13	-349.92	510.18	5,219	219.42	0.36

4 Discussion

Summary of our findings

In what follows, we present the summary and interpretation of our results according to our three research questions.

(1) Are insurees price sensitive with respect to healthcare services consumption?

First, we determined whether insurees are price sensitive with respect to healthcare consumption. Our results show that, while there is an overall pattern indicating a higher consumption of healthcare resources after insurees from the 2,500 deductible group exceed their deductible level, this consumption increase is insignificant across all specifications of our model. Hence, on average, insurees seem not to react significantly to price changes of their healthcare services induced by exceeding their deductible level. Thus, they are on average not price sensitive, and do not significantly change their consumption behaviour. This is true for our explorative specification of the model including all healthcare expenditures, as well as the model specification excluding complex service groups. Furthermore, this result also holds for the 300 deductible group.

As the commonly used measure of moral hazard in health insurance is the demand-side price sensitivity for healthcare services [35, 36], the fact that after exceeding the deductible (which implies a 90% reduction in the price for healthcare services consumed afterwards) the insurees do not significantly increase their healthcare consumption shows that there is no conclusive evidence of the presence of moral hazard after exceeding the health insurance deductible in Switzerland. We find this effect both in the lowest (i.e., 300) and in the highest (i.e., 2,500) deductible groups.

Cost-sharing solutions in health insurance have been introduced worldwide in order to curb the rise of healthcare spending [4]. Our findings suggest that the deductible system as a cost-sharing solution for Switzerland does not create significant demand-side financial incentives for the overuse of healthcare resources. Our findings are therefore in line with the view that the deductible system for Switzerland is an effective way to introduce cost-sharing, thus decreasing market inefficiencies [1]. On the other hand, our results show that the accounts of price sensitivity for healthcare demand, such as the estimates from the RAND Health insurance experiment [9, 14, 15], do not apply to insurees once they have exceeded their deductible in Switzerland.

While there might be many explanations at work, it is important to note that in our setting the price for healthcare services does not go down to zero for the healthcare services used after exceeding the deductible. Instead, insurees still have to pay 10% of their healthcare expenses until reaching a second threshold of CHF 700 of out-of-pocket expenditures (resulting in CHF 7000

worth of healthcare services used on top of the deductible). This might reduce the incentive to consume healthcare services that are not necessary to the individual situation [37].

Our findings provide further insights on insuree behaviour thanks to a subgroup analysis aiming at isolating those insurees that exceeded the deductible level due to sudden, and unexpected, healthcare expenditures. This category of insurees was hypothesized to be less prone to anticipatory behaviour and assumed to be more price sensitive. The picture slightly changes when we look at insurees which continuously consume until their deductible level is exceeded and insurees who consume less than 20% of their deductible level before surpassing the deductible level. In particular, we see different effects in place. While the former group does not show significant increased consumption of health care services after exceeding the deductible level, for insurees that spent 0% of their healthcare expenditures before the two weeks preceding the week in which the deductible was exceeded a weakly significant increase in weekly healthcare expenditures can be shown compared to before. Their mean estimates remain nevertheless insignificant at a 95% confidence level.

This can have multiple reasons. First of all, in our analysis we are comparing healthcare expenditures before and after exceeding the deductible. Therefore, the fact that insurees spending less than 10% of their healthcare expenditures before the donut present higher healthcare expenditures after exceeding their deductible might be due to their low baseline healthcare expenditures. Another reason might come from the fact that insurees are indeed price sensitive and consume more healthcare services than before exceeding the deductible because they do not have to bear high treatment costs for those services. We can assume that this subgroup of insurees accruing less than 10% of their expenses before the start of the donut is composed by both mentioned categories. In either case, we can conclude that consumption behaviour changed for this subgroup. We cannot however conclude that there was overuse.

In an additional subgroup analysis, focused on specific groups of insurees for which we hypothesized consumption effects, we do not find a significant increase in healthcare expenditures after exceeding the deductible level. This is the case for insurees benefitting from a premium reduction, which is an indication of a low socioeconomic status of the insuree and the presence of more stringent budget constraints, which should increase price sensitivity. The same result holds true for insurees that are retired, and who should have more time availability to consume healthcare services. Finally, by investigating the differential effects for insurees with and without chronic illnesses, we do not find a significant increase in healthcare expenditures after exceeding the deductible level.

Despite the fact that our study shows no significant increase in the consumption of healthcare resources after exceeding the deductible, we cannot completely exclude the hypothesis that the

deductible system, and in particular high-deductible plans, might reduce the use of necessary healthcare services, thus leading to an under-consumption of healthcare resources [38] and increasing the overall financial burden for society in the long-term [8]. What we can show is that insurees are not price sensitive with respect to healthcare services use after exceeding the deductible. This suggests that during the period before exceeding the deductible there was no unmet healthcare need – at least as perceived from the insurees themselves. If it had been the case, we would expect that as soon as the deductible is exceeded, insurees would make up for the necessary healthcare services that they had not been able to consume due to high out-of-pocket costs. However, insurees might not know best what services they should consume or not. Most notably, it has been shown that insurees under-consume preventive services [16], and chronic illness medications [37], which are typically considered high-value care services. Furthermore, there might be other obstacles than price to the use of healthcare services, such as lack of time [39]. This means that there is still the possibility that some healthcare services might be under-consumed by the insurees in the context of the deductible system in Switzerland.

(2) Does price sensitivity differ for healthcare services prone to overuse?

Second, we identified whether this leads to a change in consumption for some service groups that have been shown in the literature to be prone to overuse.

Results from the analysis on specific healthcare service groups that have been shown in the literature to be more prone to overuse show lower mean estimates than the baseline model, but no significance. However, while insignificant, we detect a slightly higher consumption for "Imaging", "Gastrointestinal", and "Heart".

It is to be noted that the services which have been shown in the literature to be more prone to overuse, such as imaging or diagnostic services, are responsible for lower healthcare costs than the services which are more likely to cause the exceeding the deductible, e.g., inpatient stays. For this reason, even though insurees might indeed increase their consumption of such services, such an increase would not be statistically significant with respect to previous consumption.

While recent literature has found evidence for price sensitivity for services such as physiotherapy visits and general practitioner visits [21], findings on changes in consumption composition are mixed and suggest high heterogeneity [22–25]. With our findings we show that, on average, the services that have been indicated in the literature to be especially prone to overuse [16] after a "price" change for the consumer could not be observed to be affected in Switzerland.

(3) Is the consumption of healthcare services influenced by the level of healthcare supply availability?

Our third research question aimed at understanding the extent to which supply-side structures affect the overuse of healthcare resources. Generally, we find a high level of supply in each postal code for most medical specialties.

While we find the expected pattern indicating higher consumption for higher supply availability levels for the "Nutrition" and "Heart" service groups, we do not find a significant effect of supply availability on consumption after exceeding the deductible level. Supply side structures have been shown to reinforce or facilitate the overuse of healthcare resources [13]. However, from our findings we conclude that supply-side structures do not seem to impact the consumption of healthcare services after exceeding the deductible level.

Limitations

We note that there are some limitations to our analysis and dataset, which could limit the interpretation of our results.

First of all, we use data from only one Swiss insurer, which could present some differences with respect to data from other insurers. In particular, the insuree base of this health insurer typically exhibits an over-representation of insurees from the French-speaking part of Switzerland. However, we provide extensive descriptive statistics on the composition of our sample and the healthcare consumption behaviour, thus easing future comparisons.

Another limitation lies in the fact that in our dataset there is no data available on diagnoses, such as the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) codes. This limits the extent to which we can detect high- or low-value care services. In our analysis, we make some assumptions on what the treatment cost groups of interest are when looking at low-value care services and ran our analysis on the 13 models we create based on these assumptions.

As a statistical limitation, we also note that, due to the way in which our RDiT model works, it is not possible to make statements on the healthcare consumption in specific weeks, but only on the average unexplained healthcare consumption. Nevertheless, in order to answer our research question we only need to look at the average healthcare consumption.

Another limitation that could constitute a source of downward bias in our estimates is the fact that it is not possible to account for the moment in time in which the insuree becomes aware of having exceeded the deductible. In our analysis, we use the treatment date to define the threshold at which the insurees exceed their deductible and we look at the healthcare consumption during the 12 weeks after that. In this way, we can assume that the insurees are aware of having exceeded the deductible. In a sensitivity analysis, we also run the models using the billing date instead of the treatment date for the healthcare expenses. We find that the estimate is larger than in the main

model, indicating that using the billing date might be capturing an increase in healthcare consumption which happens later than the included interval of time. However, also this estimate is not significant.

