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Working Paper 2022:15

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Better Off by Risk Adjustment? Socioeconomic Disparities in Care Utilization in Sweden Following a Payment Reform

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Better off by risk adjustment? Socioeconomic disparities in care utilization in Sweden following a payment reform ^{*}

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Abstract

Reducing socioeconomic health inequalities is a key goal of most health systems. When care providers are paid prospectively, e.g., by a fixed sum per patient, existing inequalities may be sustained by the incentives to undertreat relatively unhealthy patients. To counter this, prospective payments are often risk-adjusted based on observable patient characteristics. Despite that risk adjustment (RA) is widely used, empirical evidence is lacking on how it affects the behavior of care providers. This paper provides such evidence using detailed administrative data from a Swedish region. We examine how a novel RA model applied to the prospective payment for primary care providers – capitation – affected socioeconomic differences in care utilization among individuals with a chronic condition. The new RA model implied substantial increases of the average capitation for patients with low socioeconomic status (SES). Yet, we do not find any robust evidence of greater access to primary care for individuals with low SES relative to individuals with high SES after the model was introduced. We find a small increase in hospital emergency department visits (a substitute to primary care), but no effects on hospitalizations. These results do not suggest that the new RA model reduced socioeconomic health inequalities. Our findings highlight that a risk-adjusted prospective payment may not by itself guide treatment decisions. We discuss other governance and management policies that may address undesired health inequalities.

Keywords: Socioeconomic health inequalities, Risk adjustment, Primary care, Health care utilization, Prospective payment, Incentives

JEL Classification: I11, I14, I18, L33, R50

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1 Introduction

Socioeconomic health inequalities are ubiquitous. Whether measured by income, wealth, education, or occupation, individuals with lower socioeconomic status (SES) tend to live shorter lives, report worse self-assessed health, and suffer from more chronic conditions than individuals with high SES (e.g., Chetty et al., 2016; Mackenbach et al., 2008, 2018).

Reducing health inequalities is one of the most important health policy objectives in many countries (e.g., Stabile and Thomson, 2014; Devaux, 2015).¹ However, the strive for this goal may be hampered by efforts to attain two other key objectives: Efficiency in healthcare production and cost containment. To achieve these objectives, funding bodies often pay insurers or providers prospectively, i.e., by *ex ante* payments intended to cover the expected care costs for an average patient during a particular time period or illness episode. Prospective payment gives incentives to economize on resources (Shleifer, 1985; Newhouse, 1996), but also to select low-cost patients (cream-skimming) and avoid (dump) or underserve (skimp) high-cost patients (Ellis, 1998). Due to their lower health status, individuals with low SES are at particular risk of suffering from dumping and skimping.²

To discourage selection, a common approach is to *risk-adjust* payments using cost predictors such as diagnoses, demographic characteristics, and SES (Stabile and Thomson, 2014; Geruso and McGuire, 2016; Ellis et al., 2018).³ Risk adjustment weakens the incentives to dump high-risk patients (Barros, 2003; McGuire et al., 2020),⁴ and may thus theoretically reduce socioeconomic inequalities in care utilization and health. But when payment is prospective, there is no guarantee that the extra funds will be spent on care for the intended patients. Providers, who have discretion to allocate the funds as they see fit, may prefer to provide more care to patients with higher demand elasticity,⁵ or simply retain the funds as profits. Furthermore, risk adjustment may dilute the incentives for preventive care otherwise embodied in prospective payment (Eggleston et al., 2012), and introduce incentives to game the system (e.g., van de Ven and Ellis, 2000; Layton, 2017), for example by ‘upcoding’ diagnoses (Dackehag and Ellegård, 2019; Geruso and Layton, 2020).

¹Inequalities in health outcomes are to some extent mirrored by inequalities in access to and use of health care. Studies have for example found that low-SES patients make fewer specialist visits (Doorslaer et al., 2004; d’Uva and Jones, 2009; Cookson et al., 2016), use less preventive care (Devaux, 2015; Cookson et al., 2016), and consume less prescription pharmaceuticals (Nordin et al., 2013). However, the associations are sometimes smaller in primary care (Cookson et al., 2016), and seem to depend on the definition of SES and on how studies adjust for morbidity.

²For evidence that selection of more profitable patients occurs, see for example Werbeck et al. (2020) regarding outpatient specialists and Brown et al. (2014) regarding health insurers.

³For example, risk adjustment is used in the Medicare Advantage, Medicare Part D, the Health Insurance Marketplaces, and many state Medicaid Managed Care programs in the US, and in the health insurance markets of the Netherlands, Switzerland, Germany, Israel, and Belgium (Layton, 2017). The prospective payment to primary care providers is risk-adjusted in for example Sweden (Anell et al., 2018), Denmark (Tange et al., 2020), and the UK (van de Ven and Ellis, 2000).

⁴One aspect is that risk adjustment may strengthen the incentives for providers to locate in areas where many high-risk patients live (e.g., Bärnighausen and Bloom, 2009; Goddard et al., 2010; Grobler et al., 2015). Using payment reforms in Australian and Swedish primary care, both Yong et al. (2018) and Anell et al. (2018) find that new entrants become more prone to locate themselves in such areas. In the region we study, there was little entry of new providers throughout the study period.

⁵For evidence suggesting that high-SES patients have higher demand sensitivity, see Tay (2003); Biørn and Godager (2010); Gutacker et al. (2016); Santos et al. (2017); Anell et al. (2021b).

Given the extensive use of risk adjustment, surprisingly few studies examine how providers react to the incentives (e.g., Brown et al., 2014; Geruso and McGuire, 2016; Layton, 2017), and there is to our knowledge no previous study of how risk adjustment affects SES-based inequalities in care utilization or health.⁶ This paper contributes with such evidence from the context of primary healthcare. We compare the care utilization and frequency of adverse health events, i.e., hospitalizations, for low- and high SES individuals following the introduction of a new risk adjustment formula in the health system of a mid-sized Swedish region (Östergötland, around 450,000 inhabitants).

Primary care providers in the study region receive most of their payment in the form of capitation: A fixed monthly sum for each enrolled patient. In 2014, the regional healthcare authority substantially changed the risk-adjustment formula. Before the reform, the capitation was mainly adjusted for age. There was a SES-based adjustment factor, but it only affected the capitation of individuals living in the very poorest areas. Since the reform, the risk adjustment formula incorporates a diagnosis-based morbidity adjustment (using the Johns Hopkins *Adjusted Clinical Groups* (ACG) system (Starfield et al., 1991)), and a SES index accounting for the additional resource demands associated with individual characteristics such as low education, unemployment, or foreign background (the *Care Need Index*, CNI; Malmström et al., 1998; Sundquist et al., 2003). Both features of the novel risk adjustment model disproportionately benefit low-SES patients, in particular those living outside the very poorest areas.⁷ Although the morbidity adjustment is blind to the individual's SES, the socioeconomic gradient in health implies that low-SES individuals as a group benefit from morbidity-adjustment. In fact, this was an intended purpose of introducing morbidity-adjustment (Aldstedt, 2012).

The reform was announced in 2012, launched in 2014 and fully phased in by 2016. We use detailed register data on health care utilization from 2007-2017 to study its implications on individuals with a relatively high care need, i.e., individuals with a chronic condition. We compare high and low SES individuals in the ages 6-64⁸ using event study and difference-in-differences (DiD) approaches. Since the risk adjustment affected the capitation for everyone, not only those with low-SES, the development of the outcomes in the high-SES group cannot be thought of as a counterfactual for the development in the low-SES group. The DiD comparison is nonetheless informative in relation to the research question, as directly it tells us how the reform affected the socioeconomic differential.

The reform implied substantially higher capitation payments for a majority of the low-SES individ-

⁶By contrast, there is some prior work showing how social determinants of health can be used to predict spending (e.g., Sundquist et al., 2003; Ash et al., 2017). This is not the same thing as studying provider responses to the implementation of the risk adjustment scheme as such.

⁷For the individuals residing in the poorest areas, it is not clear that the payment increased, as it is possible that the previous SES-based payment exceeded the the new ACG- and CNI-adjusted payment. In line with this, the overall budgets decreased after the reform for the two PCCs with the very highest concentration of low-SES patients. The region targeted these two PCCs with an extra SES-based grant from 2016 onwards. Removing the patients of these two PCCs from our estimations does not change any of our conclusions.

⁸Due to the definition of the CNI, there is no comparison group for children below five years. For elderly individuals, the individuals with low-SES (high CNI) were likely disproportionately affected by a confounding contemporaneous reform (see below). For individuals 6-64 years without a pre-existing chronic condition, the theoretical consequences of the reform is ambiguous due to the possibility that the morbidity adjustment outweighed the SES-based adjustment.

uals, but we find little to suggest that it improved their access to primary care. The DiD estimates on our main outcome measures, the probability and number of primary care physician visits, are small and negative. The estimates are similar across the dimensions of the socioeconomic index, but more negative for individuals whose provider was privately owned or projected to benefit substantially from the reform. We find a positive and statistically significant estimate on the probability of visiting a primary care nurse, but it is sensitive to specification changes and vanishes after the full phase-in of the model, when instead a negative estimate on the number of visits emerged. Moreover, a heterogeneity analysis indicates no changes for nurse visits among the patients with the very poorest health. For this highly prioritized group, we thus find no traces of improved access to primary care.

We also considers outcomes outside the primary care sector. We do not find any statistically significant effects on the probability of hospitals stay or the number of days spent in hospital. However, there is a positive and statistically effect on the probability of visiting the emergency department (ED), and the average morbidity risk score (i.e., the ACG weight) increased slightly more for low-SES group right after the reform. While one could interpret the increased probability of an ED visit as a sign of worsened health, a more plausible interpretation given the small and statistically insignificant effects on the other measures of secondary care utilization is that that these visits represent substitution from PCCs to the ED. Although the positive estimate on the ACG risk score would be consistent with decreased health, the effect is both small and transitory, and it might follow mechanically from the nurse and ED estimates (e.g., due to differences in how practices register diagnoses). In sum, we find no evidence of substantially improved access to primary care, and no indications of health improvements, for a group that were intended to benefit from the new risk adjustment model.

Our results by and large resonate with the findings of related research. At a very general level, existing risk adjustment models often explain only a modest share of variation in spending (Breyer et al., 2011; van Veen et al., 2018). A descriptive study of three Swedish regions (including our study region) using the same SES-based index for risk adjustment did not find that the providers with more low-SES patients supplied more primary care visits (Anell et al., 2021a). However, correlation studies do not identify behavioral responses to risk adjustment.

Of studies with a causal approach, the closest to our paper analyzes physician responses to differentiated capitation in a laboratory experiment with medical students as subjects (Oxholm et al., 2019). The authors find that patients with similar needs receive more care if their capitation is above the average than if it is below the average. They also find that if the differentiation does not reflect patients' actual care need, there is a difference in the supply of care compared to under pure capitation. These findings suggest that physicians adjust their treatment choices in response to information about patient prioritization signalled by the payment differentiation. When the payment is aligned with physicians' prior information about care need, differentiated capitation does not alter treatment decisions relative to a pure capitation system.

Three studies from the US use DiD strategies to examine provider responses to risk-adjusted capita-

tion by comparing patients in Medicare Advantage (MA) with regular Medicare patients, for whom health insurers receive FFS payment. Of these, the closest to ours is Lissenden and Balkrishnan (2020), which compares the use of preventive services before and after the introduction of risk adjustment using the change for FFS patients as comparator. They find that risk adjustment reduces pneumonia vaccination rates, but the effects on other preventive services are mixed and mostly not significant. The two other US studies consider provider behavior under risk-adjusted capitation versus FFS. Geruso and Layton (2020), whose main focus is on diagnostic coding, find evidence of substantial upcoding as well as an increased probability of seeing a doctor in risk-adjusted MA. Brown et al. (2014) examine measures of beneficiary satisfaction and quality of care, and find little evidence of improvements.⁹

As risk adjustment implies paying more for certain groups, our study also relates to the literature on changes of capitation rates. Duggan et al. (2016) and Cabral et al. (2018) examine the effects of capitation increases using differences in payment levels to urban and rural MA insurers and county-level data. Both studies find that the increases primarily benefit health insurers, especially in less competitive markets. Duggan et al. (2016) additionally find increased entry and increased enrollment of traditional Medicare recipients, but no significant effects on patient satisfaction, self-reported health, or health care utilization.

Taken together, these results are consistent with the lack of strings attached to the prospective payment. A policy implication is that other payment structures than risk-adjusted capitation may be preferable in relation to the goal of tackling socioeconomic health inequalities. Generally, service provision is often higher under fee-for-service (FFS) than under fixed payment schemes (capitation or salary) (Devlin and Sarma, 2008; Brekke et al., 2019; Cadena and Smith, 2022). Furthermore, there is some experimental evidence to suggest that physicians are less likely to underserve high-need patients when paid by FFS (e.g., Hennig-Schmidt et al., 2011; Brosig-Koch et al., 2017), and a recent study finds that an increase in the generosity of the FFS payment for low-SES individuals in Medicare led to increases in their care utilization (Cabral et al., 2021). This evidence suggests that mixed payment systems including a FFS component may be a more adequate way to mitigate SES-based health inequalities than to rely on a risk-adjusted capitation only.

In the next section, we discuss the theoretical implications of risk adjustment in more depth. Section 3 describes the primary care system and risk adjustment models used in Sweden and Östergötland. Section 4 presents our data sources and descriptive statistics of key variables. Section 5 outlines our estimation strategy and Section 6 contains the results. Section 7 concludes.

⁹The focus of Brown et al. (2014)'s analysis, as well as the analysis in Newhouse et al. (2015), is risk selection and overpayment. The two articles come to partly opposing conclusions. Brown et al. (2014) find that risk adjustment, if anything, increased risk selection and overpayment, whereas Newhouse et al. (2015), using a longer panel, conclude that overpayment attributable to favorable risk selection decreased.

2 Theoretical framework

Prospective payment, such as capitation for the enrolled patients in a primary care practice, shifts the financial risk from the third-party payer to the healthcare provider. A downside of the strong incentives to economize on resources is that providers may undertreat their patients (Newhouse, 1996). Apart from professional ethics and physician altruism, there are two factors that may lessen the incentives for undertreatment. First, providers may invest in preventive services to reduce future costs (Eggleston et al., 2012). Second, if patients are allowed to choose their care provider, undertreated patients might vote with their feet (Christianson and Conrad, 2012). Notably, the latter mechanism only mitigates the undertreatment of profitable patients; providers still have incentives to undertreat patients who are “too expensive” relative to the capitation (Ellis, 1998). Furthermore, the two mechanisms are interrelated, since patient choice may undermine the incentives to invest in preventive services. If patients go elsewhere, so will the return on investments in prevention.

The incentives to dump high-risk patients are clearly weaker if the capitation is risk adjusted, i.e., higher for individuals that are predicted to need more care. But risk adjustment does not by itself ensure that high-risk individuals receive more or better care (i.e., less skimping). This is easily seen in relation to the two factors that limit undertreatment in a prospective payment system. The provider’s incentives to invest in prevention are diluted in the presence of risk adjustment, because the provider can expect to be compensated for future cost increases (Eggleston et al., 2012). Thus, risk adjustment may even lead to reduced care utilization (specifically, fewer preventive services) in the short run.¹⁰ Second, the choice mechanism only works if high-risk patients are responsive to signs of undertreatment. If their demand is inelastic, there is no reason to expect that providers would channel the additional funds arising from risk adjustment to these patients in particular. Providers may prefer to retain the funds as profits, or spend them on care to other, more elastic, patients. If physicians are aiming for a target income, they may well respond to increased payments by reducing the care provided to all types of patients (McGuire and Pauly, 1991).

There are more reasons why risk adjustment might have limited effects on SES-based differences in care utilization. For instance, risk adjustment does not account for cost variation within risk groups. Providers still have incentives to select patients that are likely to be low-cost conditional on their risk score (Brown et al., 2014). Furthermore, risk-adjustment models typically explain a modest proportion of the variation in spending (Layton, 2017). If payments does not track costs well, i.e., the “fit” of the system is low (Geruso and McGuire, 2016), then the effect on provider incentives is likely small.

Risk adjustment may also affect the optimal number of patients, rather than the number of services per patient. Barham and Milliken (2015) construct a theoretical model in which physicians choose not only how much care to provide for each patient, but also how many patients to serve. They show

¹⁰In our setting, the largest potential to save costs by prevention would arise outside the primary care sector (i.e., by avoiding costly hospitalizations). This suggests that the prevention mechanism is not so important in our case.

that altruistic physicians respond to increased capitation by decreasing services to their current high-need patients, to instead concentrate efforts on attracting new, underserved, high-need patients, whose marginal benefit of care is higher.