Finally, another source of downward bias lies in the fact that, due to the way in which our treatment and control groups are built, we do not take into consideration the healthcare expenses happening at the end of the year for insurees that overcome their deductible early on in the calendar year. It can be hypothesized that insurees might have an incentive to increase their consumption before the deductible reset at the end of the year. However, we implement a sensitivity analysis by focusing only on those insurees that exceeded their deductible between the 35th and the 42nd week of the year, and for which we can thus capture the end of the year expenditures. The fact that we do not find a significant increase in expenditures for this subgroup of patients suggests that this fact does not constitute a relevant source of bias for our analyses.

Outlook for future research

Given the limitations of this research, we believe that future research would benefit from an increased availability of health insurance data. The billing of every healthcare expenditure by the health insurer would for instance allow to build a reliable control group of insurees who did not exceed their deductible. While we do not think that using this group of insurees as control group would make our estimates more reliable, it would be of interest to perform the analysis following a methodology that has been already implemented in the literature. Furthermore, being able to use data on diagnoses as well would allow to provide better insights on whether the observed healthcare consumption constitutes high- or low-value care. Information on contract notification would allow to better control for whether the insurees are aware of the fact of having exceeded the deductible, thus improving the identification of the treatment effect. Finally, more information on socio-economic variables, especially regarding income, would allow for better controls and subgroup analyses.

As we found no evidence for the overuse of healthcare services, and since cost-sharing contracts have been introduced with the main aim to decrease the overuse of healthcare resources, future research would profit from the exploration of the presence of underuse of healthcare resources.

Finally, as we found a non-significant increase in healthcare consumption after reaching the deductible, it would be of interest to identify the characteristics of those insurees who actually exhibit such moral hazard behaviour.

Implications for the healthcare system

Our findings show that insurees are generally not price sensitive and that the deductible system does not create significant demand-side financial incentives for the consumption of healthcare resources. Therefore, our findings confirm the deductible system as an effective cost-sharing solution for Switzerland. Thus, our main recommendation is that the deductible system should be kept in place.

Furthermore, we detected "Imaging", "Gastrointestinal", and "Heart" as the service groups with the highest (non-significant) healthcare expenditures increase. This would motivate increased attention towards these three service groups when monitoring insurees' healthcare expenditures in efforts to decrease unnecessary use of healthcare resources.

In terms of data availability, while health insurers should have access to data that is necessary for the billing of healthcare expenses, for research purposes it would be beneficial to increase data quality and transparency. In particular, future research would greatly benefit from availability of data on diagnoses (such as ICD-10) and on the exact timing of insuree notification on exceeding their deductible level.

Adding to our research, one relevant question is whether deductible levels are still valid, i.e., high enough. More concretely, deductible levels were set decades ago and have not been overhauled since. It might be beneficial to derive new deductible levels minimizing even further moral hazard.

Finally, deductible levels are not adjusted according to regional purchasing power, cost of living, and salary levels. When refining deductible levels, it might thus also be of interest to analyse how regionally different deductible levels could influence overuse (and underuse) of healthcare resources.

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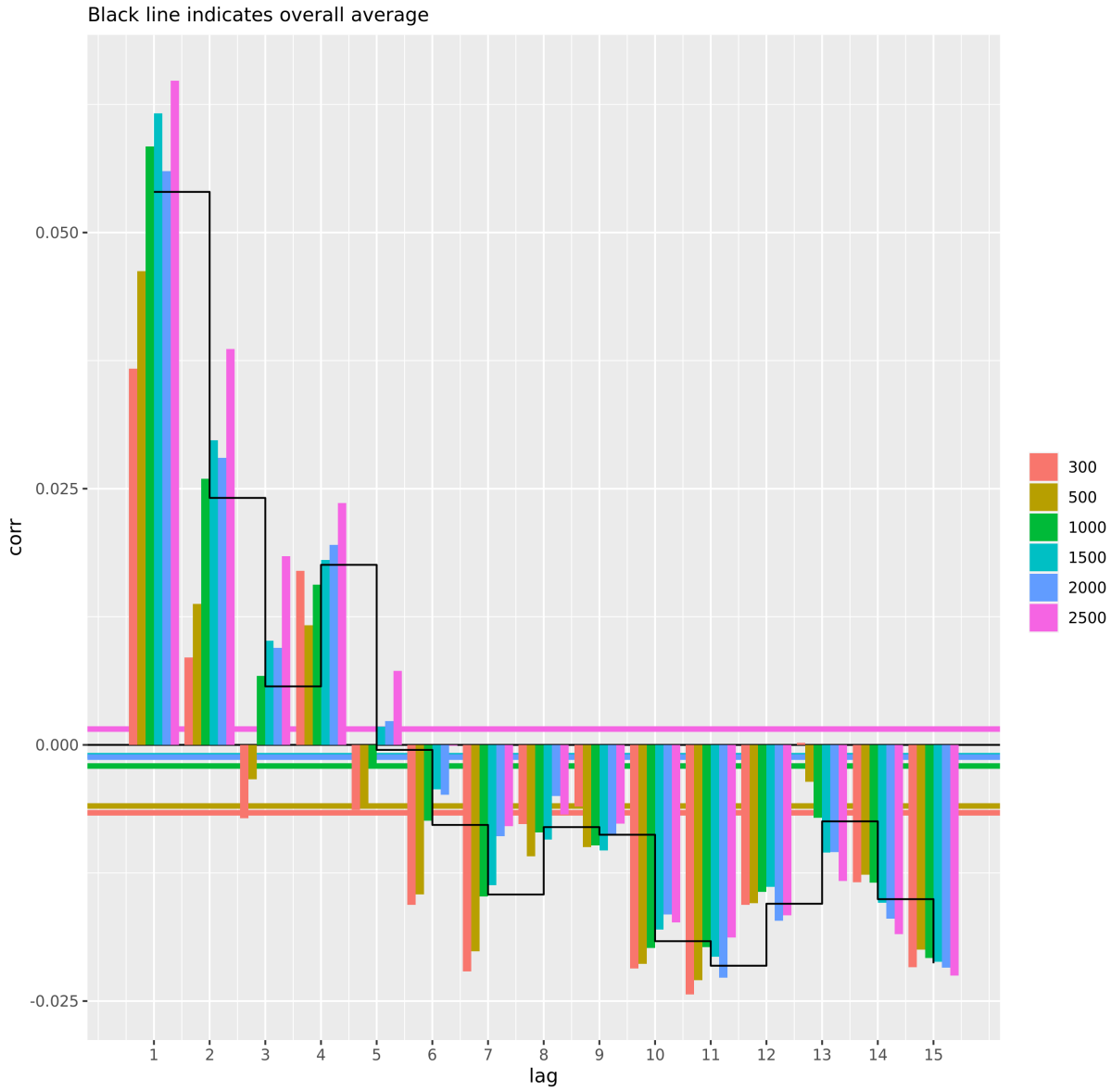
Appendix

Appendix 1. Weekly autocorrelations of healthcare expenses in 2018 for all deductible levels



Appendix 2. PCG codes used and their definition

PCG code	Definition
ABH	Addiction (excl. Nicotine)
ADH	ADHS
AIK	Autoimmune diseases
ALZ	Alzheimer's disease
AST	Asthma

BSR	Bipolar disorder
CAR	Heart disease
COP	COPD
DEP	Depression
DM1	Diabetes type 1
DM2	Diabetes type 2
DM2+	Diabetes type 2 with hypertension
EPI	Epilepsy
GLA	Glaucoma
HCH	high cholesterol
HIV	HIV/AIDS
KHO	Hormone sensitive tumors
KRE	Cancer
CRC	Cancer complex
MCR	Crohn's disease
MSK	Multiple sclerosis
NIE	Kidney disease
PAH	Pulmonary (arterial) hypertension
PAR	Parkinson's disease
PSO	Psoriasis
PSY	Psychosis
RHE	Rheumatism
SMC	Chronic pain
SMN	Neuropathic pain
THY	Thyroid disease
TRA	Transplant
WAS	Growth disorder
ZFP	Cystic fibrosis
CNS	Diseases of the brain or spinal cord
hyp	Hypertension

Appendix 3. List of tariff codes (source: Groupe Mutuel)