In settings highly characterized by professional ethics or altruism, it is further possible that providers abstain from dumping and skimping regardless of the degree of risk adjustment. In this case, the risk adjustment will not change the de facto care utilization of high-risk patients. This situation may be particularly plausible when the provider is publicly owned (soft budgets) or the competitive pressure is low (weaker tension between altruism and profitability) (Ge and Godager, 2021; Scott and Sivey, 2022). If providers already are striving to ration care according to need, then the remaining way in which a risk adjustment model may affect providers' treatment choices is via the signal it sends to providers about what groups should have high priority (Oxholm et al., 2019). If the signal from the risk adjustment model does not conflict with providers' prior beliefs about priorities, then providers may not respond to the model by altering treatment choices.

Summing up, the impact of risk-adjusted capitation on health care provision, and, consequently, health inequalities depends on detailed features of the risk-adjustment model and how information about the model trickles down to providers, as well as on characteristics of health care providers and markets. In the next section, we describe the institutional setting of our study region.

3 Institutional background

3.1 Primary care setting

In the Swedish universal health insurance system, the responsibility for the financing and organization of health care resides with 21 independent regional authorities.¹¹

Primary care is the first line of care and provides basic medical treatment, prevention, and rehabilitation to the whole population (e.g., Anell et al., 2018). Providers are typically group practices – primary care centers (PCCs) – which on average are staffed by four to six GPs plus district nurses and possibly other professions such as physiotherapists and cognitive therapists (Anell, 2015).¹² Staff are salaried workers. The regional health authority contracts with public and private PCCs on equal terms.

In our study region (Östergötland), there were 43-46 PCCs during the study period.¹³ In 2013, there were nine private for-profit PCCs, which served approximately one fifth of the population.¹⁴

Since September 2009, the region organizes primary care in a so-called patient choice system. Any

¹¹The main exceptions are home-help services and nursing home care for the elderly. The responsibility for these services lies on the 290 municipalities (Tange et al., 2020).

¹²Outside the regional organization, some physicians operate private solo practices that are funded by the central government budget. As they are not funded by the region, they are not relevant for the present study.

¹³Three private PCCs opened in October 2009, November 2010, and October 2012. Two public PCCs closed in July 2011 and one in April 2016. There was a net increase (+1 PCC) in the largest city and a net loss (-1 PCC) in the second largest city.

¹⁴The average number of patients was 8,800 for private and 10,500 for public PCCs.

provider that fulfils the pre-specified (and annually revised) accreditation criteria, which define the formal requirements for PCCs operations, is allowed to enter the choice system. Once accredited, providers are free to locate their practices anywhere in the region. Patients can visit any PCC, and they may also choose to enroll with a specific practice (although they may still visit other PCCs). PCCs may not refuse patients who wish to enroll, residents may switch PCCs as often as they like, and most of the payment to PCCs is directly linked to its enrolled patients.¹⁵

Already before the introduction of the choice system, most residents were enrolled with a PCC, and a large part of the payment to PCCs came in the form of a fixed sum per patient (capitation). In this regard, the main implication of the choice reform was that PCCs were no longer allowed to reject patients. Nonetheless, open enrollment is difficult to fully enforce (e.g., Newhouse, 1996; van de Ven and Ellis, 2000). There are informal ways to dissuade high-cost patients from enrolling, and marketing can be targeted to low-cost groups.

Another notable change during the study period concerns care provided for elderly persons (65+) in their homes. Before 2014, it was the responsibility of the region to supply this kind of care to elderly persons unable to travel to the PCC. In 2014, the municipalities in the region overtook the responsibility. In practice, this meant that some of the district nurses previously employed at PCCs instead started to work for the municipalities' home care organizations. This reform had no direct implications for primary care physicians, and was budget neutral from the point of view of PCCs (i.e., the funding of the home care nurses was transferred to the municipalities).

3.2 Payment system for primary care providers

Throughout our study period (2007-2017), the payment to PCCs in the study region predominantly consisted of capitation for enrolled patients (75-85% of payment), complemented by additional payments to account for structural features and a P4P scheme. Östergötland used two types of P4P, both including bonuses and penalties: one based on the proportion of enrolled patients' visits handled by the PCC, and the other on a number of quality indicators. Additional details of the payment schemes are described in Appendix A.¹⁶

The region has always adjusted the capitation based on observable characteristics, but the included characteristics have varied. Table 1 describes the adjustment factors used over time. Before 2014, the capitation was adjusted by age; the part of the capitation meant to cover prescription drugs was also adjusted by gender. Additionally, the capitation was higher for elderly individuals (75+) living in remote areas. The capitation was not adjusted for morbidity, but there was an adjustment factor aimed to benefit low-SES patients. Specifically, the capitation was higher for individuals living in one of the 10% of areas

¹⁵Since 2010, the regions are obliged by law to operate choice systems with these components (Dietrichson et al., 2020a).

¹⁶All information in this section is, unless otherwise mentioned, taken from the region's primary care budgets, or, for 2010-2017, the yearly terms of accreditation for PCCs or from protocols from regional board meetings, which are available on request from the authors (in Swedish).

with the lowest income level. The SES compensation was substantial: for individuals aged 20-44 years (45-65), it corresponded to around 150% (100%) of the base capitation. However, the compensation affected PCCs very unequally: In 2010, the SES compensation corresponded to less than three percent of payment for 27 of the 43 PCCs, but more than 9 percent of payment for four PCCs located in highly deprived areas.

Table 1: Adjustments of the capitation

Year	Age	Elderly	Gender	Morbidity	SES
Pre 2014	Yes	In remote areas	(Drugs)		Poor area
2014-2015	Yes		Yes	ACG	CNI
2016-2017	Yes	Yes	Yes	ACG	CNI

With the 2014 payment reform, Östergötland moved to a risk-adjustment model in which one part of the base capitation was morbidity-adjusted, and one part was adjusted by SES factors. As the region implemented the reform simultaneously with the transfer of responsibility for home care, it also removed the adjustment of the capitation for elderly individuals living in remote areas.

For the morbidity risk adjustment, the region adopted the Johns Hopkins Adjusted Clinical Groups (ACG) system. This is one of the most widely used risk-adjustment models in health care (van de Ven and Ellis, 2000; Handel et al., 2015), and it has been adopted by almost all Swedish regions during the past decade. The ACG system groups patients according to their expected health care resource use. The mutually excluding ACGs are defined by age, gender, and morbidity, measured by diagnoses recorded in administrative registers (Starfield et al., 1991).¹⁷

According to the region, a SES-based adjustment of the capitation was needed as a supplement to the morbidity adjustment, because patients with low SES may need more care regardless of their diagnoses (Zingmark, 2013). Unlike in the previous model, all individuals would be affected by the new SES adjustment, not only individuals living in the most deprived areas. To measure SES, Östergötland chose to use the Care Need Index (CNI), which had also become popular among Swedish regions after the choice reform (Anell et al., 2018). The CNI reflects the relative workload (as judged by Swedish physicians) associated with different socioeconomic and demographic patient characteristics. The index was developed by Swedish researchers in the 1990s, inspired by a similar index used to allocate funds in the British primary care system (Malmström et al., 1998; Sundquist et al., 2003). The CNI includes seven factors: Being under five years of age (weight = 3.23); being born in a non-European Union member country or in Africa, Asia, or South America (5.72); being over 65 years and living alone (6.15); being a single parent with children under 17 years (4.19); being 1 year or older and recently having moved to the area (4.19);¹⁸ being 16-64 years and unemployed (5.13); and being 25-64 years and having at most nine

¹⁷Incidentally, the cost weights used in the Swedish ACG version originate from the cost accounting model in our study region (Sveriges Kommuner och Regioner, 2020). Unfortunately, we do not have access to these data.

¹⁸The region omitted this factor from 2016 onwards, as it was not viewed as a relevant measure of SES.

years of schooling (3.97).¹⁹ Although the CNI captures more aspects than SES, the definition of our study population implies that it is essentially a pure SES-measure in our context,²⁰ and it is highly correlated with low income.

Compared to the SES-adjustment, the morbidity adjustment using ACG affected a much larger fraction of the total capitation: Approximately 90% of the capitation was morbidity-adjusted, leaving approximately 10% to be adjusted by SES.

The decision to introduce ACG was taken by the regional health care board on May 8, 2012, and mentioned alongside CNI in the terms of accreditation for 2013, which were approved on May 30, 2012 (Hälso- och sjukvårdsnämnden, 2012). The new payment model was phased in during 2014-2015 and fully in place by 2016. Another notable change in 2016 was that the region introduced a novel compensation for elderly patients (75+), following an analysis suggesting that the ACG adjustment did not sufficiently capture the costs of that group.

In summary, the level of payments remained stable for all the major features of the payment systems throughout 2010-2013, but the period between 2014 and 2017 saw some major changes.²¹ ACG and CNI were introduced, which had at least three important consequences. First, the SES-based risk-adjustment became based on patient characteristics instead of area characteristics. Second, more SES-related factors than income was adjusted for. Third, while age was still a major risk-adjustment factor, the capitation also became diagnosis-based and therefore potentially different for individuals of the same age. Fourth, 2016-2017 saw an increase in the ACG and CNI payments.

In addition to the payment from the regional health care authority, the PCCs also collect visit fees from patients, for both physician and nurse consultations. The visit fee for a consultation with a physician (nurse) was SEK 150 (100) until 2016 and increased to SEK 200 in 2017.²² Visit fees are a marginal source of income for the PCCs, as can be seen by comparing the fee to the annual capitation for an individual aged 20-44 with an ACG weight of 1 would be SEK 3,100, and noting that on average, individuals visit PCCs about once a year.

Table 2 summarizes the dates of key changes to the regional primary care system during the study period.

¹⁹We do not use the CNI weights in the analysis, as we only contrast individuals with at least one versus no CNI component.

²⁰E.g., the study population excludes children and elderly individuals, and we do not classify people who moved within the region as having low-SES, see footnote 18.

²¹Other features of the payment system were relatively stable or of minor importance for our main sample. PCCs had full cost responsibility for drugs prescribed to their patients, regardless of where in outpatient care they were prescribed. The P4P system changed in terms of the indicators used and was phased out toward the end of our study period, but it was always a small proportion of total payments.

²²These fees applied when patients visited the PCC they were enrolled at. To discourage patients from visiting another PCCs than the one that they were enrolled at, the visit fee was SEK 500 for visits at other PCCs. In 2017, the exchange rate of SEK was 9.6 to the Euro, 8.5 to the USD, and 11.0 to the GBP (Riksbanken, 2021). National regulations cap the total fee paid annually; in 2010-2011 the cap was set at SEK 900 and in 2012-2017 at SEK 1,100. Children below 20 were exempt from fees.

Table 2: The primary care system in Östergötland: Key dates

<i>Date</i>	<i>Change</i>
Sept 1, 2009	Patient choice system introduced.
May 8, 2012	Formal decision to introduce morbidity risk adjustment (ACG).
Jan 1, 2014	Implementation of new risk adjustment model (ACG and CNI).
Jan 1, 2014	Responsibility for home health nursing transferred to municipalities.
Jan 1, 2016	ACG and CNI fully phased in.
Jan 1, 2017	Patient fee raised from SEK 150 to SEK 200.

3.3 How did the reform affect the capitation of low-SES patients?

How the new risk-adjustment model changed the capitation for a given person depends on many individual and area characteristics. For individuals of the same age, gender, and ACG, and living in the same area and, the CNI-adjustment guarantees that the capitation is higher for low-SES individuals after the reform. Nevertheless, for a healthy individual, the CNI-adjusted part of the capitation would not be large enough to compensate for a low ACG weight and, for individuals living in the poorest areas, the loss of the area-based payment.²³

Our study population includes only individuals with chronic conditions, i.e., relatively ill individuals, who in general would benefit from the introduction of morbidity adjustment. Even within this group, individuals with low-SES have higher ACG on average, and thus benefited more from the payment reform: Comparing the capitation calculated using the old (2013) and new (2016) rules, the average change in the low-SES group was a 118% increase, to be compared to the average 49% increase in the high-SES group.²⁴ These effects are substantial: In absolute numbers, the average increase in the low-SES group almost corresponds to the capitation of one patient aged 20-44, while the average increase in the high-SES group is close to one third of the capitation for such a patient. The median change in each group was a 76% (low-SES) and a 19% (high-SES) increase.

Still, the new risk adjustment model did not increase the capitation for all low-SES individuals in our study population. According to our calculations, one quarter of the low-SES patients saw their capitation decrease by at least 9 percent due to the reform. Among high-SES patients, the corresponding number is even more striking: the lowest quartile lost at least 70% of their earlier capitation. Although, it should be noted that almost everyone in our study population had an above-average ACG in at least one study year, i.e., very few would be ‘persistent losers’.²⁵ Importantly, the existence of ‘losers’ in the low-SES group

²³ The total capitation payment fell substantially in 2014 for the two PCCs that used to receive the very highest compensation from the SES adjustment in the old payment system. From 2016 onwards, the region compensated these two PCCs with extra lump sum grants due to their SES burden. As we show in section 6.2.1, the results are robust to excluding patient at these PCCs from the analysis.

²⁴ In making these calculations, we have to make assumptions regarding what patients benefited from the SES-adjustment in the old system. We assume that all patients who were enrolled at one of the two PCCs that received most of this type of compensation received such compensation. This likely overstates the number of patients with adjustment in these PCCs, but on the other hand we overlook the adjustments for patients at all other PCCs.

²⁵ A substantial share of the individuals with chronic condition actually obtain a very low ACG when using diagnoses set in a

does not drive our results (see section 6.2.1).

4 Data

4.1 Data sources

We use Östergötland's register over enrollments at PCCs to define our study population. This register is available from 2008 and covers all residents, even if they have not chosen to enroll with a specific provider. Data on primary care utilization, emergency department (ED) visits, and diagnoses come from the regional care register. We use the national patient register from the National Board of Health and Welfare to define variables related to inpatient care (overnight hospital stays), and individual background data from national registers held by Statistics Sweden to define CNI weights. Information about the budget projections is sourced from regional health care administrators.

4.2 Study population

We define our main study population as follows. We start from a list of the total population in Östergötland that was registered at a PCC on January 1 2013, i.e., one year before the new payment system came into effect (433,312 individuals). We then apply the following inclusion criteria:

The individual must reside in the region throughout the pre-period (2007-2011), and be born before 2002 and after 1953. The lower age limit is justified by the fact that all children below 5 years of age have a high CNI per definition, so they lack a comparison group. The rationale for the upper age limit is that individuals who turned 65 during our study period might be affected by the transfer of responsibility for home health nursing from the region to the municipalities. As the main reason why elderly individuals have a high CNI is that they are living by themselves, the home care reform likely had a differential impact on low- and high-SES elderly individuals. Single-living elderly are often widows, i.e., relatively old, and many of the most frail persons belong to this category. Thus, older individuals with high CNI elderly were likely more affected by the re-organization of home care than older individuals with low CNI. Finally, we restrict the study population to individuals who had a chronic condition diagnosis recorded in at least one of the pre-reform years.²⁶ We obtain similar results even if we do not make this restriction, but we have a conceptual reason to apply it: the objective of the study is to examine if risk adjustment of the capitation can reduce the skimping and dumping problems that, in a pure capitation system, would disproportionately affect low-SES individuals in poor health. How the reform affected low-SES individuals in good health – whose capitation may well have been reduced due to the reform we study – is another

12 months-period, see section 4.3.3. One reason for this is that the spacing of routine follow-up visits is often larger, closer to 18-month intervals.

²⁶We use the chronic condition count produced by the Johns Hopkins ACG (R) System v 11.1 to identify chronic conditions. See the supplementary material B.

question.²⁷

In summary, our main study population is a cohort of adolescents and young to middle-aged adults, who resided in the study region in the whole pre-period and had a chronic condition before the reform. The final study population includes 92,863 individuals.

4.3 Variable definitions and descriptive statistics

4.3.1 SES definition

Our estimations contrast individuals with low SES to a comparison group of individuals with high SES. We use the CNI to define individuals' SES. Specifically, we define an indicator variable, *High CNI*, that equals 1 for individuals in the study population who possessed any of the characteristics associated with a CNI weight above 1. Given the definition of our study population, this implies that we define as low-SES individuals people who were born in certain parts of the world (see section 3.1), single parents, lack more than primary education after reaching 25 years of age, and/or unemployed.²⁸ In the following, we use the terms low-SES/high-CNI interchangeably (and similarly for high-SES/low-CNI).

We define individuals' SES based on their CNI on December 31, 2011, our most recent pre-announcement data point. To avoid post-treatment bias, we do not update the treatment definition over time. One concern is that the CNI in 2011 might be affected by care received in previous periods; e.g., primary care services might affect the transition probability between unemployment and sickness absence. To break the direct link between care utilization and CNI, we perform a sensitivity check in which we replace the actual CNI status in 2011 by the predicted status from a set of logit models.²⁹

²⁷ Although it would certainly be interesting to study this question, data presented in the supplementary material H suggests that we cannot convincingly do so with our empirical strategy.

²⁸ As mentioned, children below five and elderly living alone would also count as low-SES/high-CNI individuals, but they are excluded from our analyses. The original CNI also assigns above-1 weight to individuals who changed address (moving within or to the region) during the past year, but we classify such individuals as belonging to the comparison group as we do not view it as an informative proxy for SES. Notably, the region removed this component from the calculation of payment in 2016 because it only benefited PCCs in locations with high inward mobility, i.e., close to university student housing areas (Aldstedt et al., 2015). The descriptive statistics for the comparison group are almost identical when including and excluding this small group of people.

²⁹ To predict CNI status in 2011, we estimate logit models for the potentially time-varying CNI components, i.e., indicators for being a *single parent*, *unemployed* or *above 25 and with no more than primary education*. Each model includes the first and the third lag of the dependent variable, interacted with a gender dummy, and a continuous birth year variable. We then use the estimates from these models to predict the probability of being a single parent/unemployed/having low education, and classify individuals as having a high probability if the predicted probability is at least 90 percent. We then create a predicted CNI variable as an indicator equal to one for individuals who had a high predicted probability for at least one of these components, or were born abroad (time-invariant characteristic). This approach assigns more individuals into the high-CNI group than the usual definition. Most of the mispredictions come from the very youngest birth cohorts; especially, the prediction approach assigns all women born after 1995 to the treatment group. This implies that these individuals are excluded from the sensitivity analysis using predicted CNI. A likely reason for the mispredictions among young people is that there is only one relevant time-varying CNI component for them: being a single parent. During our study period, they were too young to be counted as unemployed or low educated.

4.3.2 Outcome variables

Our primary outcome variables are the probability of a visit and the number of visits to a *physician* at a PCC. As nurses perform many services at PCCs, we also construct the corresponding variables for *nurse* visits. We define these variables at a quarterly level. As our data does not include information on the type of services provided, we are not able to study preventive activities *per se*.

Our set of secondary outcome variables includes outcomes that may be affected by changes in primary care utilization, either because the outcomes are directly affected by the volume and quality of primary care, or because they may substitute for primary care. We examine the individual's morbidity weight from the ACG system (the ACG weight).³⁰ Notably, the introduction of ACG-based payment increases providers' incentives to more carefully register diagnoses (van de Ven and Ellis, 2000), which might have heterogeneous effects on low- and high-SES patients. We also study measures of secondary care utilization and health: The probability of a visit to a hospital emergency department (ED), the probability of being hospitalized (inpatient stay), the number of days spent in hospital, and the probability of a hospitalization with a so-called ambulatory care sensitive condition (ACSC).³¹ ACSC hospitalizations are often referred to as *avoidable* given appropriate prevention and primary care. As such, this measure is close to a 'pure' measure of health and primary care quality (although in the short run, it may be difficult to affect hospitalizations for some of the included conditions such as heart failure or diabetes). These measures are computed on an annual basis; the ACG weight because a sufficient time period is needed to collect information on diagnoses, the hospital measures because they are rare events.

4.3.3 Descriptive statistics

Panel A of Table 3 shows descriptive statistics for indicators of SES status separately for the two groups contrasted in our analysis. The first row shows that on average, individuals in the low-SES (high CNI) belonged to the high CNI group during 84% of the study period. This suggests that our approach of using a time-invariant measure of SES is reasonable. The second row shows the mean CNI weight in 2011, and the subsequent rows show the proportion of individuals possessing each of the CNI characteristics in our low-SES definition. By definition, the average CNI weight is higher in the high CNI group. The only reason why the low CNI group has a non-zero average CNI weight is that we classified individuals whose CNI is high *just because they moved* as belonging to the low CNI group (see footnote 28).

³⁰We used the official ACG software, version 11.2.1, to compute ACG weights. Our measure of the ACG weight does not correspond exactly to the weights used by the region for the payment. The region computes ACG weights based on diagnoses registered over 18 months. We computed the ACG weight including only diagnoses registered during a calendar year, for convenience given the structure of our data (annual). Furthermore, the ACG weights used in the regional payment system only includes diagnoses set in primary care. We included all diagnoses in our computation of the ACG weights, to get a more comprehensive measure of individuals' health status.

³¹We use the definition of ACSC developed by the National Board of Health and Welfare. The set of ACSCs include the following chronic conditions: anemia, asthma, diabetes, heart failure, hypertension, COPD, angina, the following acute conditions: bleeding ulcer, diarrhea, epileptic seizures, inflammatory diseases in the female pelvic organs, pyelitis, and ear, nose and throat infections, and the following conditions of special relevance to elderly patients: cardiac arrhythmia, influenza, pneumonia, and urinary tract infections.

We note from the table that low education, unemployment and immigrant status are the most common reasons for being categorized as belonging to the high CNI group. The labour income is considerably lower in the high CNI group, confirming that our analysis contrasts groups with substantially different SES.

Table 3: Descriptive statistics

<i>Panel A: CNI components and income</i>						
	HIGH CNI			Low CNI		
	N	Mean	SD	N	Mean	SD
High CNI (within ind.)	26663	0.84	0.25	66200	0.07	0.14
CNI weight (t=2011)	26663	5.73	2.86	66200	0.23	0.93
Single parent	26663	0.19	0.39	66200	0.00	0.00
Foreign	26663	0.31	0.46	66200	0.00	0.00
Low education	26663	0.41	0.49	66200	0.00	0.00
Unemployed	26663	0.36	0.48	66200	0.00	0.00
Moved	26663	0.07	0.25	66200	0.06	0.23
Labour income (SEK)	26663	139196	150756	66200	255873	190334

<i>Panel B: Health and care variables</i>						
	HIGH CNI			Low CNI		
	N	Mean	SD	N	Mean	SD
GP visits (PCC)	26663	1.56	1.97	66200	1.20	1.55
Nurse visits (PCC)	26663	1.46	4.74	66200	1.18	3.47
Phys visits (HC)	26663	1.69	2.08	66200	1.32	1.68
Nurse visits (HC)	26663	1.82	5.42	66200	1.56	3.77
Any ED visit	26663	0.23	0.42	66200	0.17	0.38
Any inpatient stay	26663	0.11	0.31	66200	0.09	0.28
Any planned inpatient	26663	0.03	0.18	66200	0.03	0.18
Any acute inpatient	26663	0.08	0.28	66200	0.06	0.24
Hospital days	26663	0.97	7.35	66200	0.72	6.03
ACSC hospitalisations	26663	0.01	0.10	66200	0.01	0.08
ACG weight	26663	1.53	1.35	66200	1.27	1.17
Disability benefit	26663	0.16	0.36	66200	0.09	0.29

Note: Panel A: The first row shows descriptive statistics for the proportion of the years in the sample that individuals are classified as having high CNI (within individual variation). The subsequent rows show descriptives for the CNI weight, the CNI components, and annual labour income in 2011. **Panel B** shows descriptive statistics for the health related variables. PCC is primary care, HC = all health care, ACG weight is the individual's ACG weight calculated from diagnoses set in 2011, ED = emergency department, ACSC = Ambulatory Care Sensitive Conditions. **Both panels:** The descriptives are presented separately for individuals with high CNI (i.e., low SES) and low CNI (high SES) as of December 2011. Note that we have classified individuals who would in effect have a strictly positive CNI due solely to having moved within the region as belonging to the low-CNI group (see main text). All variables are measured on an annual basis using data for 2011. The summary statistics are weighted to balance the treatment and comparison groups in terms of gender and birth year.

Panel B of Table 3 shows descriptive statistics of variables related to health care utilization and health status in 2011. Despite that all individuals in our study population had a chronic condition, we see that individuals in the high CNI group on average visited physicians and nurses more, in primary care (PC) as well as in the whole health care sector (HC), than individuals in the low CNI group. They were more likely to visit the ED, slightly more likely to be hospitalized, and stayed more nights in hospital on average. The ACG weight is higher in the low-SES group, which confirms that they have relatively low health status even conditional on having a chronic condition. Another indication of the lower health status in the low-SES group is that 16% received disability pension, compared to 9% of the comparison group.

The average ACG weights exceed one in both groups, which means that their healthcare costs lay

above the regional population average. This is reasonable, since the study population only includes individuals with a chronic condition. To gain further insights on the morbidity in the low- and high-SES groups, Figure 1 shows the distribution of ACG weights in 2011, by group.³² Although it is clear that low-SES individuals are overrepresented in the higher ACG risk groups, there is a considerable overlap between the distributions.

The proportion of individuals classified in the very lowest ACG is remarkably high for both groups (18-20%), given that the study population only includes individuals with a chronic condition. But Swedish patients are usually called in for routine check-ups in 18-months intervals, which may produce such a pattern since we only include 12 months of data when calculating the ACG. As we show later, almost all individuals in the study population are classified in ACG groups corresponding to above-average health costs (i.e., > 1) at least once during the study period.

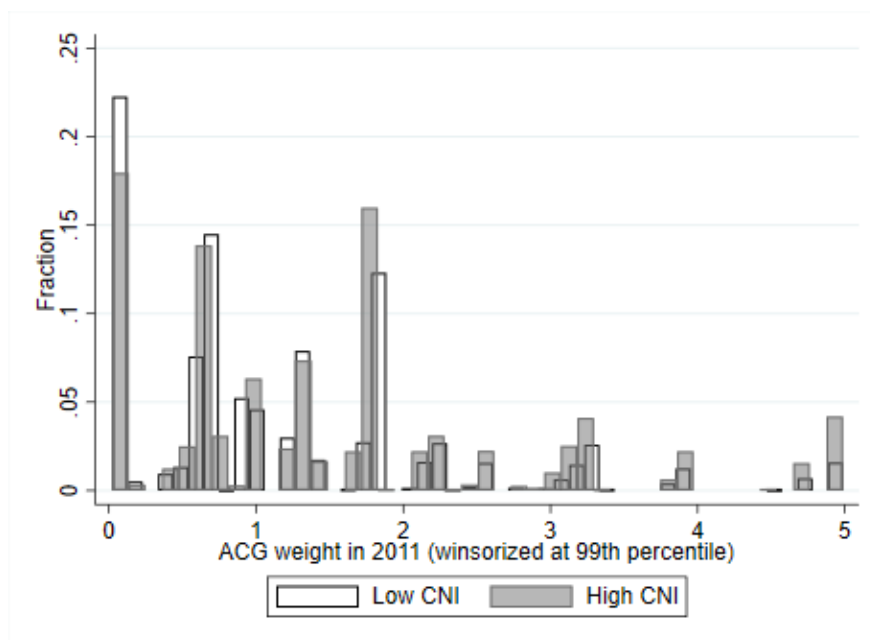


Figure 1: ACG distribution by SES (high CNI = low SES)

5 Empirical strategy

We compare the high and low SES groups in a difference-in-differences estimation framework. Since the risk adjustment affected the capitation for everyone, not only those with low-SES, the development of the outcomes in the high-SES group cannot be thought of as a counterfactual for the development in the low-SES group. The DiD comparison is nonetheless informative in relation to the research question,

³²The ACG variable is highly skewed with a small number of outliers. To make the figure interpretable, the weights are winsorized at the 99th percentile. I.e., individuals with ACG above the 99th percentile have been assigned the weight of the 99th percentile.

as directly it tells us how the reform affected a socioeconomic differential. As in any DiD analysis, the extent to which the DiD can be interpreted as being driven by the reform depends on the plausibility of a parallel trends assumption (e.g., Abadie, 2005).

The major threat to this assumption in our case is the possibility of diverging health trends. In particular, the generally lower health of low-SES individuals may deteriorate more quickly. This would imply increases of both primary and secondary care utilization relative to the utilization of high-SES individuals, irrespective of the reform. As we restrict the sample to individuals with a chronic condition, this source of bias is not so large as it would have been if we had studied the whole population.³³ Individuals with chronic illnesses are receiving treatment and monitoring from the health care system, which make it more likely that the small difference in levels is kept in an equilibrium, unless upset by an external shock such as, e.g., a new risk-adjustment model. To further mitigate the scope for differential health trends, we balance the high- and low SES groups in terms of age and gender by including age- and gender specific weights obtained by Coarsened Exact Matching (CEM) (Iacus et al., 2011) as weights in our regressions. We also examine the robustness of our results to including group-specific linear trends.

We estimate flexible event-study specifications for all outcomes. We interact a vector of time fixed effects with an indicator variable for belonging to the low-SES/high-CNI group. In our models of primary care utilization, we have 44 quarters of data (2007-2017) and thus the event study specification for outcome y becomes:

$$y_{iq} = \sum_{q=1}^{q=44} \gamma_q \mathbf{I}(\text{High CNI}) \times \mathbf{I}(q) + \lambda_q + \mu_i + \varepsilon_{iq} \quad (1)$$

y_{iq} is the value of the dependent variable for individual i in quarter q , $\mathbf{I}(\text{High CNI}) \times \mathbf{I}(q)$ is the interaction between the low-SES indicator and the FE for quarter q , λ_q is the vector of quarter FEs, μ_i is the vector of individual FEs and ε_{iq} is an error term. Standard errors are clustered by individual; as the capitation differs across individuals, this is the level of treatment assignment (Abadie et al., 2017). We present the estimated vector of γ_q s in graphical format, using the last quarter of 2011 as the reference category.

To gain precision, we also estimate more restrictive DiD models contrasting the whole pre-period (2007-11) with the announcement (2012-13), phase-in (2014-15) and final post reform (2016-17) periods.

³³ An alternative approach to reduce the scope of this problem would be to study a population defined by age instead of a cohort. In a sensitivity analysis, we consider such a study population in which individuals enter the sample when they turn six, and leave the sample when they turn 65. The population is redefined yearly using the population registered at a PCC in the region on January 1. Because the region started to record the data on PCC enrollment in 2008, we can only analyse this time-varying study population in 2008-2017.

We build these aggregate estimates from the following event-study-like specification:³⁴

$$y_{iq} = \sum_{q=21}^{q=44} \gamma_q \mathbf{I}(\text{High CNI}) \times \mathbf{I}(q) + \eta \mathbf{I}(\text{High CNI}) \times q + \lambda_q + \mu_i + \varepsilon_{iq} \quad (2)$$

The specification is equivalent to (1), except that it restricts all pre-period estimates to be 0 and allows for a separate linear trend for the high-CNI group ($\eta \mathbf{I}(\text{High CNI}) \times q$); although in the baseline specifications, we restrict the coefficient η to zero (thus assuming similar trends). To obtain DiD estimates from the quartely estimates, we compute averages of the γ_q s from Eq. (2) over three separate periods: i) the announcement period (2012-2013, i.e., $q \in (21, 28)$), the phase-in period (2014-2015, i.e., $q \in (29, 36)$), and the period after the new system was fully phased in (2016-2017, i.e., $q \in (37, 44)$). Since we are not in a staggered DiD setting (Goodman-Bacon, 2021), this approach yields exactly the same point estimates as a standard DID specification using *post* \times *treatment* dummies. We use the delta method to estimate standard errors for the estimated DiDs (clustered by individual here too).

We also estimate event study and DiD models for our secondary outcomes (hospitalization etc), with the exception that the outcome data is annual instead of quarterly. The reference year is 2011 in these estimations.

6 Results

6.1 Primary care utilization

Figure 2 shows raw trends (upper subfigures) and event study estimates (lower subfigures) for physician visits. The figures on the left show results for the probability of making at least one visit and the figures on the right show results for the number of physician visits. The upper figures display raw quarterly averages, together with moving averages calculated using a four-quarter window with two lags and one lead around each quarter. The vertical lines/shaded areas indicate the start of the announcement period (2012-2013), the phase-in period (2014-2015), and the period after the reform was fully implemented (2016-2017).

The moving averages show that the levels of both variables were stable over the period, except for a bump starting around the introduction of the patient choice system in the latter part of 2009. After 2015, the variables display a negative trend.

The utilization of primary care is generally higher in the low-SES group (black lines) than in the high-SES group (gray lines), which is expected given the lower health status in the low-SES group. Overall, the outcomes for the low- and high SES groups develop similarly over time. Importantly, the trends do

³⁴The reason why we use this approach is that it allows us to include a group-specific linear time-trend for the treatment group extrapolating the differential trend from the pre-period (η ; see Bilinski and Hatfield, 2018). When we do include such a trend, the fully dynamic specification in eq. (2) helps us ensure that the group-specific trend is estimated using only variation in the pre-period as recommended by Wolfers (2006) and Lee and Solon (2011).

not diverge in the way they would have done if the health status of low-SES individuals had deteriorated relatively faster during the study period (assuming worse health would imply increased utilization). By contrast, the most noticeable deviation between the two group is that the number of visits *decreased more* in the low-SES group in the very last part of the study period. Despite the overall similarity, the event study estimates from Eq. 1, shown in the lower part of Figure 2, indicate that the quarter estimates are generally more positive for the low-SES group during the pre-period, especially for the probability of a visit. However, as seen from the figure, this is solely driven by chosen reference quarter – if we had used any other pre-reform quarter as our reference period, almost all pre-period event study estimates would have been very close to zero. In most years, the event study estimates further display a seasonal pattern, with higher SES differentials in the first quarter of the year.³⁵ In particular, the event study estimates for the first quarters are especially large in 2010 and 2011 (right before the announcement period). Plausibly, this pattern arises mechanically from the temporary increase in visits those years.