Codes tarifaires en vigueur
Forum Daten-Austausch

000	Inconnu
001	Tarmed
002	Forfaits Tarmed
003	Forfaits Tarmed nouveau
005	Forfaits ambulatoires
010	SwissDRG
011	Catalogue des rémunérations supplémentaires SwissDRG
012	Tarif pour autres prestations de soins stationnaires
020	ST Reha
022	Examens et traitements ambulatoires FBAM / Hôpital de l'Ile Berne
026	Positions tarifaires hospitalières spéciales Hôpital de l'Ile Berne
027	Positions tarifaires hospitalières spéciales Frauenklinik Berne
030	TARPSY
031	TARPSY Catalogue des rémunérations supplémentaires
050	Tarif für Arbeitsmedizinische Vorsorgeuntersuchungen
052	Tarif médical cantonal Schwyz
062	Tarif médical cantonal Nidwald/Obwald
091	Tarif médical cantonal Zoug
101	Tarif médical cantonal Fribourg
103	Pauschale für allgemeine Physiotherapie
110	Tarif médical cantonal Soleure
134	Convention complémentaire chapitre radiooncologie au tarif médical BL
174	Tarif médical cantonal St-Gall
204	Tarif médical cantonal Thurgovie
220	Tarif médical cantonal Vaud
222	Zahnarzt-Tarif UV / MV / IV (SSO)
223	Tarif für zahntechnische Arbeiten UV / MV / IV (VZLS)
230	Tarif médical cantonal Valais
251	Tarif médical cantonal Genève
272	Tarif médical Liechtenstein
273	Tarif médical Liechtenstein
280	Tarif Auslandrechnungen (Sozialversicherungsabkommen)
302	Catalogue des Prestations hospitalières (CPH)
305	Tarif médical suisse AA/AM/AI
311	Physiothérapie
312	Physiotherapie-Tarif KV (1.1.2018)
316	Liste féférale des analyses
317	Liste féférale des analyses (ab 01.07.2009)
318	Liste des analyses Liechtenstein
320	Tarif dentaire suisse PP (SSO)
321	Tarif pour les travaux de technique dentaire PP (VZLS)
322	Tarif dentaire suisse AA / AM / AI / Amal (SSO)
323	Tarif pour les travaux de technique dentaire AA / AM / AI / Amal (VZLS)
324	Tarif des chiropraticiens (SCG)
325	Tarif d'ergothérapie (ASE)
326	Travaux en technique Orthopédique de chaussures AA AM AI (ASMCBO)
327	Travaux en orthopedie technique Tarif AA AM AI (ASTO)
328	Tarif de logopédie
329	Tarif pour appareils acoustiques (HZV)

330	Tarif pour des prestations neuropsychologiques ambulatoires fournies aux assurés selon LAI, LAA et LAM dans des institutions reconnues (H+)
331	Tarif de prothèse occulaire
332	Evaluation de la capacité fonctionnelle (ECF)
334	Tarif pour infirmières et infirmiers ASI selon AA/AM/AI
335	Tarif pour les travaux de technique dentaire (ALPDS) selon AA/AM/AI
337	Rollstuhltarif UV/MV/IV
338	Ergotherapie-Tarif UV/MV/IV
340	Neuropsychologische Leistungen KVG
350	Pauschalen KVG ausserhalb Tarif 003
352	KVG-FL: Leistungen von Psychotherapeuten
400	Catalogue de médicaments code Pharma
401	SL Therapeutische Gruppe 70 (Homoeopathica / Anthroposophica / Spezifische Immuntherapeutika)
402	Catalogue de médicaments EAN
403	Catalogue de médicaments swissmedic
404	Homöopathische und anthroposophische Arzneimittel swissmedic (6-stellig Zulassungsnummer)
405	Adjonctions aux tarifs médicaux
406	Autres prestations non définies dans des tarifs officiels (médecin LAMal/LCA)
407	Autres prestations non définies dans des tarifs officiels (prestations paramédicales LAMal/LCA)
408	Ausländische Referenznummer für Arzneimittel z.B PZN
410	Liste des médicaments avec tarif (LMT)
424	Tarif des chiropraticiens
450	Liste LiMA
451	Codes rayon
452	LiMA: liste des moyens et appareils
453	HVUV: Verordnung über die Abgabe von Hilfsmitteln durch die Unfallversicherung
454	MiGeL: Mittel und Gegenstände Liste (HVB Pflege)
471	Hemodialyse
500	Traitements par dialyse ambulatoire (SVK et H+)
501	SVK
502	SVK
504	Tarif Ernährung zuhause
505	Mechanische Heimventilation
510	Tarif de conseils nutritionnels (ASDD)
511	Tarif de conseils diabétiques (ASD)
512	Tarif pour des prestations non médicales de conseils et de soins en milieu hospitalier: traitement ambulatoire oncologique (H+)
513	Tarif pour des prestations non médicales de conseils et de soins en milieu hospitalier: conseil et traitement ambulatoires en matière de stomie (H+)
514	Tarif pour des prestations ambulatoires de conseils en nutrition fournies en établissements hospitaliers (H+)
515	Tarif pour des prestations ambulatoires de conseils aux diabétiques fournies en établissements hospitaliers (H+)
516	Tarif pour les conseils diabétiques (ASI)
530	Tarife cadre suisse de Spitex
532	Prestations de soins ambulatoire
533	Spitex-Tarif UV/MV/IV
540	Tarif de location d'appareils d'inhalation et de respiration

541	Tarif de la ligue pulmonaire
542	Tarif für Inhalations- und Atemtherapie (Ergänzungen zur MiGeL) KVG
550	Tarif suisse des sages-femmes
551	Tarif pour des prestations non médicales de conseils et de soins en milieu hospitalier: traitement ambulatoire lié à l'accouchement, à la préparation à l'accouchement et aux soins postnatals par des sages-femmes, CHF (H+)
552	Tarif pour des prestations non médicales de conseils et de soins en milieu hospitalier: traitement ambulatoire lié à l'accouchement, à la préparation à l'accouchement et aux soins postnatals par des sages-femmes, PT (H+)
553	Tarif pour des prestations ambulatoires physiothérapeutiques fournies en établissements hospitaliers (H+)
554	Tarif pour des prestations ambulatoires ergothérapeutiques fournies en établissements hospitaliers (H+)
555	Tarif pour des prestations ambulatoires logopédiques fournies en établissements hospitaliers (H+)
556	Tarif de la réhabilitation musculoskelettal et neurologique ambulatoires en établissements hospitaliers (H+)
557	Physiotherapie-Tarif ambulant KVG neu, beantragt durch H+ und curafutura
570	Rémunération basée sur les prestations (RBP)
571	Autres prestations non définies dans des tarifs officiels (pharmacie LAMal/LCA)
580	Tarif de la Garde Aérienne Suisse de Sauvetage (REGA)
581	Psychotherapie Tarif KVG
583	Transports et sauvetages
584	Transporte und Rettungen KVG / VVG
590	Traitements alternatifs (santésuisse)
601	Analyses spécifiques de laboratoire - Labor Dr. Güntert
603	Analyses spécifiques de laboratoire - Institut Dr. Risch
607	Analyses spécifiques de laboratoire - Unilabs Mittelland
609	Analyses spécifiques de laboratoire - Medica Medizinische Laboratorien
610	Analyses spécifiques de laboratoire - Laborgemeinschaft 1
611	Analyses spécifiques de laboratoire - Polytest Zug SA
620	Analyses spécifiques de laboratoire - Institut Dr. Viollier
699	Autres prestations non définies dans des tarifs officiels (laboratoire LAMal/LCA)
701	Forfaits par cas/taxes hospitalières Hôpital de l'Ile Berne
702	Forfaits par cas/taxes hospitalières Bürgerspital Solothurn
712	Cat. hosp. stationnaire vaudois pour maladie
730	Forfaits et taxes de jour HCF
780	Hôpital cantonal NW, commun et semi-privé
800	APDRG: cost-weight version 3.2
804	APDRG: cost-weight version 4.1
805	APDRG: cost-weight version 5.1
806	APDRG: cost-weight version 6.0
850	Forfait RKB, LAA
907	Bewirtschaftung Hilfsmitteldepots IV
909	Tarif für Hörgeräteversorgung bei der AHV/IV
910	Tarif hospitalier pour prestations stationnaires selon LAA/LAI/LAM
920	Tarif hospitalier pour prestations stationnaires selon LAMal
930	Tarif pour prestations de soins stationnaires selon la LCA
940	Tarif hospitalier pour autres prestations ambulatoires
951	EMS BESA 4
952	EMS BESA 12