Even though the event study estimates suggests that low- and high SES individuals were on a more positive trend in the pre-period (which we adjust for later), nothing in these figures suggests that the payment reform had a positive impact on the access to physicians for low-SES individuals. From the announcement period onwards, the event study estimates hover around zero. Although the two groups display seasonal differences, it is implausible that neutralizing shocks affecting the two groups differentially would occur in close to all post-announcement quarters.

³⁵When we asked administrators in the region about the seasonal pattern, they speculated that it may follow mechanically from the tendency that physicians set the end date of sickness certificates to Jan 1, triggering visits due to renewals in the first quarter of the year. We lack data on the sickness absence among our study population, but the relatively worse health and large uptake of disability pension suggests that the low-SES group have higher sickness absence too.

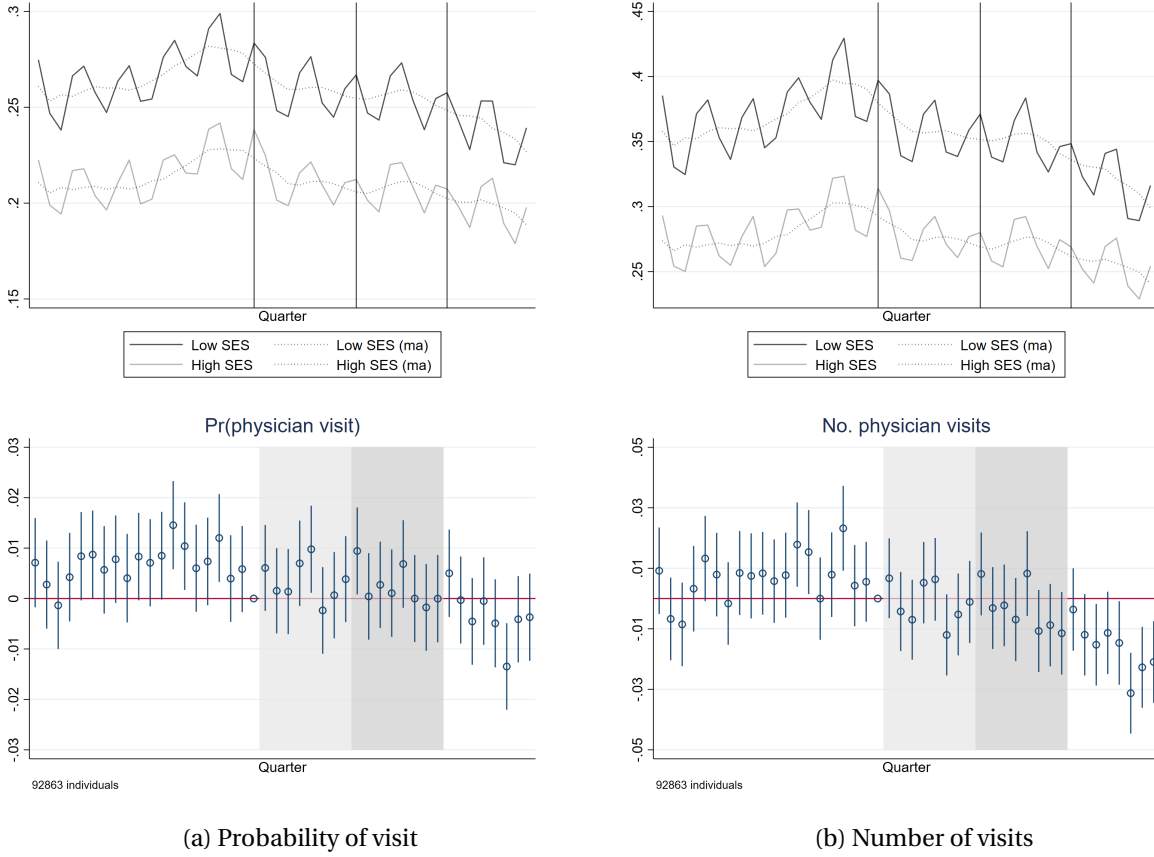


Figure 2: Physician visits by quarter 2007-2017

Note: *Upper panel:* The lines show raw quarterly averages by group (low SES/high SES) and the dots show moving averages over four quarters (two lags, 1 lead). *Lower panel:* Event study estimates using the last quarter of 2011 as the reference quarter. The vertical lines (upper panel) and shaded areas (lower panel) indicate the announcement period (2012-2013) and the two first post reform years (2014-2015). The reform was fully phased in by 2016 (rightmost part of figures).

From the event study estimates, we expect that formal DiD estimates would be zero or even negative. This is confirmed by the results shown in Table 4. The table displays DiDs from estimations of Eq. (2), separate for the three subperiods 2012-2013 (announcement period), 2014-2015 (phase-in period) and 2016-2017 (after the reform was fully phased in). Panel A displays the results for the probability of making at least one visit, and Panel B the results for the number of visits. In our preferred specification (column 1), the estimates are negative and statistically significant from the announcement period and onwards. The announcement and first post-period estimates are not statistically different from each other, while the estimate for the second post-period is significantly smaller (more negative). The estimates for the probability of a visit correspond to a decrease of 1.4% (announcement), 2.0% (first post-period), and 4.6% (second post-period) of the mean in the high-SES group, and the estimates for the number of visits correspond to decreases of 2.8%, 3.5%, and 8.1% relative to the mean.

In columns 2-8, we vary the specification to examine the stability of the results. Column 2 shows that the inclusion of group-specific linear trends yields estimates that are even more negative than in

the baseline specification. It is reassuring that the inclusion of a trend does not change our conclusions, given the presence of positive pre-reform event study estimates in Figure 2. Column 3 shows that models not using the CEM weights yield smaller or even positive point estimates for the announcement and first post-reform periods. This is to be expected given the demographic differences between the high and low-SES groups. Nonetheless, even the positive estimates are precise enough to rule out meaningful increases in the low-SES group. After 2016, the estimates without weights are negative and statistically significant. Column 4 excludes the individual fixed effects, leaving the estimates virtually unchanged. Column 5 excludes individuals who left the sample during follow-up (due to migration or death). The estimates are smaller, implying that the negative estimates in the preferred specification partly reflect attrition. However, all estimates are negative, and the estimate for 2016-2017 is statistically significant for the probability of a visit (Panel A), as are all the estimates for the number of visits (Panel B).

Column 6 indicates that the estimates are slightly less negative when we use the predicted treatment status to compute a time-varying CNI measure; however, the differences are small. Column 7 shows results from a specification using a time-varying study population (see footnote 33). This is the only specification in which the estimates are consistently positive and statistically significant. Importantly, as we show in Online Appendix G, these estimates are entirely driven by a diverging pre-trend; when including group-specific trends, the estimates are very close to zero and statistically insignificant. Column 8 shows that clustering the standard errors at the PCC level has minor effects; the only difference is that the estimate for the announcement period loses significance in the model for the probability of a visit. Column 9 restricts the pre-period to the quarters after Östergötland introduced its patient choice reform (i.e., after 2010). As expected given the event study estimates in Figure 2, the estimates are more negative in this specification, but they are still similar to the preferred estimates.

Thus, across a range of specifications, we find no robust evidence that the payment reform expanded the access to physician services for low-SES individuals relative to high-SES individuals – if anything, it decreased.

Nurses play a prominent role in Swedish primary care. We therefore also report trends and event study estimates for the probability and number of *nurse* visits, although with the disclaimer that the contemporaneous reorganization of home care may have had spillover effects also on our study sample.

The upper part of Figure 3 shows large increases in the levels of the two outcomes in very first part of the study period, and a slower but still increasing trend thereafter. The event study estimates in the lower part of the figure do not indicate differential pre-trends for the probability of seeing a nurse, and the pre-trends for the number of visits move closely together since the structural break in the early study period. We note that the probability of seeing a nurse increased more for the low-SES group in the announcement period and in 2014-2015, but the average number of visits did not. In 2016-2017, the high-SES group approached the low-SES group both on the extensive (probability of visit) and intensive (number of visits) margin.

Table 5 shows the DiD estimates for nurse visits. Looking first at the probability of a visit (column 1),

Table 4: Physician visits: Difference-in-differences estimates and robustness

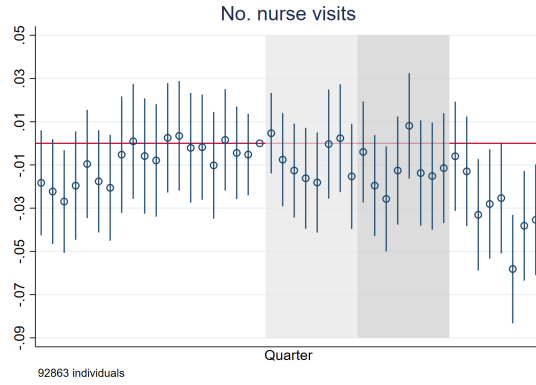
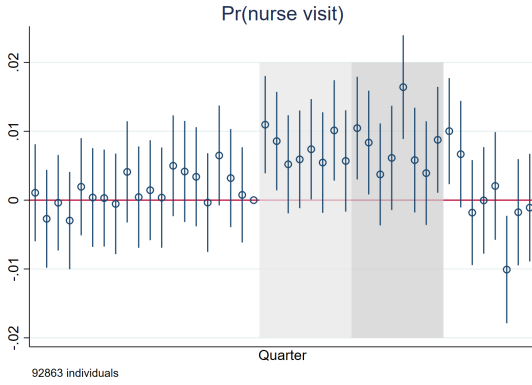
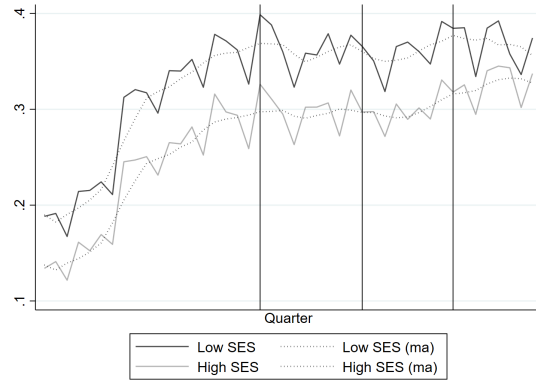
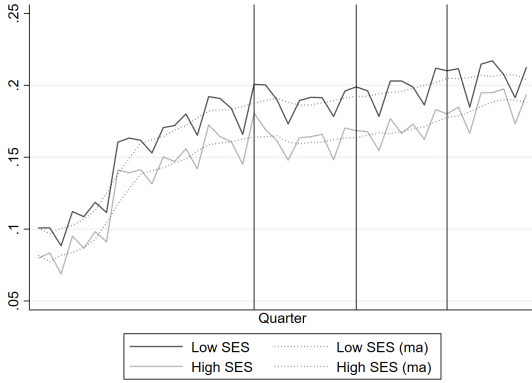
Panel A: Probability of visit									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Announcement	-0.00309* (0.00145)	-0.00457* (0.00226)	0.0000420 (0.00140)	-0.00309* (0.00145)	-0.00283 (0.00150)	-0.00203 (0.00142)	0.00652*** (0.00136)	-0.00309 (0.00164)	-0.00403* (0.00164)
2014 reform	-0.00423** (0.00156)	-0.00656* (0.00330)	0.000756 (0.00150)	-0.00423** (0.00156)	-0.00202 (0.00159)	-0.00307* (0.00152)	0.0107*** (0.00151)	-0.00423* (0.00173)	-0.00518** (0.00177)
2016 reform	-0.00989*** (0.00160)	-0.0131** (0.00436)	-0.00345* (0.00154)	-0.00989*** (0.00160)	-0.00653*** (0.00162)	-0.00854*** (0.00156)	0.0100*** (0.00160)	-0.00989*** (0.00239)	-0.0108*** (0.00183)
N	4085972	4085972	4085972	4085972	3771196	3884012	4861192	4085972	2971616
No. clusters	92863	92863	92863	92863	85709	88273	148180	44	92863
Mean dep.	0.215	0.215	0.215	0.215	0.219	0.217	0.220	0.215	0.214
Announcement=2014 DiD	0.483	0.321	0.648	0.483	0.631	0.517	0.00630	0.522	0.483
2014 DiD = 2016 DiD	0.000379	0.000907	0.00580	0.000379	0.00645	0.000461	0.661	0.00624	0.000379
Linear trend	No	Yes	No	No	No	No	No	No	No
CEM	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Ind. FE	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Attritioners	Included	Included	Included	Included	Excluded	Included	Included	Included	Included
Treatment def.	Fixed	Fixed	Fixed	Fixed	Fixed	Predicted	Yearly	Fixed	Fixed
Pop. def.	Cohort	Cohort	Cohort	Cohort	Cohort	Cohort	Yearly	Cohort	Cohort
Cluster	Ind	Ind	Ind	Ind	Ind	Ind	Ind	PCC	Ind
Min year	2007	2007	2007	2007	2007	2007	2007	2007	2010

Panel B: Number of visits									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Announcement	-0.00785** (0.00248)	-0.0133*** (0.00382)	-0.00408 (0.00238)	-0.00785** (0.00248)	-0.00734** (0.00256)	-0.00591* (0.00241)	0.00737** (0.00227)	-0.00785** (0.00281)	-0.0107*** (0.00276)
2014 reform	-0.00979*** (0.00268)	-0.0184** (0.00567)	-0.00384 (0.00258)	-0.00979*** (0.00268)	-0.00593* (0.00275)	-0.00749** (0.00259)	0.0130*** (0.00256)	-0.00979** (0.00326)	-0.0126*** (0.00304)
2016 reform	-0.0229*** (0.00269)	-0.0346*** (0.00751)	-0.0162*** (0.00259)	-0.0229*** (0.00269)	-0.0175*** (0.00275)	-0.0200*** (0.00261)	0.00667* (0.00264)	-0.0229*** (0.00424)	-0.0257*** (0.00310)
N	4085972	4085972	4085972	4085972	3771196	3884012	4861192	4085972	2971616
No. clusters	92863	92863	92863	92863	85709	88273	148180	44	92863
Mean dep.	0.283	0.283	0.283	0.283	0.289	0.287	0.289	0.283	0.282
Announcement=2014 DiD	0.472	0.137	0.928	0.472	0.613	0.548	0.0280	0.541	0.472
2014 DiD = 2016 DiD	0.000000363	0.000000639	0.000000512	0.000000363	0.0000161	0.000000641	0.0133	0.0000184	0.000000363
Linear trend	No	Yes	No	No	No	No	No	No	No
CEM	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Ind. FE	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Attritioners	Included	Included	Included	Included	Excluded	Included	Included	Included	Included
Treatment def.	Fixed	Fixed	Fixed	Fixed	Fixed	Predicted	Yearly	Fixed	Fixed
Pop. def.	Cohort	Cohort	Cohort	Cohort	Cohort	Cohort	Yearly	Cohort	Cohort
Cluster	Ind	Ind	Ind	Ind	Ind	Ind	Ind	PCC	Ind
Min year	2007	2007	2007	2007	2007	2007	2007	2007	2010

Note: In each model, the dependent variable is either the indicator for at least one visit (Panel A) or the number of physician visits (Panel B) at a primary care center in a quarter. The table shows three average DiDs, each computed over a number of quarterly differences-in-differences (DiD) estimates from linear regression models. The estimates contrast individuals with Care Need Index (CNI) > 0 to individuals with CNI = 0; Announcement shows the average of the quarterly DiD estimates in the announcement period (Q2 2012 – Q4 2013), 2014 reform shows the average of the quarterly DiD estimates after the reform (2014–2015), and 2016 reform shows the average of the quarterly DiD estimates after the price increase in 2016 (2016–2017).

Announcement=2014 DiD shows p-value of test of equality of the DiDs for 2012–13 and 2014–15 periods. 2014 DiD = 2016 DiD shows p-value of test for equality of DiDs in 2014–15 and 2016–17. All models include quarter fixed effects. Individual's CNI status is measured on Dec 31 2011 unless stated otherwise (see row Treatment def). Predicted = use predicted CNI for 2011 instead of actual CNI. CEM weights balance the sample in terms of birth year and gender. Attritioners are defined as individuals moving out from the region or dying in 2013–2017. The study population is a cohort who were registered at a PCC in the region on Jan 1 2013 and lived in the region throughout 2007–2011; the exception is the column for which Pop.Def is indicated as Yearly. In that specification, the study population includes individuals registered at a PCC in the region on January 1 year t, for t=2010–2017. Standard errors are clustered by individual in all models except in column 8, in which they are clustered by the individual's PCC at baseline. * p<0.05, ** p<0.01, *** p<0.001.

the DiDs are positive and statistically significant in the announcement and phase-in-period (amounting to 4.2 and 4.6% of the control group mean), but negative, though small and statistically insignificant, after 2016. The DiD estimates for the number of nurse visits (column 2) are small and statistically insignificant in the announcement and first post-period, and negative and statistically significant in the second post-period (8.2% of the control group mean). In Appendix C, we report robustness tests similar to the ones used for physician visits. The results are generally stable, except that the estimate for the probability of a visit loses significance when we include a linear trend or cluster the standard errors at the PCC level.