953	EMS PLAISIR 8
954	EMS RAI/RUG 12
955	EMS RAI/RUG 44 + 12
956	EMS ZSB 10
957	EMS CH Index RAI/RUG 12
958	EMS Tessin 5
959	EMS Fribourg 6
960	Prestations de soins stationnaires
963	Structures de jour ou de nuit et soins spitex in house par niveau/forfait
964	Structures de jour et de nuit et soins spitex in house par tarif horaire
965	Soins aigus et de transition par niveau
966	Soins aigus et de transition par tarif horaire
967	Forfaits pour soins aigus et de transition
970	Forfaits pour prestations de soins non à charge
980	Tarif für Handelsware UV/MV/IV (SVOT/ORS)
998	Conventions bilatérales
999	Prestations ne figurant dans aucun des tarifs énumérés
E02	Wochenpauschale kardiale Rehabilitation
OFA	Zytogenetik
STT	Stationäre Leistungen ohne DRG
T33	Reservierung Tarifsuisse - Ambulante Leistungen

Appendix 4. Full list of descriptive statistics

Deductibles in 2018 (number of patients)	**300** (N=212249)	**500** (N=111566)	**1,000** (N=14084)	**1,500** (N=17997)	**2,000** (N=3175)	**2,500** (N=12135)	**Overall** (N=371206)
Weekly Healthcare Expenses (Dependent Var.)							
Mean (SD)	164 (864)	140 (751)	122 (937)	140 (806)	159 (896)	163 (965)	154 (835)
Median [Min - Max]	0 [0 - 316000]	0 [0 - 360000]	0 [0 - 540000]	0 [0 - 128000]	0 [0 - 101000]	0 [0 - 220000]	0 [0 - 540000]
Yearly Total Consumption 2017							
Mean (SD)	8290 (14000)	6880 (12600)	5660 (11400)	5900 (11400)	6330 (11400)	5160 (10500)	7530 (13300)
Median [Min - Max]	3970 [2.55 - 1060000]	3350 [2.55 - 1600000]	2620 [8.60 – y<463000]	2670 [4.60 - 371000]	2930 [7.60 - 248000]	2200 [2.65 - 323000]	3580 [2.55 - 1600000]

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
Yearly Total Consumption 2018							
Mean (SD)	8510 (14200)	7290 (12,500)	6370 (11900)	7290 (12600)	8250 (11400)	8460 (12700)	8000 (13500)
Median [Min - Max]	4050 [0 - 1100000]	3530 [0 - 868000]	3250 [0 - 546000]	3810 [9.55 - 346000]	4590 [686 - 150000]	4980 [88.3 - 377000]	3900 [0, 1100000]
Age							
< 65	130953 (61.7%)	65274 (58.5%)	10518 (74.7%)	13059 (72.6%)	2423 (76.3%)	10181 (83.9%)	232408 (62.6%)
>= 65	81296 (38.3%)	46292 (41.5%)	3566 (25.3%)	4938 (27.4%)	752 (23.7%)	1954 (16.1%)	138798 (37.4%)
Mean (SD)	59.2 (15.7)	60.8 (14.6)	54.6 (14.4)	55.9 (14.0)	54.2 (13.8)	51.2 (13.2)	59.1 (15.3)
Nationality							
non-Swiss	70365 (33.2%)	39725 (35.6%)	4753 (33.7%)	5302 (29.5%)	1018 (32.1%)	4238 (34.9%)	125401 (33.8%)
Swiss	141884 (66.8%)	71841 (64.4%)	9331 (66.3%)	12695 (70.5%)	2157 (67.9%)	7897 (65.1%)	245805 (66.2%)
Deductible level in the year before (2017)							
300	204240 (96.2%)	325 (0.3%)	803 (5.7%)	342 (1.9%)	180 (5.7%)	537 (4.4%)	206427 (55.6%)
500	2639 (1.2%)	110105 (98.7%)	296 (2.1%)	178 (1.0%)	60 (1.9%)	210 (1.7%)	113488 (30.6%)
1,000	935 (0.4%)	257 (0.2%)	12686 (90.1%)	658 (3.7%)	171 (5.4%)	289 (2.4%)	14996 (4.0%)
1,500	1879 (0.9%)	391 (0.4%)	110 (0.8%)	16712 (92.9%)	741 (23.3%)	1193 (9.8%)	21026 (5.7%)
2,000	319 (0.2%)	92 (0.1%)	43 (0.3%)	13 (0.1%)	1996 (62.9%)	234 (1.9%)	2697 (0.7%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
2,500	2237 (1.1%)	396 (0.4%)	146 (1.0%)	94 (0.5%)	27 (0.9%)	9672 (79.7%)	12572 (3.4%)
Changed Deductibles Between 2017/2018							
no	204240 (96.2%)	110105 (98.7%)	12686 (90.1%)	16712 (92.9%)	1996 (62.9%)	9672 (79.7%)	355411 (95.7%)
yes	8009 (3.8%)	1461 (1.3%)	1398 (9.9%)	1285 (7.1%)	1179 (37.1%)	2463 (20.3%)	15795 (4.3%)
Exceeded Deductibles in 2017							
no	8822 (4.2%)	8176 (7.3%)	3166 (22.5%)	5940 (33.0%)	1145 (36.1%)	5948 (49.0%)	33197 (8.9%)
yes	203427 (95.8%)	103390 (92.7%)	10918 (77.5%)	12057 (67.0%)	2030 (63.9%)	6187 (51.0%)	338009 (91.1%)
Premium Reduction in 2018							
no, whole year	131387 (61.9%)	85146 (76.3%)	11297 (80.2%)	14884 (82.7%)	2206 (69.5%)	9393 (77.4%)	254313 (68.5%)
yes, not whole year	6554 (3.1%)	3420 (3.1%)	348 (2.5%)	381 (2.1%)	57 (1.8%)	244 (2.0%)	11004 (3.0%)
yes, whole year	74308 (35.0%)	23000 (20.6%)	2439 (17.3%)	2732 (15.2%)	912 (28.7%)	2498 (20.6%)	105889 (28.5%)
ADHS (2018)							
no	211657 (99.7%)	111462 (99.9%)	14054 (99.8%)	17958 (99.8%)	3167 (99.7%)	12096 (99.7%)	370394 (99.8%)
yes	592 (0.3%)	104 (0.1%)	30 (0.2%)	39 (0.2%)	8 (0.3%)	39 (0.3%)	812 (0.2%)
Addiction (excl. nicotine) (2018)							
no	211815 (99.8%)	111471 (99.9%)	14054 (99.8%)	17966 (99.8%)	3171 (99.9%)	12107 (99.8%)	370584 (99.8%)
yes	434 (0.2%)	95 (0.1%)	30 (0.2%)	31 (0.2%)	4 (0.1%)	28 (0.2%)	622 (0.2%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
Autoimmune diseases (2018)							
no	210171 (99.0%)	110628 (99.2%)	14006 (99.4%)	17882 (99.4%)	3157 (99.4%)	12059 (99.4%)	367903 (99.1%)
yes	2078 (1.0%)	938 (0.8%)	78 (0.6%)	115 (0.6%)	18 (0.6%)	76 (0.6%)	3303 (0.9%)
Alzheimer's disease (2018)							
no	211548 (99.7%)	111199 (99.7%)	14055 (99.8%)	17941 (99.7%)	3167 (99.7%)	12122 (99.9%)	370032 (99.7%)
yes	701 (0.3%)	367 (0.3%)	29 (0.2%)	56 (0.3%)	8 (0.3%)	13 (0.1%)	1174 (0.3%)
Asthma (2018)							
no	207947 (98.0%)	109623 (98.3%)	13894 (98.7%)	17768 (98.7%)	3133 (98.7%)	11974 (98.7%)	364339 (98.2%)
yes	4302 (2.0%)	1943 (1.7%)	190 (1.3%)	229 (1.3%)	42 (1.3%)	161 (1.3%)	6867 (1.9%)
Bipolar disorder (2018)							
no	211663 (99.7%)	111374 (99.8%)	14063 (99.9%)	17970 (99.9%)	3172 (99.9%)	12117 (99.9%)	370359 (99.8%)
yes	586 (0.3%)	192 (0.2%)	21 (0.1%)	27 (0.2%)	3 (0.1%)	18 (0.1%)	847 (0.2%)
Heart disease (2018)							
no	209495 (98.7%)	110094 (98.7%)	13989 (99.3%)	17844 (99.1%)	3153 (99.3%)	12069 (99.5%)	366644 (98.8%)
yes	2754 (1.3%)	1472 (1.3%)	95 (0.7%)	153 (0.9%)	22 (0.7%)	66 (0.5%)	4562 (1.2%)
COPD (2018)							
no	208133 (98.1%)	109562 (98.2%)	13930 (98.9%)	17805 (98.9%)	3142 (99.0%)	12057 (99.4%)	364629 (98.2%)
yes	4116 (1.9%)	2004 (1.8%)	154 (1.1%)	192 (1.1%)	33 (1.0%)	78 (0.6%)	6577 (1.8%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
Depression (2018)							
no	185797 (87.5%)	100681 (90.2%)	12955 (92.0%)	16650 (92.5%)	2861 (90.1%)	11128 (91.7%)	330072 (88.9%)
yes	26452 (12.5%)	10885 (9.8%)	1129 (8.0%)	1347 (7.5%)	314 (9.9%)	1007 (8.3%)	41134 (11.1%)
Diabetes type 1 (2018)							
no	207511 (97.8%)	109570 (98.2%)	13961 (99.1%)	17856 (99.2%)	3147 (99.1%)	12046 (99.3%)	364091 (98.1%)
yes	4738 (2.2%)	1996 (1.8%)	123 (0.9%)	141 (0.8%)	28 (0.9%)	89 (0.7%)	7115 (1.9%)
Diabetes type 2 (2018)							
no	207398 (97.7%)	109080 (97.8%)	13846 (98.3%)	17662 (98.1%)	3117 (98.2%)	11954 (98.5%)	363057 (97.8%)
yes	4851 (2.3%)	2486 (2.2%)	238 (1.7%)	335 (1.9%)	58 (1.8%)	181 (1.5%)	8149 (2.2%)
Diabetes type 2 with hypertension (2018)							
no	202642 (95.5%)	106416 (95.4%)	13755 (97.7%)	17566 (97.6%)	3114 (98.1%)	11953 (98.5%)	355446 (95.8%)
yes	9607 (4.5%)	5150 (4.6%)	329 (2.3%)	431 (2.4%)	61 (1.9%)	182 (1.5%)	15760 (4.2%)
Epilepsy (2018)							
no	208929 (98.4%)	110626 (99.2%)	13973 (99.2%)	17882 (99.4%)	3151 (99.2%)	12051 (99.3%)	366612 (98.8%)
yes	3320 (1.6%)	940 (0.8%)	111 (0.8%)	115 (0.6%)	24 (0.8%)	84 (0.7%)	4594 (1.2%)
Glaucoma (2018)							
no	205400 (96.8%)	107660 (96.5%)	13785 (97.9%)	17531 (97.4%)	3102 (97.7%)	11939 (98.4%)	359417 (96.8%)
yes	6849 (3.2%)	3906 (3.5%)	299 (2.1%)	466 (2.6%)	73 (2.3%)	196 (1.6%)	11789 (3.2%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
High cholesterol (2018)							
no	183600 (86.5%)	94874 (85.0%)	12570 (89.3%)	16087 (89.4%)	2872 (90.5%)	11229 (92.5%)	321232 (86.5%)
yes	28649 (13.5%)	16692 (15.0%)	1514 (10.7%)	1910 (10.6%)	303 (9.5%)	906 (7.5%)	49974 (13.5%)
HIV/AIDS (2018)							
no	210862 (99.3%)	111187 (99.7%)	14031 (99.6%)	17945 (99.7%)	3160 (99.5%)	12066 (99.4%)	369251 (99.5%)
yes	1387 (0.7%)	379 (0.3%)	53 (0.4%)	52 (0.3%)	15 (0.5%)	69 (0.6%)	1955 (0.5%)
Hormone sensitive tumors (2018)							
no	210295 (99.1%)	110557 (99.1%)	13981 (99.3%)	17827 (99.1%)	3154 (99.3%)	12049 (99.3%)	367863 (99.1%)
yes	1954 (0.9%)	1009 (0.9%)	103 (0.7%)	170 (0.9%)	21 (0.7%)	86 (0.7%)	3343 (0.9%)
Cancer (2018)							
no	212221 (100.0%)	111551 (100.0%)	14081 (100.0%)	17995 (100.0%)	3173 (99.9%)	12134 (100.0%)	371155 (100.0%)
yes	28 (0.0%)	15 (0.0%)	3 (0.0%)	2 (0.0%)	2 (0.1%)	1 (0.0%)	51 (0.0%)
Cancer complex (2018)							
no	210302 (99.1%)	110530 (99.1%)	13977 (99.2%)	17783 (98.8%)	3134 (98.7%)	11993 (98.8%)	367719 (99.1%)
yes	1947 (0.9%)	1036 (0.9%)	107 (0.8%)	214 (1.2%)	41 (1.3%)	142 (1.2%)	3487 (0.9%)
Multiple sclerosis (2018)							
no	211475 (99.6%)	111305 (99.8%)	14065 (99.9%)	17968 (99.8%)	3172 (99.9%)	12115 (99.8%)	370100 (99.7%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
yes	774 (0.4%)	261 (0.2%)	19 (0.1%)	29 (0.2%)	3 (0.1%)	20 (0.2%)	1106 (0.3%)
Kidney disease (2018)							
no	212013 (99.9%)	111457 (99.9%)	14078 (100.0%)	17983 (99.9%)	3174 (100.0%)	12131 (100.0%)	370836 (99.9%)
yes	236 (0.1%)	109 (0.1%)	6 (0.0%)	14 (0.1%)	1 (0.0%)	4 (0.0%)	370 (0.1%)
Pulmonary (arterial) hypertension (2018)							
no	212188 (100.0%)	111547 (100.0%)	14081 (100.0%)	17992 (100.0%)	3175 (100%)	12135 (100%)	371118 (100.0%)
yes	61 (0.0%)	19 (0.0%)	3 (0.0%)	5 (0.0%)	0 (0%)	0 (0%)	88 (0.0%)
Parkinson's disease (2018)							
no	211398 (99.6%)	111143 (99.6%)	14050 (99.8%)	17935 (99.7%)	3166 (99.7%)	12113 (99.8%)	369805 (99.6%)
yes	851 (0.4%)	423 (0.4%)	34 (0.2%)	62 (0.3%)	9 (0.3%)	22 (0.2%)	1401 (0.4%)
Psoriasis (2018)							
no	211691 (99.7%)	111288 (99.8%)	14043 (99.7%)	17953 (99.8%)	3168 (99.8%)	12116 (99.8%)	370259 (99.7%)
yes	558 (0.3%)	278 (0.2%)	41 (0.3%)	44 (0.2%)	7 (0.2%)	19 (0.2%)	947 (0.3%)
Psychosis (2018)							
no	208014 (98.0%)	110807 (99.3%)	13986 (99.3%)	17904 (99.5%)	3142 (99.0%)	12031 (99.1%)	365884 (98.6%)
yes	4235 (2.0%)	759 (0.7%)	98 (0.7%)	93 (0.5%)	33 (1.0%)	104 (0.9%)	5322 (1.4%)
Rheumatism (2018)							