(a) Probability of visit

(b) Number of visits

Figure 3: Nurse visits by quarter 2007-2017

Note: Upper panel: The lines show raw quarterly averages by group (low SES/high SES) and the dots show moving averages over four quarters (two lags, 1 lead). *Lower panel:* Event study estimates using the last quarter of 2011 as the reference quarter. The vertical lines (upper panel) and shaded areas (lower panel) indicate the announcement period (2012-2013) and the two first post reform years (2014-2015). The reform was fully phased in by 2016 (rightmost part of figures).

Table 5: Nurse visits: Difference-in-differences estimates

	Probability of visit	Number of visits
	(1)	(2)
Announcement	0.00611*** (0.00143)	0.000573 (0.00698)
2014 reform	0.00665*** (0.00159)	-0.00332 (0.00713)
2016 reform	-0.000807 (0.00172)	-0.0212** (0.00777)
N	4085972	4085972
Individuals	92863	92863
Mean dep.	0.145	0.257
Announcement=2014 DiD	0.728	0.581
2014 DiD = 2016 DiD	0.00000126	0.000798

Note: The dependent variable is either an indicator for at least one visit or the quarterly number of visits with a nurse at a primary care center. The estimates in the table are average DiDs, computed over a number of quarterly differences-in-differences (DiD) estimates from linear regression models. The estimates contrast individuals with Care Need Index (CNI)>0 to individuals with CNI=0; Announcement shows the average of the quarterly DiD estimates in the announcement period (Q2 2012 – Q4 2013), 2014 reform shows the average of the quarterly DiD estimates after the reform (2014-2015), and 2016 reform shows the average of the quarterly DiD estimates after the price increase in 2016 (2016-2017). Announcement=2014 DiD shows p-value of test of equality of the DiDs for 2012-13 and 2014-15 periods. 2014 DiD = 2016 DiD shows p-value of test for equality of DiDs in 2014-15 and 2016-17. All models include quarter fixed effects. Individual's CNI status is measured on Dec 31 2011. CEM weights balance the sample in terms of birth year and gender. Attritioners are defined as individuals moving out from the region or dying in 2013-2017. The study population is a cohort born 1953-2001 who were registered at a PCC in the region on Jan 1 2013 and lived in the region throughout 2007-2011 and had a chronic condition status registered in the pre-period. Standard errors are clustered by individual. * p<0.05, ** p<0.01, *** p<0.001.

Summing up, across a range of specifications, we fail to find any evidence suggesting that primary care providers responded to the payment reform by offering low-SES individuals increased access to physicians. We do find some evidence that the likelihood of seeing a nurse increased more for low-SES individuals, at least temporarily, but the result is not robust to including a linear trend.

For both physician and nurse visits, we find smaller (more negative) estimates in the very last period (2016-2017) compared to the phase-in period (2014-2015). This may be puzzling, considering that the weight of morbidity and socioeconomic status in the capitation increased substantially in 2016. The puzzle is resolved by recalling the theoretical framework, which points out that an increase in the capitation for a given patient need not channel into an increase in services provided for the intended person. Indeed, if the negative tendencies during the implementation phase reflect rational shifts of effort towards other patient groups, it is not strange that the pattern was further intensified once the reform was fully rolled out. However, it should also be said that the negative estimates may be driven by the increase in the patient fee in 2017, which might have had stronger effects on the (dis-)incentives to seek care for low-SES individuals.

6.2 Extensions

6.2.1 Heterogeneity

We explore heterogeneity of the estimates in several dimensions. We report the full results in the Online Appendix D, and describe the results briefly here.

One potentially important source of heterogeneity stems from the SES adjustment used in the old risk adjustment model. As described in section 3.1, the structure of the previous risk adjustment model implied that the capitation for low-SES individuals who lived in the few very poorest areas might well have decreased after the reform. Pooling such individuals with those who lived outside the poorest areas makes the impact of the reform ambiguous, which may possibly explain the negative estimates on physician visits. To explore this kind of heterogeneity, we estimate DiD models on a sample excluding patients who were enrolled at the two PCCs which benefited the most from the old SES-adjustment. The estimates do not suggest that the main results are explained by opposing effects on these PCCs and other PCCs. For physician visits, the estimates are very similar. For nurse visits, positive estimates on the probability of a visit in the first part of the period are somewhat smaller than in the main specification.

Irrespective of the earlier SES adjustment, the introduction of morbidity adjustment reduced the capitation of low-SES individuals in good health (i.e., people with low ACG). Indeed, even in our study population of people with a chronic condition, Figure 1 shows that low ACG values are relatively common. To examine if this mix of winners and losers in terms of capitation affects the results, we estimate our main models on a restricted sample that only includes observations whose ACG weight ≥ 1 . Notably, to closely approximate the current incentives in a given quarter, we use the current ACG weights to make the restriction (instead of, e.g., the value in 2011). Under this restriction, almost no low-SES individuals,

but still around four percent of the high-SES individuals, would receive a lower capitation under the new payment scheme. Nonetheless, we obtain similar results as in the main specification for the physician visit outcomes. If anything, the estimates become more negative. Since the negative estimates persist when we only study the observations with very highest ACG weight, we can conclude that the negative estimates on physician visits are *not* driven by low-SES individuals with relatively good health status (who became less profitable after the reform).

When it comes to nurse visits, the positive estimates on the probability of seeing a nurse become smaller and statistically insignificant when we remove observations with $ACG \leq 1$. Thus, the individuals with the very poorest health did not get greater access to nurses. This could mean that the increased access to nurses was targeted to relatively healthy individuals, but it could also indicate reverse causality: Since nurses tend to register fewer diagnoses, individuals may receive a lower ACG weight in years when they are especially likely to see a nurse instead of a physician. Notably, having an ACG weight below 1 is a common but transitory phenomenon in our study population (as witnessed by the fact that 89,483 out of 92,863 individuals remain in the estimation sample, though they appear in much fewer quarters).³⁶

As the SES measure is composed by several factors (region of birth, single parent, short education, or unemployed), we also consider heterogeneity of the estimates for the number of physician visits across individuals with different reasons for having a high CNI. For each of these J CNI components, we estimate specifications contrasting individuals with characteristic j (and possibly also other characteristics) to individuals with a low CNI. We find little heterogeneity in the estimates for the different CNI components (see Online Appendix E).

We furthermore examine heterogeneity of the estimates for the number of physician visits over two characteristics of the PCCs: *i*) public or private ownership, and *ii*) the expected budget change between 2013 and 2014, according to the region's budget projections in 2013. The hypothesis is that private PCCs and PCCs who were expected to lose money due to the reform would be more responsive to financial incentives. The event-study patterns are similar to the overall patterns for both public and private PCCs and for expected winners and losers in terms of the budgetary impact. However, the DiD estimates indicate that the effects are significantly more negative for private PCCs, and for expected budgetary winners (see Online Appendix F for the full results).

The more negative estimates for treated individuals registered at private PCCs and winners in terms of the expected budgetary impact may indicate that these PCCs are less prone to spend the additional money received for low SES patients to provide care for that group. However, it is important to acknowledge that the results do not by themselves show that the money was directly channelled as profits. For instance, the PCCs might have used the money to treat other patients or to extend the length of consultations for low-SES patients, or spent it on other activities not included in our models. In all circumstances, the heterogeneity should not be overstated: By and large, the patterns are similar for all types of PCCs.

³⁶This is not so strange as it may seem. $ACG=1$ implies having exactly average health care costs. Given the skewness of health care costs, it would rather be surprising if people had an ACG weight above 1 most years.

6.2.2 Other outcomes

Apart from primary care utilization, it is interesting to examine the reform effect on other outcomes. One such outcome is the ACG weight. In these models, it is important to acknowledge that effects on the ACG weight do not only reflect health effects, but also upcoding efforts. The upper left panel of Figure 4 show event-study estimates for the ACG weight, and the corresponding DiD estimates are shown in column 1 in Table 6. The event study estimates are positive in the announcement and first post-period, become smaller in 2016, and turn negative in 2017, although none of the estimates are significant. The DiD specification indicates that there is a significant positive effect in 2014-2015 but not in other periods. Regardless of whether the measure is viewed as mirroring health or upcoding, the estimates are small, and thus do not indicate substantial effects of the reform on the SES-based difference.

The reform might have affected individuals' propensity to seek care outside the primary care setting. The upper right panel of Figure 4 shows estimates on the probability of having visited a hospital emergency department at least once during a year. Column 2 of Table 6 shows the corresponding DiD estimates. The event study estimates are positive all post-announcement years, and significant in 2013-2014. The DiD estimates are significant in all post-periods.

The middle left and right panel of Figure 4 shows event-study estimates of the probability of a hospitalization in a given year (left) and the number of hospital days (right). The corresponding DiD estimates are shown in Column 3 and 4 of Table 6. The estimates indicate positive but small and statistically insignificant effects on these outcomes.

The bottom left panel of Figure 4 shows event-study estimates of the probability of an avoidable hospitalization in a given year. Column 5 in Table 6 shows the corresponding DiD estimates. The sign of the event-study estimates varies between periods. In the DiD specifications, all estimates are positive but they are close to zero and not statistically significant.

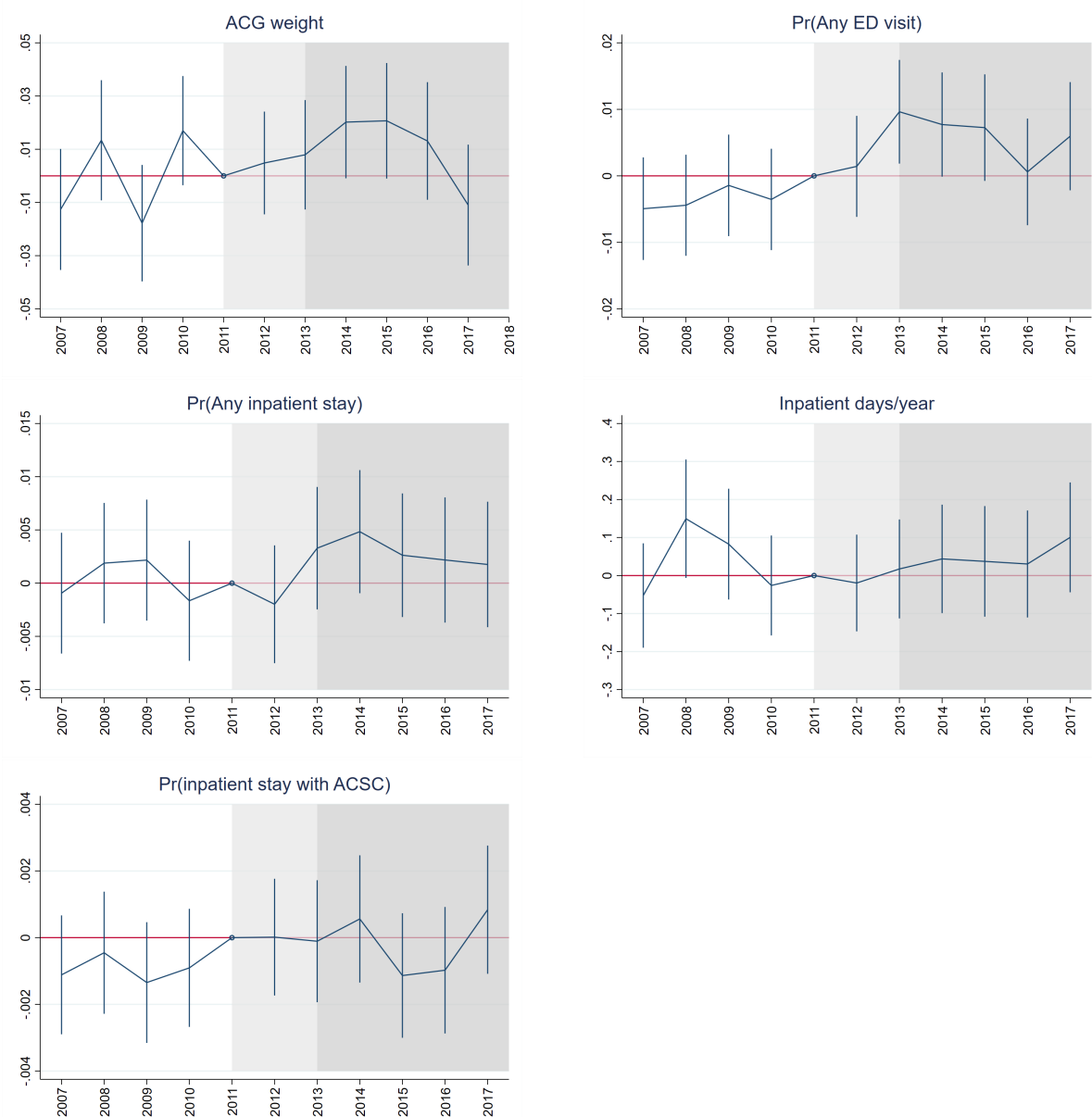


Figure 4: Other outcomes; annual data 2007-2017

Note: ACG weight = risk score from the morbidity risk adjustment model. Any ED visit = indicator for having at least one visit at an emergency department at hospital in Östergötland. Pr(Any inpatient stay) = indicator for having at least one inpatient stay at any hospital in Sweden. Inpatient days/year = number of days in hospital during the year (any Swedish hospital). Any ACSC = indicator for having at least 1 hospitalization with an ambulatory care sensitive condition diagnosis (any Swedish hospital).

Table 6: Other outcomes (difference-in-differences estimates)

	(1) ACG weight	(2) Any ED visit	(3) Any inpatient stay	(4) Inpatient days	(5) Any ACSC
Announcement	0.00639 (0.00689)	0.00837*** (0.00241)	0.000342 (0.00176)	-0.0320 (0.0459)	0.000719 (0.000555)
2014 reform	0.0205** (0.00751)	0.0103*** (0.00251)	0.00344 (0.00185)	0.00986 (0.0495)	0.000482 (0.000606)
2016 reform	0.00114 (0.00801)	0.00613* (0.00260)	0.00167 (0.00191)	0.0345 (0.0519)	0.000691 (0.000616)
Constant	1.294*** (0.00103)	0.187*** (0.000319)	0.0842*** (0.000239)	0.782*** (0.00656)	0.00730*** (0.0000762)
N	1009057	1003660	1003631	1003631	1003929
Individuals	92863	92863	92863	92863	92863
Announcement=2014 DiD	0.0607	0.490	0.132	0.428	0.723
2014 DiD = 2016 DiD	0.0116	0.148	0.392	0.651	0.761

Note: ACG weight = risk score from morbidity risk adjustment model. Any ED visit = Pr(at least one visit at an emergency department (hospitals in Östergötland)). Any inpatient = Pr(at least one inpatient stay (any Swedish hospital)). Inpatient days = no. inpatient days (any Swedish hospital). Any ACSC = indicator for having at least 1 hospitalization with an ACSC diagnosis (any Swedish hospital). The estimates contrast individuals with Care Need Index (CNI) >0 to individuals with CNI=0; Announcement shows the DiD estimate for the announcement period (2012 – 2013), 2014 reform shows the DiD estimate after the reform (2014–2015), and 2016 reform shows the DiD estimate after the price increase in 2016 (2016–2017). Announcement–2014 DiD shows p-value of test of equality of the DiDs for 2012–13 and 2014–15 periods. 2014 DiD = 2016 DiD shows p-value of test for equality of DiDs in 2014–15 and 2016–17. All models include individual and year fixed effects, and use CEM weights to balance the sample in terms of birth year and gender. The constant shows the mean of the dependent variable in the low-CNI group. Standard errors are clustered by individual. * p<0.05, ** p<0.01, *** p<0.001.

Summing up, we find some evidence that the ACG weight increased slightly more for the low-SES group, at least during the phase-in period (2014–2015). There is also a positive effect on the probability of visiting the ED, but no significant effect on other secondary care measures. Taken together with our earlier results regarding primary care utilization, one potential interpretation is that low-SES patients responded to decreased access to primary care physicians by turning to the ED. If ED physicians differ in their diagnosis registration habits, this may in turn explain the positive estimates on the ACG weight. (Note that we find the largest effect on the ACG weight in 2014–2015, i.e., the years with the largest estimates for the probability of visiting a nurse and the ED.)

Another potential interpretation of the positive estimates on the ACG weight and ED visits is that the health of the low-SES group deteriorated more over the study period. Although, this interpretation does not fit well with the observed trend of the ACG outcome differential, which turns negative towards the end of the sample period. Neither is it consistent with the negative estimate on primary care physician visits and the lack of effects on hospitalizations. Furthermore, in Online Appendix H, we report estimations using data from three other regions of Sweden in which we compare the development of high and low CNI individuals in regions that did not change their risk-adjustment models at the same time.³⁷ Estimating similar models for ACSC hospitalizations, the probability of an inpatient stay, and the number of hospital days per year, we find no evidence in the direction of greater health deteriorations over time for the low-SES individuals as indicated by these variables. Furthermore, when looking at the ACG, we find that the difference in ACG between high- and low SES individuals with chronic conditions does not

³⁷ It is tempting to use data from these regions to estimate a triple-DiD for the primary care outcomes. However, due to substantial contemporaneous changes to the market structure and payment systems in these regions, the results from such a model would be hard to interpret.

grow over time.³⁸ These results for other regions show that faster health deteriorations in the low-SES group are not inevitable – at least not over periods of the same length as our study period, and for individuals in the studied age groups.