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
no	211142 (99.5%)	111014 (99.5%)	14033 (99.6%)	17926 (99.6%)	3149 (99.2%)	12096 (99.7%)	369360 (99.5%)
yes	1107 (0.5%)	552 (0.5%)	51 (0.4%)	71 (0.4%)	26 (0.8%)	39 (0.3%)	1846 (0.5%)
Chronic pain (2018)							
no	204333 (96.3%)	108018 (96.8%)	13782 (97.9%)	17647 (98.1%)	3110 (98.0%)	11915 (98.2%)	358805 (96.7%)
yes	7916 (3.7%)	3548 (3.2%)	302 (2.1%)	350 (1.9%)	65 (2.0%)	220 (1.8%)	12401 (3.3%)
Thyroid disease (2018)							
no	206773 (97.4%)	108931 (97.6%)	13860 (98.4%)	17692 (98.3%)	3128 (98.5%)	11991 (98.8%)	362375 (97.6%)
yes	5476 (2.6%)	2635 (2.4%)	224 (1.6%)	305 (1.7%)	47 (1.5%)	144 (1.2%)	8831 (2.4%)
Transplant (2018)							
no	211611 (99.7%)	111322 (99.8%)	14065 (99.9%)	17979 (99.9%)	3168 (99.8%)	12115 (99.8%)	370260 (99.7%)
yes	638 (0.3%)	244 (0.2%)	19 (0.1%)	18 (0.1%)	7 (0.2%)	20 (0.2%)	946 (0.3%)
Growth disorder (2018)							
no	212241 (100.0%)	111564 (100.0%)	14084 (100%)	17996 (100.0%)	3175 (100%)	12135 (100%)	371195 (100.0%)
yes	8 (0.0%)	2 (0.0%)	0 (0%)	1 (0.0%)	0 (0%)	0 (0%)	11 (0.0%)
Cystic fibrosis (2018)							
no	212009 (99.9%)	111485 (99.9%)	14077 (100.0%)	17988 (100.0%)	3173 (99.9%)	12126 (99.9%)	370858 (99.9%)
yes	240 (0.1%)	81 (0.1%)	7 (0.0%)	9 (0.1%)	2 (0.1%)	9 (0.1%)	348 (0.1%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
Diseases of the brain or spinal cord (2018)							
no	211544 (99.7%)	111361 (99.8%)	14069 (99.9%)	17977 (99.9%)	3172 (99.9%)	12116 (99.8%)	370239 (99.7%)
yes	705 (0.3%)	205 (0.2%)	15 (0.1%)	20 (0.1%)	3 (0.1%)	19 (0.2%)	967 (0.3%)
ADHS (2017)							
no	211759 (99.8%)	111468 (99.9%)	14059 (99.8%)	17976 (99.9%)	3170 (99.8%)	12109 (99.8%)	370541 (99.8%)
yes	490 (0.2%)	98 (0.1%)	25 (0.2%)	21 (0.1%)	5 (0.2%)	26 (0.2%)	665 (0.2%)
Addiction (excl. nicotine) (2017)							
no	211841 (99.8%)	111482 (99.9%)	14052 (99.8%)	17974 (99.9%)	3169 (99.8%)	12115 (99.8%)	370633 (99.8%)
yes	408 (0.2%)	84 (0.1%)	32 (0.2%)	23 (0.1%)	6 (0.2%)	20 (0.2%)	573 (0.2%)
Autoimmune diseases (2017)							
no	210705 (99.3%)	110903 (99.4%)	14036 (99.7%)	17926 (99.6%)	3161 (99.6%)	12100 (99.7%)	368831 (99.4%)
yes	1544 (0.7%)	663 (0.6%)	48 (0.3%)	71 (0.4%)	14 (0.4%)	35 (0.3%)	2375 (0.6%)
Alzheimer's disease (2017)							
no	211624 (99.7%)	111264 (99.7%)	14059 (99.8%)	17959 (99.8%)	3170 (99.8%)	12130 (100.0%)	370206 (99.7%)
yes	625 (0.3%)	302 (0.3%)	25 (0.2%)	38 (0.2%)	5 (0.2%)	5 (0.0%)	1000 (0.3%)
Asthma (2017)							
no	208306 (98.1%)	109833 (98.4%)	13916 (98.8%)	17808 (98.9%)	3140 (98.9%)	12008 (99.0%)	365011 (98.3%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
yes	3943 (1.9%)	1733 (1.6%)	168 (1.2%)	189 (1.1%)	35 (1.1%)	127 (1.0%)	6195 (1.7%)
Bipolar disorder (2017)							
no	211704 (99.7%)	111396 (99.8%)	14065 (99.9%)	17979 (99.9%)	3171 (99.9%)	12124 (99.9%)	370439 (99.8%)
yes	545 (0.3%)	170 (0.2%)	19 (0.1%)	18 (0.1%)	4 (0.1%)	11 (0.1%)	767 (0.2%)
Heart disease (2017)							
no	209805 (98.8%)	110336 (98.9%)	14005 (99.4%)	17893 (99.4%)	3155 (99.4%)	12087 (99.6%)	367281 (98.9%)
yes	2444 (1.2%)	1230 (1.1%)	79 (0.6%)	104 (0.6%)	20 (0.6%)	48 (0.4%)	3925 (1.1%)
COPD (2017)							
no	208776 (98.4%)	109926 (98.5%)	13954 (99.1%)	17843 (99.1%)	3149 (99.2%)	12079 (99.5%)	365727 (98.5%)
yes	3473 (1.6%)	1640 (1.5%)	130 (0.9%)	154 (0.9%)	26 (0.8%)	56 (0.5%)	5479 (1.5%)
Depression (2017)							
no	187694 (88.4%)	101734 (91.2%)	13102 (93.0%)	16899 (93.9%)	2916 (91.8%)	11371 (93.7%)	333716 (89.9%)
yes	24555 (11.6%)	9832 (8.8%)	982 (7.0%)	1098 (6.1%)	259 (8.2%)	764 (6.3%)	37490 (10.1%)
Diabetes type 1 (2017)							
no	207797 (97.9%)	109765 (98.4%)	13972 (99.2%)	17881 (99.4%)	3153 (99.3%)	12058 (99.4%)	364626 (98.2%)
yes	4452 (2.1%)	1801 (1.6%)	112 (0.8%)	116 (0.6%)	22 (0.7%)	77 (0.6%)	6580 (1.8%)
Diabetes type 2 (2017)							
no	208169 (98.1%)	109482 (98.1%)	13896 (98.7%)	17750 (98.6%)	3123 (98.4%)	12006 (98.9%)	364426 (98.2%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
yes	4080 (1.9%)	2084 (1.9%)	188 (1.3%)	247 (1.4%)	52 (1.6%)	129 (1.1%)	6780 (1.8%)
Diabetes type 2 with hypertension (2017)							
no	204314 (96.3%)	107342 (96.2%)	13827 (98.2%)	17639 (98.0%)	3128 (98.5%)	12014 (99.0%)	358264 (96.5%)
yes	7935 (3.7%)	4224 (3.8%)	257 (1.8%)	358 (2.0%)	47 (1.5%)	121 (1.0%)	12942 (3.5%)
Epilepsy (2017)							
no	209167 (98.5%)	110663 (99.2%)	13986 (99.3%)	17895 (99.4%)	3157 (99.4%)	12070 (99.5%)	366938 (98.9%)
yes	3082 (1.5%)	903 (0.8%)	98 (0.7%)	102 (0.6%)	18 (0.6%)	65 (0.5%)	4268 (1.1%)
Glaucoma (2017)							
no	205879 (97.0%)	108075 (96.9%)	13834 (98.2%)	17610 (97.8%)	3119 (98.2%)	11975 (98.7%)	360492 (97.1%)
yes	6370 (3.0%)	3491 (3.1%)	250 (1.8%)	387 (2.2%)	56 (1.8%)	160 (1.3%)	10714 (2.9%)
High cholesterol (2017)							
no	184804 (87.1%)	95876 (85.9%)	12775 (90.7%)	16324 (90.7%)	2934 (92.4%)	11476 (94.6%)	324189 (87.3%)
yes	27445 (12.9%)	15690 (14.1%)	1309 (9.3%)	1673 (9.3%)	241 (7.6%)	659 (5.4%)	47017 (12.7%)
HIV/AIDS (2017)							
no	210924 (99.4%)	111215 (99.7%)	14036 (99.7%)	17953 (99.8%)	3160 (99.5%)	12075 (99.5%)	369363 (99.5%)
yes	1325 (0.6%)	351 (0.3%)	48 (0.3%)	44 (0.2%)	15 (0.5%)	60 (0.5%)	1843 (0.5%)
Hormone sensitive tumors (2017)							
no	210955 (99.4%)	110901 (99.4%)	14017 (99.5%)	17894 (99.4%)	3160 (99.5%)	12079 (99.5%)	369006 (99.4%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
yes	1294 (0.6%)	665 (0.6%)	67 (0.5%)	103 (0.6%)	15 (0.5%)	56 (0.5%)	2200 (0.6%)
Cancer (2017)							
no	212218 (100.0%)	111542 (100.0%)	14078 (100.0%)	17994 (100.0%)	3174 (100.0%)	12134 (100.0%)	371140 (100.0%)
yes	31 (0.0%)	24 (0.0%)	6 (0.0%)	3 (0.0%)	1 (0.0%)	1 (0.0%)	66 (0.0%)
Cancer complex (2017)							
no	210641 (99.2%)	110761 (99.3%)	14008 (99.5%)	17838 (99.1%)	3152 (99.3%)	12064 (99.4%)	368464 (99.3%)
yes	1608 (0.8%)	805 (0.7%)	76 (0.5%)	159 (0.9%)	23 (0.7%)	71 (0.6%)	2742 (0.7%)
Multiple sclerosis (2017)							
no	211668 (99.7%)	111369 (99.8%)	14066 (99.9%)	17983 (99.9%)	3171 (99.9%)	12125 (99.9%)	370382 (99.8%)
yes	581 (0.3%)	197 (0.2%)	18 (0.1%)	14 (0.1%)	4 (0.1%)	10 (0.1%)	824 (0.2%)
Kidney disease (2017)							
no	212079 (99.9%)	111483 (99.9%)	14081 (100.0%)	17989 (100.0%)	3174 (100.0%)	12131 (100.0%)	370937 (99.9%)
yes	170 (0.1%)	83 (0.1%)	3 (0.0%)	8 (0.0%)	1 (0.0%)	4 (0.0%)	269 (0.1%)
Pulmonary (arterial) hypertension (2017)							
no	212196 (100.0%)	111549 (100.0%)	14082 (100.0%)	17994 (100.0%)	3175 (100%)	12135 (100%)	371131 (100.0%)
yes	53 (0.0%)	17 (0.0%)	2 (0.0%)	3 (0.0%)	0 (0%)	0 (0%)	75 (0.0%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
Parkinson's disease (2017)							
no	211520 (99.7%)	111241 (99.7%)	14058 (99.8%)	17957 (99.8%)	3169 (99.8%)	12121 (99.9%)	370066 (99.7%)
yes	729 (0.3%)	325 (0.3%)	26 (0.2%)	40 (0.2%)	6 (0.2%)	14 (0.1%)	1140 (0.3%)
Psoriasis (2017)							
no	211711 (99.7%)	111296 (99.8%)	14042 (99.7%)	17963 (99.8%)	3172 (99.9%)	12113 (99.8%)	370297 (99.8%)
yes	538 (0.3%)	270 (0.2%)	42 (0.3%)	34 (0.2%)	3 (0.1%)	22 (0.2%)	909 (0.2%)
Psychosis (2017)							
no	208325 (98.2%)	110895 (99.4%)	14002 (99.4%)	17923 (99.6%)	3148 (99.1%)	12065 (99.4%)	366358 (98.7%)
yes	3924 (1.8%)	671 (0.6%)	82 (0.6%)	74 (0.4%)	27 (0.9%)	70 (0.6%)	4848 (1.3%)
Rheumatism (2017)							
no	211335 (99.6%)	111077 (99.6%)	14044 (99.7%)	17951 (99.7%)	3162 (99.6%)	12113 (99.8%)	369682 (99.6%)
yes	914 (0.4%)	489 (0.4%)	40 (0.3%)	46 (0.3%)	13 (0.4%)	22 (0.2%)	1524 (0.4%)
Chronic pain (2017)							
no	204413 (96.3%)	108190 (97.0%)	13789 (97.9%)	17714 (98.4%)	3117 (98.2%)	11986 (98.8%)	359209 (96.8%)
yes	7836 (3.7%)	3376 (3.0%)	295 (2.1%)	283 (1.6%)	58 (1.8%)	149 (1.2%)	11997 (3.2%)
Thyroid disease (2017)							
no	209119 (98.5%)	110136 (98.7%)	13963 (99.1%)	17847 (99.2%)	3152 (99.3%)	12067 (99.4%)	366284 (98.7%)
yes	3130 (1.5%)	1430 (1.3%)	121 (0.9%)	150 (0.8%)	23 (0.7%)	68 (0.6%)	4922 (1.3%)
Transplant (2017)							

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
no	211700 (99.7%)	111340 (99.8%)	14070 (99.9%)	17986 (99.9%)	3169 (99.8%)	12122 (99.9%)	370387 (99.8%)
yes	549 (0.3%)	226 (0.2%)	14 (0.1%)	11 (0.1%)	6 (0.2%)	13 (0.1%)	819 (0.2%)
Growth disorder (2017)							
no	212239 (100.0%)	111564 (100.0%)	14084 (100%)	17996 (100.0%)	3175 (100%)	12135 (100%)	371193 (100.0%)
yes	10 (0.0%)	2 (0.0%)	0 (0%)	1 (0.0%)	0 (0%)	0 (0%)	13 (0.0%)
Cystic fibrosis (2017)							
no	211938 (99.9%)	111455 (99.9%)	14071 (99.9%)	17988 (100.0%)	3173 (99.9%)	12129 (100.0%)	370754 (99.9%)
yes	311 (0.1%)	111 (0.1%)	13 (0.1%)	9 (0.1%)	2 (0.1%)	6 (0.0%)	452 (0.1%)
Diseases of the brain or spinal cord (2017)							
no	211580 (99.7%)	111376 (99.8%)	14068 (99.9%)	17977 (99.9%)	3173 (99.9%)	12120 (99.9%)	370294 (99.8%)
yes	669 (0.3%)	190 (0.2%)	16 (0.1%)	20 (0.1%)	2 (0.1%)	15 (0.1%)	912 (0.2%)
Premium region in 2018							
AG	10259 (4.8%)	4133 (3.7%)	772 (5.5%)	1304 (7.2%)	177 (5.6%)	588 (4.8%)	17233 (4.6%)
AI	46 (0.0%)	20 (0.0%)	2 (0.0%)	12 (0.1%)	0 (0%)	3 (0.0%)	83 (0.0%)
AR	524 (0.2%)	205 (0.2%)	59 (0.4%)	86 (0.5%)	16 (0.5%)	36 (0.3%)	926 (0.2%)
BE1	6975 (3.3%)	2516 (2.3%)	792 (5.6%)	398 (2.2%)	54 (1.7%)	345 (2.8%)	11080 (3.0%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
BE2	7006 (3.3%)	3896 (3.5%)	510 (3.6%)	644 (3.6%)	117 (3.7%)	296 (2.4%)	12469 (3.4%)
BE3	2160 (1.0%)	1322 (1.2%)	199 (1.4%)	314 (1.7%)	82 (2.6%)	129 (1.1%)	4206 (1.1%)
BL1	5925 (2.8%)	2005 (1.8%)	376 (2.7%)	643 (3.6%)	131 (4.1%)	404 (3.3%)	9484 (2.6%)
BL2	1346 (0.6%)	564 (0.5%)	101 (0.7%)	208 (1.2%)	44 (1.4%)	124 (1.0%)	2387 (0.6%)
BS	6244 (2.9%)	1795 (1.6%)	257 (1.8%)	586 (3.3%)	63 (2.0%)	326 (2.7%)	9271 (2.5%)
ET	2302 (1.1%)	76 (0.1%)	4 (0.0%)	7 (0.0%)	3 (0.1%)	14 (0.1%)	2406 (0.6%)
FR1	5574 (2.6%)	3223 (2.9%)	386 (2.7%)	337 (1.9%)	35 (1.1%)	200 (1.6%)	9755 (2.6%)
FR2	6711 (3.2%)	5093 (4.6%)	553 (3.9%)	642 (3.6%)	74 (2.3%)	248 (2.0%)	13321 (3.6%)
GE	26645 (12.6%)	16073 (14.4%)	1332 (9.5%)	1681 (9.3%)	310 (9.8%)	1900 (15.7%)	47941 (12.9%)
GL	523 (0.2%)	317 (0.3%)	78 (0.6%)	86 (0.5%)	8 (0.3%)	21 (0.2%)	1033 (0.3%)
GR1	408 (0.2%)	114 (0.1%)	24 (0.2%)	44 (0.2%)	4 (0.1%)	16 (0.1%)	610 (0.2%)
GR2	1071 (0.5%)	230 (0.2%)	78 (0.6%)	72 (0.4%)	11 (0.3%)	28 (0.2%)	1490 (0.4%)
GR3	181 (0.1%)	69 (0.1%)	22 (0.2%)	26 (0.1%)	1 (0.0%)	4 (0.0%)	303 (0.1%)
JU	2898 (1.4%)	1665 (1.5%)	128 (0.9%)	215 (1.2%)	26 (0.8%)	135 (1.1%)	5067 (1.4%)
LU1	2101 (1.0%)	695 (0.6%)	115 (0.8%)	123 (0.7%)	25 (0.8%)	90 (0.7%)	3149 (0.8%)
LU2	496 (0.2%)	176 (0.2%)	39 (0.3%)	66 (0.4%)	13 (0.4%)	30 (0.2%)	820 (0.2%)
LU3	772 (0.4%)	252 (0.2%)	52 (0.4%)	93 (0.5%)	19 (0.6%)	56 (0.5%)	1244 (0.3%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
NE	5147 (2.4%)	2785 (2.5%)	157 (1.1%)	180 (1.0%)	35 (1.1%)	114 (0.9%)	8418 (2.3%)
NW	196 (0.1%)	76 (0.1%)	18 (0.1%)	41 (0.2%)	6 (0.2%)	17 (0.1%)	354 (0.1%)
OW	272 (0.1%)	89 (0.1%)	30 (0.2%)	55 (0.3%)	7 (0.2%)	14 (0.1%)	467 (0.1%)
SG1	1301 (0.6%)	536 (0.5%)	121 (0.9%)	137 (0.8%)	30 (0.9%)	70 (0.6%)	2195 (0.6%)
SG2	1553 (0.7%)	729 (0.7%)	173 (1.2%)	246 (1.4%)	48 (1.5%)	90 (0.7%)	2839 (0.8%)
SG3	497 (0.2%)	232 (0.2%)	67 (0.5%)	111 (0.6%)	15 (0.5%)	33 (0.3%)	955 (0.3%)
SH1	342 (0.2%)	95 (0.1%)	25 (0.2%)	32 (0.2%)	3 (0.1%)	18 (0.1%)	515 (0.1%)
SH2	166 (0.1%)	69 (0.1%)	16 (0.1%)	29 (0.2%)	7 (0.2%)	14 (0.1%)	301 (0.1%)
SO	5029 (2.4%)	2384 (2.1%)	332 (2.4%)	540 (3.0%)	78 (2.5%)	240 (2.0%)	8603 (2.3%)
SZ	980 (0.5%)	554 (0.5%)	107 (0.8%)	190 (1.1%)	19 (0.6%)	84 (0.7%)	1934 (0.5%)
TG	3662 (1.7%)	1461 (1.3%)	319 (2.3%)	602 (3.3%)	64 (2.0%)	173 (1.4%)	6281 (1.7%)
TI1	7005 (3.3%)	4373 (3.9%)	291 (2.1%)	505 (2.8%)	39 (1.2%)	314 (2.6%)	12527 (3.4%)
TI2	829 (0.4%)	592 (0.5%)	44 (0.3%)	57 (0.3%)	5 (0.2%)	26 (0.2%)	1553 (0.4%)
UR	180 (0.1%)	89 (0.1%)	13 (0.1%)	46 (0.3%)	4 (0.1%)	10 (0.1%)	342 (0.1%)
VD1	28005 (13.2%)	18431 (16.5%)	2032 (14.4%)	2661 (14.8%)	612 (19.3%)	2584 (21.3%)	54325 (14.6%)
VD2	19579 (9.2%)	11576 (10.4%)	1374 (9.8%)	1640 (9.1%)	468 (14.7%)	1338 (11.0%)	35975 (9.7%)
VS1	21491 (10.1%)	11460 (10.3%)	1508 (10.7%)	1077 (6.0%)	151 (4.8%)	649 (5.3%)	36336 (9.8%)