7 Discussion and concluding remarks

Despite the widespread use of risk adjusted payment in health care, there are close to no earlier empirical studies of how providers react to the incentives embodied in risk adjustment models.

We study how the introduction of morbidity risk adjustment and a more sensitive SES-based adjustment of the capitation to primary care providers affects socioeconomic differences in care utilization. Focusing on a core group of patients – individuals with chronic conditions – we find no evidence of increased access to primary care physicians for individuals with low SES relative to individuals with high SES. Rather, our estimates suggest the opposite. While there are some signs of a temporary increased likelihood of visiting a primary care nurse, this result is not robust to specification changes, and the result is completely absent for the patients with the very poorest health. Thus, for the patients with the lowest health status, we find no improved access to neither primary care physicians nor nurses after the reform. There is a positive effect on the probability of visiting a hospital emergency department, which may function as a substitute to primary care. Given the null results for our measures of hospitalizations, it does not seem as though the reform had a meaningful effect on socioeconomic differences in health.

It deserves to be emphasized that increasing the number of visits is not the only way in which the PCCs might have reacted to the risk adjustment. It is possible that low-SES patients benefited in other ways that we could not observe, such as extended consultation time or other activities not accounted for in the models. However, we note that any such efforts did not make enough of a difference to reduce the incidence of severe adverse health events (as indicated by hospitalizations).

Importantly, although we find little to suggest that the payment reform improved the situation for low SES individuals relative to high-SES individuals with chronic conditions, it is still possible that the reform improved the situation for both groups relative to *other* patients (e.g., because the introduction of morbidity-adjustment made people with chronic conditions in general more profitable), or that other groups benefited from the change of the risk-adjustment model. To conduct an evaluation of the total effects of the reform, we would have needed primary care data from a large number of comparison regions, with stable primary care institutions over the study period.³⁹ Our primary interest was socioeconomic

³⁸By contrast, the comparison with other regions shows that for individuals with no pre-existing chronic condition, the ACG weight mechanically increases more for low-SES individuals in post reform years. This suggests that the approach of splitting the sample by the existence of a chronic introduces mean reversion (Daw and Hatfield, 2018). Notably, in our study population, the corresponding mean reversion implies that our high-SES group is ‘too healthy’, which makes our main estimates conservative.

³⁹In Sweden, there is no national register of primary care akin to the national patient register for secondary care. Even if we would have approached all 21 Swedish regions to collect data for such an evaluation, considerable empirical challenges would remain due to the relatively small number of regions (clusters), which all implemented similar forms of risk-adjustment models during a relatively short period of time.

inequalities, which allow for a within-region comparison.

The theoretical framework in Section 2 offers several explanations why the risk adjustment may have limited effects on the socioeconomic differences in care utilization and health in our study population. The most fundamental aspect is that a prospective payment system gives autonomy to providers regarding how to spend their funds. How this autonomy is used depends on the objective of the provider. Altruistic providers may channel the funds towards other, otherwise underserved high-need patients (Barham and Milliken, 2015), while more profit-oriented providers may prefer to retain the funds as profits, or to improve the quality of services offered to even more profitable patients. For instance, given the existence of a large morbidity-weighted component of the capitation in our study setting, profit-oriented providers might prefer to invest in efforts to attract and retain high-SES patients, who are likely to be what Brown et al. (2014) denote as ‘cheap for their risk score’. If low-SES patients’ demand would have been relatively elastic with respect to quality, the link between the capitation payment and the volume of primary care services might have been stronger. Although we lack data about preferences, studies from other settings have found that the low-SES patients have relatively inelastic demand (Biørn and Godager, 2010; Santos et al., 2017; Gutacker et al., 2016; Anell et al., 2021b).

Provider autonomy over the allocation of prospective funds may also be the reason why the point estimates for physician visits become even more negative following the full phase-in of the risk adjustment in 2016. However, another potential explanation is that low- and high-SES individuals might have reacted differently to the increase in the patient fee the very last year of our study period. If so, it is a cruel irony that the policy intended to address socioeconomic disparities in health (risk adjustment) failed to do so, while another policy designed for other purposes (the fee increase) might have aggravated the disparities.

The weak responses to the risk adjustment may also relate to the fact that the capitation payment goes to the primary care practice, not to the individual physicians. There is some experimental evidence to suggest that group-level financial incentives are less effective than incentives targeting individual physicians (Petersen et al., 2013). Although, a number of studies indicate that the Swedish group practices do respond to financial incentives (Ellegård et al., 2018; Dackehag and Ellegård, 2019; Ellegård, 2020; Dietrichson et al., 2020b; Vengberg et al., 2021). Ultimately, the objective of the PCC manager will determine the extent to which the incentives facing the practice trickle down to the individual health professionals (Ellegård and Glenngård, 2019). The profitability of the practice is obviously a key objective for managers of private for-profit PCCs, but even for managers of public PCCs, showing a decent surplus or at least breaking even is an important performance measure in the Swedish setting. The managers’ best response to the risk adjustment might be to encourage physicians to allocate their time to more profitable patients, or to stay silent about the extra funds.

With salaried physicians, the incentive to skimp on quality for high-risk patients may not be so strong in the first place. In such a context, it may be argued that the risk adjustment is not so much a tool to affect provider incentives (Glazer and McGuire, 2000), as it is a tool to ensure that providers receive a

reasonable compensation for their, largely unavoidable, costs. Indeed, the low-SES group visited primary care relatively often already before the new model was introduced. The risk adjustment model might thus have signalled to physicians that they were already making the correct priorities, not that they should do more to low-SES patients. This can be contrasted with the experimental results in (Oxholm et al., 2019), which indicated that information about patient needs that challenged physicians' prior beliefs led to changes in treatment choices.

Our results may also reflect a poor 'fit' of the new risk adjustment model (Geruso and McGuire, 2016). Some suggestive evidence that the model did not correctly embody the third-party payers is given by the fact that the regional health authority introduced *ad hoc* extra compensations a few years after the reform: One extra grant that essentially targeted the small number of PCCs that 'lost' money due to the new design of the socioeconomic compensation, and an additional top-up to the capitation for the very oldest patients, whose care needs were deemed insufficiently accounted for by the ACG. With less than perfect fit, it is possible that the incentive effects of the new reform were not so strong, even though the reform implied large increases of the average capitation in the low-SES group.

Although our results are consistent with a number of mechanisms, a useful message to policymakers is that risk adjustment of the capitation to primary care practices may not be an effective method to reduce socioeconomic disparities in health. Coupled with the results from a related literature showing that physicians are less likely to undertreat high-need patients when their payment is based on the service volume than when payment is fixed (e.g., Hennig-Schmidt et al., 2011; Brosig-Koch et al., 2017; Cadena and Smith, 2022), our results suggest that it is preferable to link the payment more closely to the care actually provided to patients if the goal is to reduce SES-based inequalities in health. Alternatively, a 'soft' way to achieve similar incentives within a prospective system is to monitor and hold providers accountable based on care volumes for prioritized patient groups.

A valuable contribution of this study to the research literature is to provide rare evidence on the (lack of) behavioral responses to risk adjustment. To further the literature, future studies should aim for research designs that can separate between competing mechanisms, and use more comprehensive measures of resource utilization. Evidence from other institutional contexts is also warranted, since the devil resides in the details when it comes to payment schemes.

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Appendix A Details on the payment scheme

This Appendix shows the capitation amounts for individuals with different characteristics in 2010-2013 and 2014-2017. All monetary values are expressed in 2017 prices.

Table A.1 displays the payment per enrolled individual for the key features of the capitation in the period 2010-2013, i.e., before the reform under study.

Table A.1: Key features of the capitation in Östergötland 2010-2013 (2017 price level)

Year	<i>Age-adjusted</i>	<i>Drug</i>	<i>SES</i>	<i>Geography & 75+ (11-25 km)</i>	<i>Geography & 75+ (25+ km)</i>
	(1)	(2)	(3)	(4)	(5)
2010	1,087	1,639	1,851	4,532	6,798
2011	1,078	1,819	1,796	4,483	6,723
2012	1,098	1,508	1,824	4,554	6,831
2013	1,142	1,483	1,874	4,679	7,018

Table A.2: Key features of the capitation in Östergötland 2014-2017 (2017 price level)

Year	<i>ACG</i>	<i>CNI</i>	<i>75+</i>	<i>Age-adjusted</i>	<i>Drugs</i>
	(1)	(2)	(3)	(4)	(5)
2014	1,163	110		792	968
2015	2,270	113		388	471
2016	3,132	237	764		
2017	3,098	239	884		

Table A.2 displays the payment per enrolled individual for the key features of the capitation in the period 2014-2017, i.e., during the phase-in period and thereafter.⁴⁰ The amounts pertain to an individual with a weight of 1.0. ACG (column 1) is a composite of three payments: payment based on diagnoses in primary care, specific prescription drugs, and general prescription drugs.

Both the ACG and the CNI payments (column 2) increased in 2016. ACG was weighted more heavily than CNI: the CNI capitation was 9% of the ACG in 2014, 5% in 2015, and 8% in 2016-2017. As a proportion of total payments, CNI was 7% in 2014-2015 and 12% in 2016-2017. In 2016, the region's calculation of CNI changed, as the parameter inhabitants 1 year or older that have recently moved to the area was removed from the index (similar to what we do in the analysis, and for the same reason).

Simultaneously with the full phase-in of ACG and CNI in 2016, Östergötland introduced a capitation for enrolled individuals 75 years or older, following a concern that the ACG did not adequately track costs for the very oldest individuals (column 3). An age-adjusted capitation (column 4) carried over from the previous period during the phase-in period, but the payment was reduced and completely phased out by 2016. Furthermore, the weighting scheme used was also changed. The age group 20-44 was still the

⁴⁰The payments are for individual enrolled a publicly owned PCCs, the payment to private PCCs was 3% higher payment for all features of the payment system to compensate for value-added tax.

reference group with weight 1.0 but the weights were reduced for the youngest children (0-6 years) and from 65 and up. A reduced drug capitation also carried over for two years and was fully phased out by 2016. The weighting scheme for this part of the capitation did not change much.

The area- and SES-, geography-, and age-based risk-adjustments to the capitation used during 2010-2013 disappeared with the introduction of ACG and CNI. That is, the capitation was only based on individual characteristics from 2014 and onwards, in contrast to the earlier area-based capitation, in which the payment was determined by the area the individual lived in.

Before 2014, there was a basic grant to PCCs located in towns with only one PCC. This component remained but in a changed form after 2014: the category cutoffs were reduced to below 5,000, between 5,000 and 6,500, and between 6,500 and 8,000/11,000 (depending on year). For a PCC with 5,000 enrolled patients in such a town the payment per patient increased from around 220 SEK in 2010-2013 to around 260-270 SEK in 2014-2017. For a PCC with 10,000 patients in one of these towns, the payment decreased from 80 SEK to 0 in 2014-2015, and then increased to about 110 SEK in 2016-2017 when the cutoff was increased.

Appendix B Chronic condition indicator

To classify individuals by their chronic condition status, we use the chronic condition count variable produced by the The Johns Hopkins ACG (R) System, v. 11.2.1. This variable indicates the number of diagnoses that are ‘likely to last longer than twelve months and is (sic!) likely to have a negative impact on health or functional status’ (Department of Health Policy and Management, 2016).

By and large, the ACG system flags diagnoses that appear on a list of chronic conditions developed by the Center for Child and Adolescent Health Policy, Mass, General Hospital for Children, in Boston, Massachusetts. According to the ACG system documentation, ‘The Center for Child and Adolescent Health Policy list and the ACG System differ in definitions related to infectious diseases such as tuberculosis, peptic ulcer disease, congenital heart disease (which is generally resolved through surgical interventions at birth), gastrointestinal obstructions and perforations (likely to be acute and treatable conditions), osteomyelitis, and prematurity. These conditions are not considered chronic conditions in the ACG System chronic condition marker.’ (Department of Health Policy and Management, 2016).

The technical documentation to the ACG System does not reveal the exact ICD codes of chronic conditions, but it contains a list of aggregated diagnosis categories – so-called Expanded Diagnosis Clusters (EDCs) – that include the diagnoses classified as chronic conditions. Table B.1 lists these EDCs. Note that not all diagnosis codes within these EDC categories are considered chronic.

Table B.1: Chronic condition classification from the Johns Hopkins ACG (R) System

Expanded Diagnosis Cluster (EDC)	
Acute hepatitis	Hypertension, w/o major complications
Acute leukemia	Hypertension, with major complications
Acute lower respiratory tract infection	Hypothyroidism
Acute myocardial infarction	Impulse control
Acute renal failure	Inflammatory bowel disease
Acute sprains and strains	Inherited metabolic disorders
Adjustment disorder	Irritable bowel syndrome
Administrative concerns and non-specific laboratory abnormalities	Ischemic heart disease (excluding acute myocardial infarction)
Adverse events from medical/surgical procedures	Kyphoscoliosis
Age-related macular degeneration	Lactose intolerance
Anxiety, neuroses	Low back pain
Aplastic anemia	Low impact malignant neoplasms
Arthropathy	Malignant neoplasms of the skin
Asthma, w/o status asthmaticus	Malignant neoplasms, bladder
Asthma, with status asthmaticus	Malignant neoplasms, breast
Attention deficit disorder	Malignant neoplasms, cervix, uterus
Autism Spectrum Disorder	Malignant neoplasms, colorectal
Autoimmune and connective tissue diseases	Malignant neoplasms, esophagus
Benign and unspecified neoplasm	Malignant neoplasms, kidney

Continued on next page

Table B.1 – continued from previous page

	EDC
Bipolar disorder	Malignant neoplasms, liver and biliary tract
Blindness	Malignant neoplasms, lung
Cardiac arrhythmia	Malignant neoplasms, lymphomas
Cardiac valve disorders	Malignant neoplasms, ovary
Cardiomyopathy	Malignant neoplasms, pancreas
Cardiovascular disorders, other	Malignant neoplasms, prostate
Cardiovascular signs and symptoms	Malignant neoplasms, stomach
Cataract, aphakia	Migraines
Central nervous system infections	Multiple sclerosis
Cerebral palsy	Muscular dystrophy
Cerebrovascular disease	Musculoskeletal disorders, other
Chromosomal anomalies	Nephritis, nephrosis
Chronic cystic disease of the breast	Neurologic disorders, other
Chronic liver disease	Neurologic signs and symptoms
Chronic pancreatitis	Newborn Status, Complicated
Chronic renal failure	Obesity
Chronic respiratory failure	Organic brain syndrome
Chronic ulcer of the skin	Osteoporosis
Cleft lip and palate	Other endocrine disorders
Congenital anomalies of limbs, hands, and feet	Other hemolytic anemias
Congenital heart disease	Other skin disorders
Congestive heart failure	Paralytic syndromes, other
Cystic fibrosis	Parkinson's disease
Deafness, hearing loss	Peripheral neuropathy, neuritis
Deep vein thrombosis	Peripheral vascular disease
Degenerative joint disease	Personality disorders
Dementia	Prostatic hypertrophy
Delirium	Psychological disorders of childhood
Depression	Psychosexual
Developmental disorder	Psych-physiologic and somatoform disorders
Diabetic retinopathy	Pulmonary embolism
Disorders of lipid metabolism	Quadriplegia and paraplegia
Disorders of Newborn Period	Renal disorders, other
Disorders of the immune system	Respiratory disorders, other
Eating disorder	Retinal disorders (excluding diabetic retinopathy)
Emphysema, chronic bronchitis, COPD	Rheumatoid arthritis
Endometriosis	Schizophrenia and affective psychosis
ESRD	Seizure disorder
Eye, other disorders	Short stature
Failure to thrive	Sleep apnea
Fluid/electrolyte disturbances	Sickle cell disease
Gastrointestinal signs and symptoms	Spinal cord injury/disorders

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Table B.1 – continued from previous page

EDC	
Gastrointestinal/Hepatic disorders, other	Strabismus, amblyopia
Generalized atherosclerosis	Substance use
Genito-urinary disorders, other	Thrombophlebitis
Glaucoma	Tracheostomy
Gout	Transplant status
Hematologic disorders, other	Type 1 diabetes
Hemophilia, coagulation disorder	Type 2 diabetes
High impact malignant neoplasms	Vesicoureteral reflux
HIV, AIDS	

Appendix C Robustness of nurse visit estimates

Table C.1: Nurse visits: Difference-in-differences estimates and robustness

Panel A: Probability of visit									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Announcement	0.00611*** (0.00143)	0.00336 (0.00207)	0.0118*** (0.00135)	0.00611*** (0.00143)	0.00633*** (0.00148)	0.00528*** (0.00140)	0.0115*** (0.00142)	0.00611 (0.00447)	0.00459** (0.00153)
2014 reform	0.00665*** (0.00159)	0.00232 (0.00310)	0.0139*** (0.00150)	0.00665*** (0.00159)	0.00856*** (0.00163)	0.00622*** (0.00155)	0.0154*** (0.00163)	0.00665 (0.00353)	0.00512** (0.00175)
2016 reform	-0.000807 (0.00172)	-0.00671 (0.00411)	0.00996*** (0.00162)	-0.000807 (0.00172)	0.00184 (0.00177)	0.000157 (0.00168)	0.0119*** (0.00179)	-0.000807 (0.00344)	-0.00233 (0.00189)
N	4085972	4085972	4085972	4085972	3771196	3884012	4861192	4085972	2971616
No. clusters	92863	92863	92863	92863	85709	88273	148180	44	92863
Mean dep.	0.145	0.145	0.145	0.145	0.149	0.148	0.166	0.145	0.160
Announcement=2014 DiD	0.728	0.587	0.149	0.728	0.156	0.530	0.0100	0.748	0.728
2014 DiD = 2016 DiD	0.00000126	0.00000141	0.00752	0.00000126	0.0000240	0.0000580	0.0303	0.00000655	0.00000126
Linear trend	No	Yes	No	No	No	No	No	No	No
CEM	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Ind. FE	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Attritioners	Included	Included	Included	Included	Excluded	Included	Included	Included	Included
Treatment def.	Fixed	Fixed	Fixed	Fixed	Fixed	Predicted	Yearly	Fixed	Fixed
Pop. def.	Cohort	Cohort	Cohort	Cohort	Cohort	Cohort	Yearly	Cohort	Cohort
Cluster	Ind	Ind	Ind	Ind	Ind	Ind	Ind	PCC	Ind
Min year	2007	2007	2007	2007	2007	2007	2007	2007	2010

Panel B: Number of visits									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Announcement	0.000573 (0.00698)	-0.0159 (0.00880)	0.0153* (0.00654)	0.000573 (0.00698)	-0.00247 (0.00631)	-0.00367 (0.00662)	0.0127 (0.00736)	0.000573 (0.0104)	-0.00554 (0.00693)
2014 reform	-0.00332 (0.00713)	-0.0291* (0.0133)	0.0111 (0.00674)	-0.00332 (0.00713)	-0.000744 (0.00725)	-0.00465 (0.00679)	0.0145 (0.00781)	-0.00332 (0.00869)	-0.00944 (0.00756)
2016 reform	-0.0212** (0.00777)	-0.0564** (0.0179)	-0.000218 (0.00732)	-0.0212** (0.00777)	-0.0159* (0.00797)	-0.0209** (0.00729)	0.00128 (0.00830)	-0.0212* (0.00892)	-0.0273** (0.00836)
N	4085972	4085972	4085972	4085972	3771196	3884012	4861192	4085972	2971616
No. clusters	92863	92863	92863	92863	85709	88273	148180	44	92863
Mean dep.	0.257	0.257	0.257	0.257	0.259	0.265	0.311	0.257	0.283
Announcement=2014 DiD	0.581	0.136	0.523	0.581	0.784	0.884	0.809	0.570	0.581
2014 DiD = 2016 DiD	0.000798	0.000157	0.0217	0.000798	0.00509	0.00147	0.0241	0.000715	0.000798
Linear trend	No	Yes	No	No	No	No	No	No	No
CEM	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Ind. FE	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Attritioners	Included	Included	Included	Included	Excluded	Included	Included	Included	Included
Treatment def.	Fixed	Fixed	Fixed	Fixed	Fixed	Predicted	Yearly	Fixed	Fixed
Pop. def.	Cohort	Cohort	Cohort	Cohort	Cohort	Cohort	Yearly	Cohort	Cohort
Cluster	Ind	Ind	Ind	Ind	Ind	Ind	Ind	PCC	Ind
Min year	2007	2007	2007	2007	2007	2007	2007	2007	2010

Note: In each model, the dependent variable is either the an indicator for at least one visit (Panel A) or the number of nurse visits (Panel B) at a primary care center in a quarter. The table shows three average DiDs, each computed over a number of quarterly differences-in-differences (DiD) estimates from linear regression models. The estimates contrast individuals with Care Need Index (CNI)>0 to individuals with CNI=0; Announcement shows the average of the quarterly DiD estimates in the announcement period (Q2 2012 – Q4 2013), 2014 reform shows the average of the quarterly DiD estimates after the reform (2014-2015), and 2016 reform shows the average of the quarterly DiD estimates after the price increase in 2016 (2016-2017).

Announcement=2014 DiD shows p-value of test of equality of the DiDs for 2012-13 and 2014-15 periods. 2014 DiD = 2016 DiD shows p-value of test for equality of DiDs in 2014-15 and 2016-17. All models include quarter fixed effects. Individual's CNI status is measured on Dec 31 2011 unless stated otherwise (see row Treatment def). Predicted = use predicted CNI for 2011 instead of actual CNI. CEM weights balance the sample in terms of birth year and gender. Attritioners are defined as individuals moving out from the region or dying in 2013-2017. The study population is a cohort who were registered at a PCC in the region on Jan 1 2013 and lived in the region throughout 2007-2011; the exception is the column for which Pop.Def is indicated as Yearly. In that specification, the study population includes individuals registered at a PCC in the region on January 1 year t, for t=2010-2017. Standard errors are clustered by individual in all models except in column 8, in which they are clustered by the individual's PCC at baseline. * p<0.05, ** p<0.01, *** p<0.001.

Appendix D Heterogeneity by reform effect on capitation

Table D.1 shows results from DiD models of the probability and number of physician and nurse visits, estimated for two subsets of the study population.

In Panel A, the estimation sample excludes individuals who were enrolled at the two PCCs whose revenues decreased a lot due to the removal of the previous, area-based, SES adjustment – notably, the novel, CNI-based SES payment did not compensate these PCCs for the loss of area-based payment, even though they had the by far highest average CNI among PCCs in the region (.47 and .62, vs. around .15-.30 for other PCCs in 2011). In fact, from 2016 onwards, these two PCCs received a special compensation (over and above the CNI payment) that was motivated by their high SES burden.

In Panel B, the estimation sample excludes all observations with an ACG below 1. This implies that individuals only appear in the sample in years when they have above average ACG. Notably, the number of observations is approximately half of that in the main specification, which shows that below-average ACG is not a persistent phenomenon for most people.

The results from these specifications are similar to the main results (Tables 4 and 5). As these specifications in principle rule out the possibility that high-CNI (low-SES) individuals have lower capitation than they would have had under the previous payment regime, these results suggest that the main results are not driven by the fact that the payment reform reduced the capitation for some low-SES individuals.

Table D.1: Observations affected positively by the reform

<i>Panel A: Excluding two low-SES PCCs</i>				
	(1) Pr(phys)	(2) Nr(phys)	(3) Pr(nurse)	(4) Nr(nurse)
Announcement	-0.00374* (0.00149)	-0.00795** (0.00255)	0.00168 (0.00147)	-0.00373 (0.00711)
2014 reform	-0.00460** (0.00165)	-0.0105*** (0.00284)	0.00395* (0.00167)	-0.00594 (0.00773)
2016 reform	-0.00995*** (0.00169)	-0.0228*** (0.00285)	-0.00364* (0.00181)	-0.0263** (0.00841)
N	3842080	3842080	3842080	3842080
Individuals	87320	87320	87320	87320
<i>Panel B: Excluding observations with ACG below 1</i>				
	(1) Pr(phys)	(2) Nr(phys)	(3) Pr(nurse)	(4) Nr(nurse)
Announcement	-0.00869*** (0.00216)	-0.0188*** (0.00407)	0.000149 (0.00225)	-0.0134 (0.0123)
2014 reform	-0.0100*** (0.00231)	-0.0227*** (0.00437)	0.00179 (0.00248)	-0.0211 (0.0121)
2016 reform	-0.0171*** (0.00237)	-0.0408*** (0.00434)	-0.00776** (0.00261)	-0.0431*** (0.0127)
N	1964584	1964584	1964584	1964584
Individuals	89483	89483	89483	89483

Note: The dependent variable is either an indicator for at least one visit ("Pr") or the quarterly number of visits ("Nr") with a physician or a nurse at a primary care center. In Panel A, the sample excludes individuals who were enrolled at the two PCCs with lowest SES. In Panel B, the sample excludes observations with an ACG < 1. Standard errors are clustered by individual. * p<0.05, ** p<0.01, *** p<0.001. "file write myfile"

Appendix E Heterogeneity across CNI dimensions

This section shows heterogeneity estimates derived from event study models in which we contrast individuals belonging to a certain CNI category (foreign, single parent, short education, unemployed) to the whole comparison group of high-SES individuals. Since an individual can belong to more than one CNI category (the dimensions are not mutually exclusive), it is possible to belong to more than one category.

Figure E.1 indicates that there is not much heterogeneity across the CNI dimensions for physician visits. In particular, no group seem to have benefited in terms of getting more care. All groups contribute to the baseline negative estimates after 2016, and the patterns are reasonably similar before 2016.

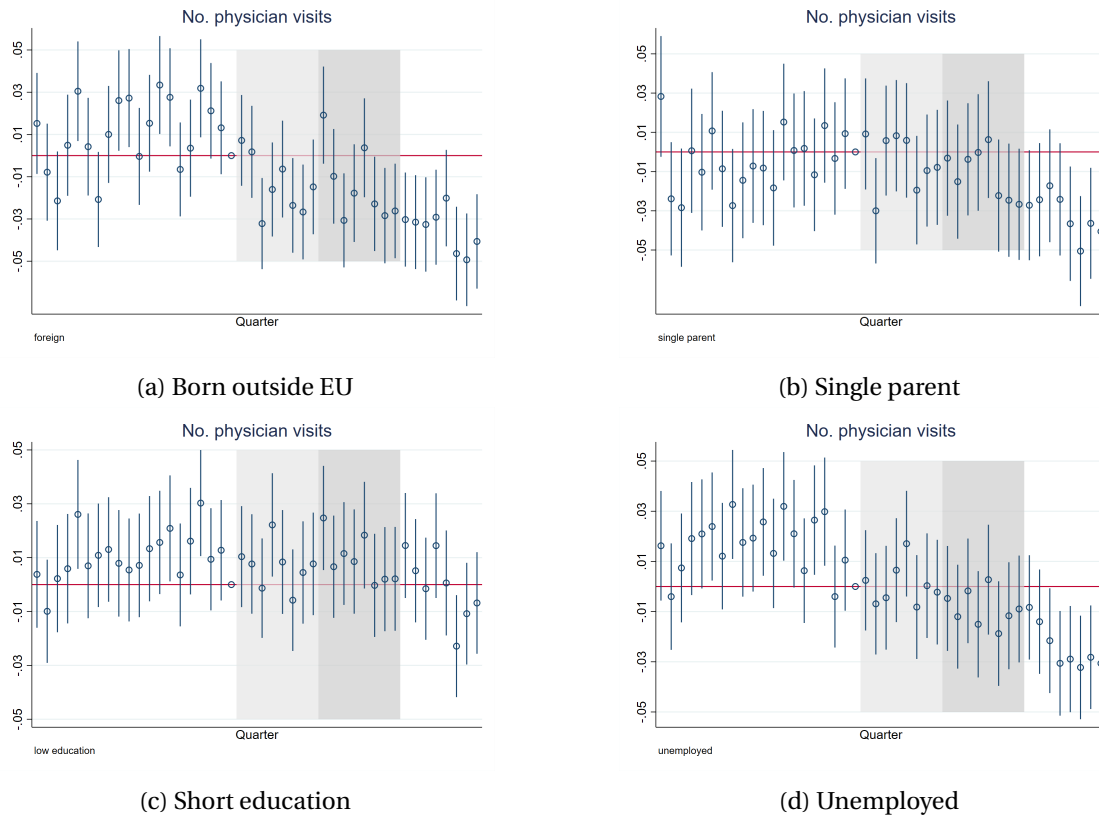


Figure E.1: Heterogeneity over CNI dimensions

Appendix F Heterogeneity across PCC characteristics

This section examines treatment effect heterogeneity on physician visits across two types of PCC characteristics: ownership type (private/public) and the expected budget impact of the changed payment system. Figure E.1 and Figure E.2 display event-study graphs, and Table E.1 shows the estimated triple interaction terms from DiD models with standard errors clustered by the PCC.

Figure E.1 shows that the negative treatment effects in 2016-2017 are visible for both private and public PCCs. The estimates are larger and the trend starts somewhat earlier for private PCCs, albeit the estimates are noisy for this type. The DiD estimate in Table E.1 indicate that the difference between private and public PCCs is significant in both post-periods.

The less positive estimates for treated individuals registered at private PCCs may indicate that private units are less prone to spend the additional money received for high CNJ individuals to provide additional care for that group. However, it is important to acknowledge that the results do not by themselves show that the money was directly channeled as profits; for instance, the private PCCs might have been spent the funds on other groups, or on longer consultations for treated individuals.

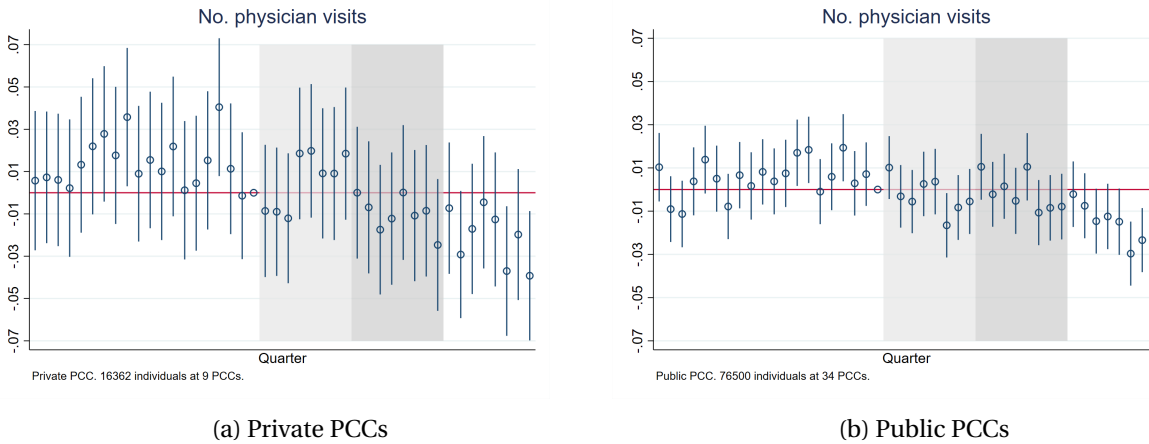


Figure E.1: Heterogeneity over ownership type

Note: The dependent variable is the quarterly number of physician visits at a PCC. Separate models for individuals registered at private (upper panel) and public (lower panel) PCCs. The shaded areas represent the announcement period and the first two years of the post-reform period.

In Figure E.2, we group PCCs according to whether they were projected to experience large increases or declines in their budget in 2014, i.e., the first post-reform year. To produce the projections in these budgets, the health care administrators applied 2014 payment rules to the characteristics of the listed population in August 2013. Thus, the information represents the best guess at the end of 2013 of what the financial situation would look like in 2014.⁴¹

⁴¹The listed population in August 2013 could to some extent be affected by announcement effects of the reform, but the announcement is unlikely to be a major influence. We also have access to budgets projected using data from April 2013; the deviation from the August projection is 4% or below for all but three PCCs.

We divide PCCs into three groups defined by how large a budget shock they experienced in 2014: a more than 2% decrease ("*Losers*"; 25 PCCs), a more than 2% increase ("*Winners*"; 6 PCCs), or smaller budget changes than that ("*Middle*"; 12 PCCs). The reason why as many as 25 PCCs are classified as losers relates directly to the transfer of home care to the municipalities, which implied an overall budget cut of around 5%.⁴²

Figure E.2 indicates that the overall pattern of negative estimates, especially in the 2016-2017, is present across the three categories but perhaps clearest among Winner PCCs. The DiD estimate in Table E.1 indicate that the difference between Loser and Middle PCCs is significant in both post-periods, and that the difference between Loser and Winner PCCs is significant in 2016-2017.

⁴²As noted previously, the budget cut was accompanied with a transfer of district nurse capacity to the municipalities, reflecting the narrower scope for the PCC services.