Deductibles in 2018 (number of patients)	300 (N=212249)	500 (N=111566)	1,000 (N=14084)	1,500 (N=17997)	2,000 (N=3175)	2,500 (N=12135)	Overall (N=371206)
VS2	1616 (0.8%)	1252 (1.1%)	148 (1.1%)	87 (0.5%)	9 (0.3%)	31 (0.3%)	3143 (0.8%)
ZG	761 (0.4%)	349 (0.3%)	68 (0.5%)	111 (0.6%)	14 (0.4%)	63 (0.5%)	1366 (0.4%)
ZH1	11712 (5.5%)	4138 (3.7%)	520 (3.7%)	717 (4.0%)	139 (4.4%)	585 (4.8%)	17811 (4.8%)
ZH2	7265 (3.4%)	3594 (3.2%)	474 (3.4%)	732 (4.1%)	122 (3.8%)	408 (3.4%)	12595 (3.4%)
ZH3	4494 (2.1%)	2263 (2.0%)	368 (2.6%)	614 (3.4%)	87 (2.7%)	267 (2.2%)	8093 (2.2%)

Appendix 5. RDiT results for the 2500 deductible group without donut for the three specifications of the dependent variable (All service groups, Excluding complex service groups, Including overuse-prone service groups)

Specification	Mean estimate	Lower bound	Upper bound	N	SE	P-value
Explorative specification: All service groups	1161.91	-778.13	3101.95	6738	989.83	0.12
First specification: Excluding complex service groups	552.63	-546.88	1652.14	6730	560.98	0.16
Second specification: Chiropractic	0.18	-2.20	2.55	6737	1.21	0.44
Second specification: Dermatology	0.88	-6.18	7.94	6709	3.60	0.40
Second specification: ENT	24.37	-80.02	128.75	6650	53.26	0.32
Second specification: Ergotherapy	0.24	-0.31	0.79	3384	0.28	0.19
Second specification: Gastrointestinal	38.37	-58.10	134.85	6681	49.22	0.22
Second specification: Heart	0.20	-2.75	3.15	6604	1.51	0.45
Second specification: Imaging	5.88	-12.67	24.43	6724	9.46	0.27
Second specification: Musculoskeletal	127.99	-224.04	480.03	6602	179.61	0.24
Second specification: GP visits	2.23	-4.29	8.76	6736	3.33	0.25
Second specification: Nutrition	0.26	-1.15	1.67	3363	0.72	0.36
Second specification: Pain therapy	13.26	-20.99	47.50	6705	17.47	0.22
Second specification: Physiotherapy	1.29	-12.56	15.13	3350	7.07	0.43
Second specification: Respiratory	2.97	-10.86	16.80	6717	7.06	0.34

Appendix 6. RDiT effect sizes compared for the 300 deductible group for the three approaches (All, Excluding tariffs, Including tariffs), with donut

Appendix 7. RDiT results for the 2,500 deductible group with donut for selected subgroups based on the first specification of the dependent variable (excluding complex service groups)

Subgroups	Mean estimate	Lower bound	Upper bound	N	SE	P-value
Above retirement age	41.33	-218.15	300.82	229	132.39	0.38
Below retirement age	37.22	-256.92	331.37	2126	150.07	0.40
No chronic illnesses	51.60	-228.44	331.65	1583	142.88	0.36
One chronic illness	14.86	-250.07	279.78	376	135.17	0.46
Multiple chronic illnesses	99.49	-193.55	392.54	66	149.52	0.25

Appendix 8. RDiT results compared for the 2,500 deductible group by supply availability level of medical specialties, with donut

Medical specialty	Supply availability level	Mean estimate	Lower bound	Upper bound	N	SE	P-value
Chiropractic	Low	-0.48	-3.05	2.09	1942	1.31	0.64

Medical specialty	Supply availability level	Mean estimate	Lower bound	Upper bound	N	SE	P-value
Chiropractic	Medium	0.69	-0.55	1.93	540	0.63	0.14
Chiropractic	High	0.14	-1.74	2.02	3103	0.96	0.44
Dermatology	Low	0.30	-3.78	4.38	1449	2.08	0.44
Dermatology	Medium	-1.94	-8.65	4.77	491	3.42	0.71
Dermatology	High	0.29	-6.26	6.84	3623	3.34	0.47
ENT	Low	0.88	-4.11	5.87	1735	2.55	0.36
ENT	Medium	-0.49	-9.02	8.03	562	4.35	0.55
ENT	High	0.14	-5.84	6.11	3485	3.05	0.48
Ergotherapy	Low	0.17	-0.66	1.00	360	0.42	0.35
Ergotherapy	Medium	0.22	-0.36	0.80	959	0.30	0.23
Ergotherapy	High	-0.19	-0.74	0.36	1409	0.28	0.75
Gastrointestinal	Low	0.25	-31.94	32.45	1936	16.43	0.49
Gastrointestinal	Medium	28.79	-33.65	91.23	548	31.86	0.18
Gastrointestinal	High	-0.13	-22.66	22.40	2888	11.50	0.50
GP visit	Low	0.36	-1.77	2.48	664	1.08	0.37
GP visit	Medium	0.27	-1.81	2.35	1790	1.06	0.40
GP visit	High	0.23	-1.88	2.35	3051	1.08	0.41
Heart	Low	-5.23	-48.15	37.69	1341	21.90	0.59
Heart	Medium	0.54	-35.90	36.99	443	18.60	0.49
Heart	High	2.72	-39.36	44.80	3288	21.47	0.45
Imaging	Low	3.58	-122.24	129.41	1760	64.20	0.48
Imaging	Medium	-3.18	-126.22	119.85	559	62.77	0.52
Imaging	High	-1.18	-121.57	119.20	3094	61.42	0.51
Musculoskeletal	Low	0.49	-1.30	2.28	1207	0.91	0.30

Medical specialty	Supply availability level	Mean estimate	Lower bound	Upper bound	N	SE	P-value
Musculoskeletal	Medium	-0.44	-5.89	5.02	374	2.78	0.56
Musculoskeletal	High	0.65	-3.94	5.24	3728	2.34	0.39
Nutrition	Low	-0.27	-1.46	0.92	677	0.61	0.67
Nutrition	Medium	0.28	-0.58	1.15	348	0.44	0.26
Nutrition	High	0.29	-0.77	1.35	1832	0.54	0.29
Physiotherapy	Low	0.64	-20.36	21.64	401	10.72	0.48
Physiotherapy	Medium	2.62	-9.07	14.31	953	5.96	0.33
Physiotherapy	High	1.13	-10.75	13.01	1321	6.06	0.43
Respiratory	Low	0.77	-8.66	10.20	1736	4.81	0.44
Respiratory	Medium	3.12	-4.67	10.92	550	3.98	0.22
Respiratory	High	-0.14	-7.74	7.47	3016	3.88	0.51