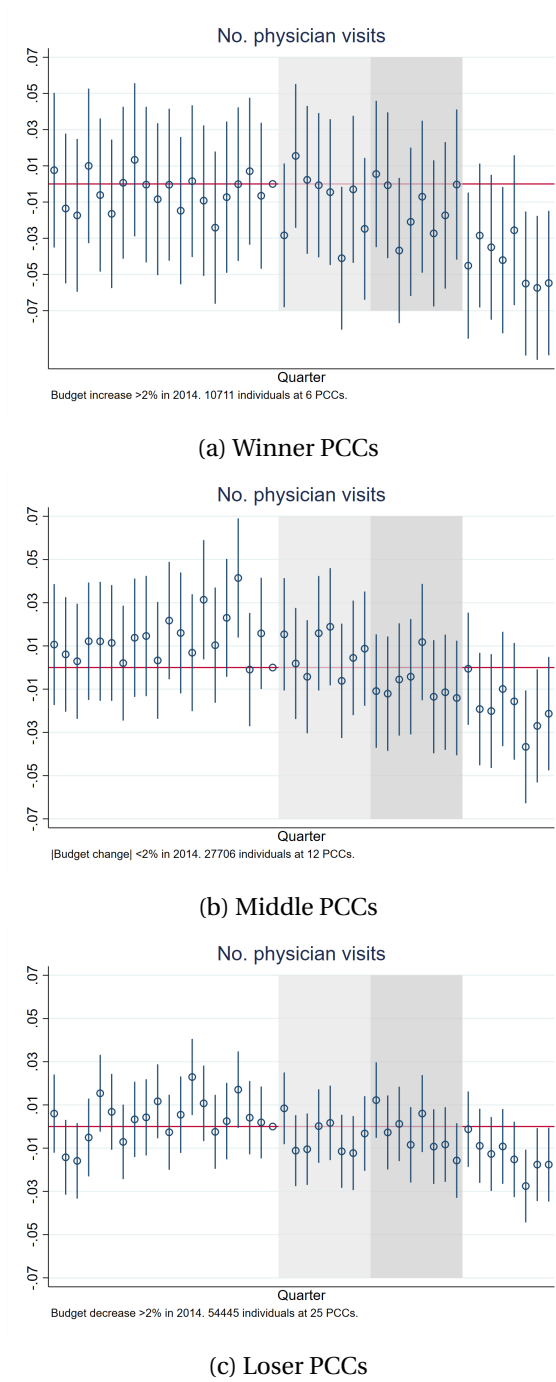


Figure E2: Heterogeneity over expected budget change in 2014

Note: The dependent variable is the quarterly number of physician visits at a PCC. Separate models for individuals registered at a PCC with a more than 2% budget increase (upper panel), more than 2% budget decrease (lower panel), or a change within that range (middle panel) in 2014 compared to 2013. The shaded areas represent the announcement period and the first two years of the post-reform period.

Table F.1: Provider-level heterogeneity in DiD estimate on physician visits

	(1)	(2)
Announcement × Middle	0.00213 (0.00641)	
Announcement × Winner	0.00167 (0.00790)	
2014 × Middle	-0.0139* (0.00680)	
2014 × Winner	-0.00252 (0.00945)	
2016 × Middle	-0.0146* (0.00699)	
2016 × Winner	-0.0217* (0.00906)	
Announcement × private		0.000351 (0.00731)
2014 × private		-0.0167* (0.00689)
2016 × private		-0.0138* (0.00607)
N	4085972	4085928
Clusters	44	43

Note: Estimates of heterogeneity in DiD estimates over provider groups defined by (1) projected budget change in 2014 (2) private/public ownership. In all models, the dependent variables is the quarterly number of physician visits. The estimates shown in the table are triple interaction terms of the form *treatment group* × *period* × *provider group*; i.e., *treatment group* indicates individuals with high CNI (low SES), *period* is either the announcement period, the first part of the post reform period (2014-2015), or the period after the price increase (2016-2017), and *provider group* indicates either PCCs with projected budget change in the mid-range (Middle = at most a 2% change) or a large increase (Winner = more than 2%) (columns 1-2), or private PCC (columns 3-4). All models include individual and year fixed effects, and use CEM weights to balance the sample in terms of birth year and gender. Standard errors are clustered by PCC. * p<0.05, ** p<0.01, *** p<0.001.

Appendix G Additional results for the time-varying population

Figure G.1 shows event-study estimates for the time-varying population discussed in section 6.1. The DiD estimates for this population, reported in column 7 of Table 4, were positive. However, the event-study estimates in Figure G.1 indicate that there is an upward-sloping trend in the pre-treatment period.⁴³ When we include a linear trend estimated on the pre-treatment quarters in our DiD specification (i.e., according to Eq. 2), the positive estimates disappear: the estimate for the announcement period is then -0.0026 ($p = 0.478$), the estimate for the phase-in period is -0.0036 ($p = 0.534$), and the estimate for the final period is -0.016 ($p = 0.035$). Thus, there is no strong evidence of increases in physician visits for this study population either.

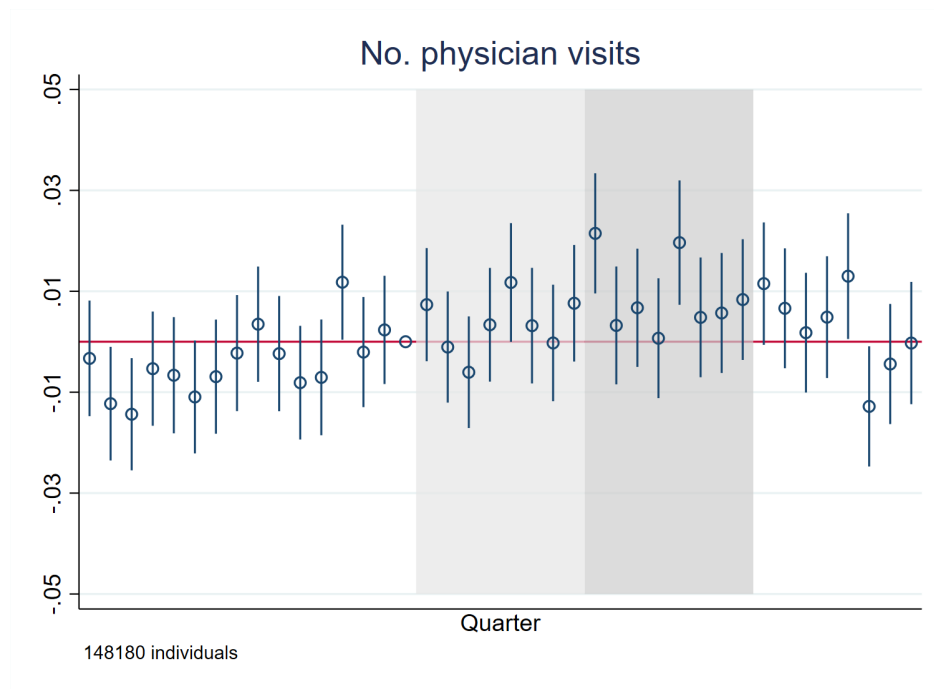


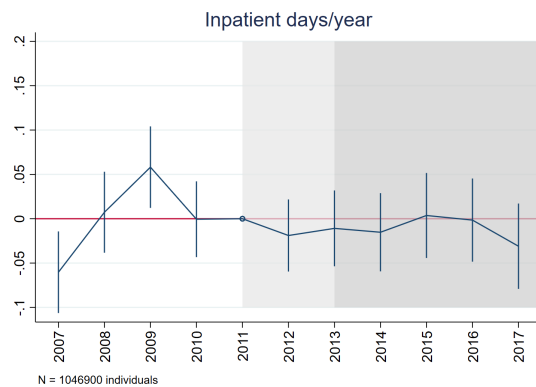
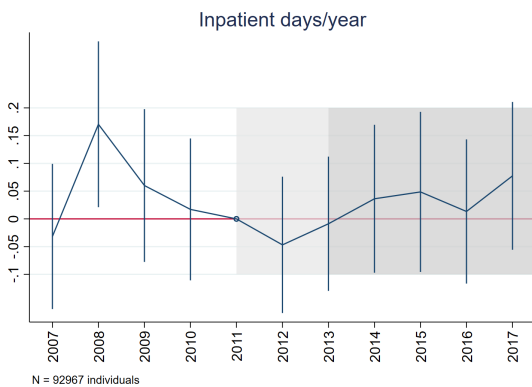
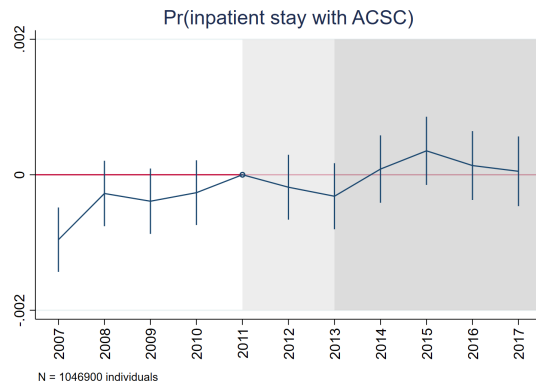
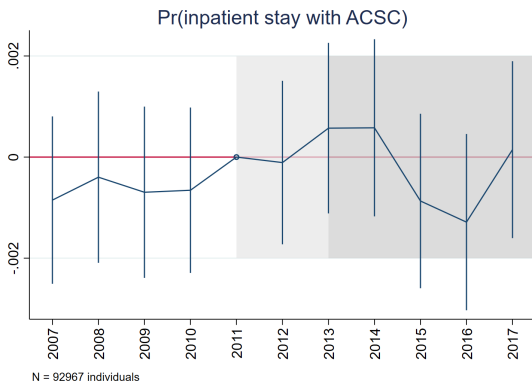
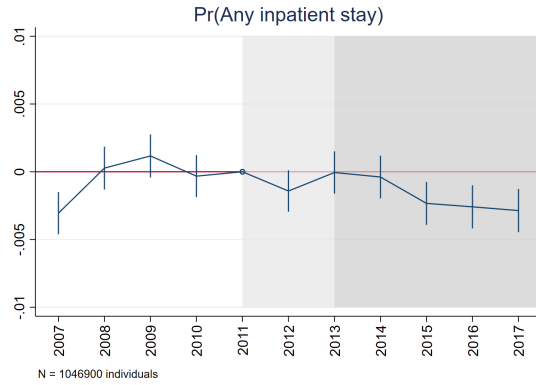
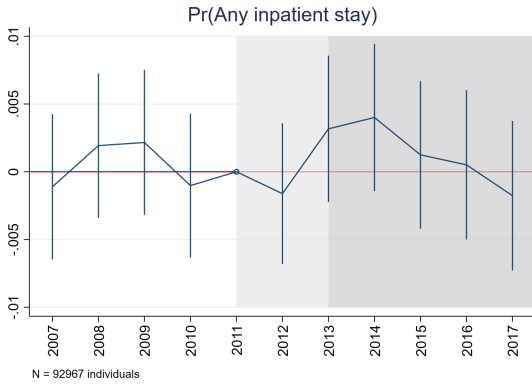
Figure G.1: Event study for time-varying population (2008-2017)

⁴³A potential reason for the upward-sloping trend is that the composition of this sample may have changed due to the relatively large and increasing immigration of refugees from the Middle East and Africa during this period (see e.g., migrationsverket.se/Om-Migrationsverket/Statistik/Beviljade-uppehallstillstand-oversikter.html), who would be included in the treatment group and may have needed more care. As our primary sample is not time-varying, it avoids this issue.

Appendix H Comparison with other regions

In this section, we estimate event-study specifications for three other regions from which we have access to data on ACG and secondary care outcomes: Stockholm, Västra Götaland, and Skåne (the three largest Swedish regions).

Figure H.1 shows estimates for the probability of an inpatient stay, of an ACSC hospitalization, and the number of inpatient days per year. The left panels show estimates for a sample mimicking the main study population in Östergötland and the right panels shows estimates for a combined sample of the other three regions. The high-CNI definition used in these estimations is almost as in the main estimations; the exception is that individuals who moved within a region in 2010-2011 are included in the high-CNI group. We cannot separate out these individuals from the high-CNI group in the other three regions as we lack data on who moved within these region. (As mentioned, including this group leaves our main estimates in Östergötland virtually unchanged.) The figures show that the high CNI/low SES group in Östergötland had a roughly similar development on these variables as the other three regions, except that the probability of an inpatient stay appears to have increased slightly more in Östergötland in 2013-2014. Importantly, the lack of positive “post-reform” trends in the other regions indicates that over study periods of this length, diverging health trends between low and high SES individuals need not be an issue.



(a) Östergötland

(b) Other regions

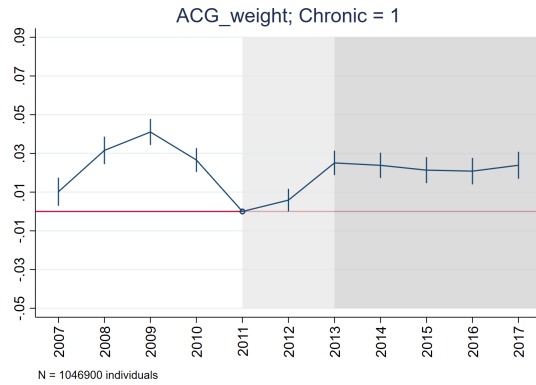
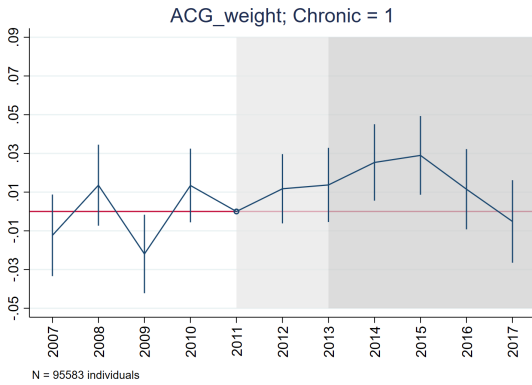
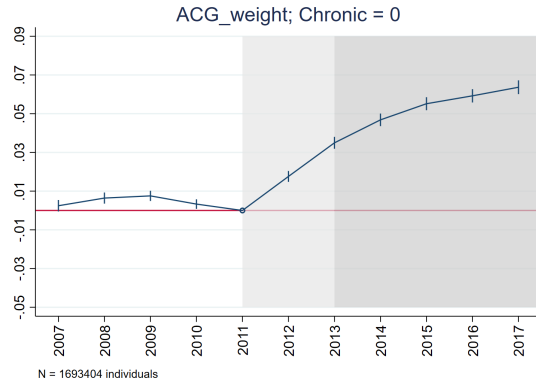
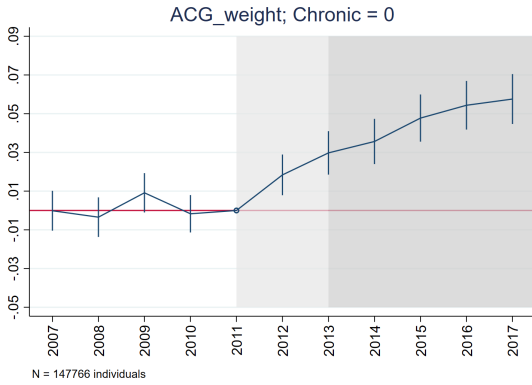
Figure H.1: Hospital outcomes comparison with Stockholm, Västra Götaland and Skåne regions; annual data 2007-2017

Note: The estimates are for individuals with a pre-period chronic condition who lived in Östergötland (a) or in any of the other regions (b) at the end of 2006-2012. The outcomes are from the national inpatient register. The treatment definition is almost as in the main estimations; the only exception is that individuals who moved within a region in 2010-2011 are included in the high CNI group. The estimates are weighted to match the high CNI group in terms of birthyear and gender.

Figure H.2 shows event study graphs for the ACG weight in Östergötland and the three other regions. Here, we show results both for individual *without* a pre-existing chronic condition (upper figures) and for the group with such a condition (lower figures). The figures for individuals without a chronic condition

indicate a lack of pre-trends and thereafter a sharp increase in all regions. The reason is likely that the definition of the group without chronic conditions forces the trends to be similar in the pre-period, where after the latent higher probability of becoming chronically ill in the low SES group is allowed to manifest itself. This implies that it is not credible to attribute the increase in Östergötland to the payment reform. Therefore, we do not study other outcomes for this group.

For the group with chronic conditions, the pre-trends in the other three regions are not parallel, most likely due to the patient choice reforms implemented in those regions in 2008-2009 (including the introduction of ACG compensation in Västra Götaland and Skåne). However, there is little evidence of a steady divergence between the low- and high-SES groups when it comes to the ACG weight, neither across the whole period, nor in the first and second post-period in these regions. As was the case for the secondary care outcomes, these estimates do not provide strong evidence of diverging health trends between low and high SES individuals with chronic conditions.



(a) Östergötland

(b) Other regions

Figure H.2: ACG, comparison with Stockholm, Västra Götaland and Skåne regions; annual data 2007-2017

Note: The estimates are for individuals who lived in Östergötland (a) or any of the other three regions (b) at the end of 2006-2012. The upper (lower) figures are for individuals without (with) a pre-period chronic condition. The treatment definition is almost as in the main estimations; the only exception is that individuals who moved within a region in 2010-2011 are included in the high-CNI group. The estimates are weighted to make the low and high-CNI groups balanced in terms of birth year and gender.