An Incentive Program with Almost No Incentive: An Overlooked Benefit of Pay-For-Performance

[PRELIMINARY. PLEASE DO NOT CIRCULATE]

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The idea of "pay for performance" (P4P) has been advocated and applied for more than two decades. The large literature has concerned whether it improves health outcomes and found mixed evidence, some researchers calling for increased financial incentives for the effectiveness of P4P programs. The consensus is that how best to pay for performance remains a compelling question, notwithstanding numerous forms of incentive programs already experimented around the world. A problem in this literature is that although the idea of P4P is to reduce inefficient use of healthcare resources (typically overuse in traditional pay-for-volume), researchers have only studied its impact on limited narrowly-defined outcomes rather than the social efficiency gain from P4P. This paper offers a new view that P4P can improve efficiency in the allocation of healthcare resources, by studying a unique physician incentive program introduced in Australia in 2001 to promote effective management of chronic diseases, the diabetes Service Incentive Payment (SIP), which attracts an incentive of A$40 per patient per year after completing a lengthy cycle of diabetes care - almost negligible for general practitioners (GPs). We evaluate the effect of the diabetes SIP on various healthcare utilisation and cost outcomes of diabetics, using a large survey linked to multiple years of detailed administrative medical records. More specifically, we identify the causal effect of the SIP availability by exploiting postcode-level variation in the penetration of SIP completion, based on the idea that SIP penetration measures the level of GPs' knowledge about and familiarity to the SIP in each area, which is presumably exogenous from each GP's point of view. To account for potential confounding differences across areas, we use pairs of diabetics and GPs who are ineligible for the SIP as a control group and employ a difference-in-differences framework. The results show significant and heterogeneous effects of the SIP. People with diabetes aged 65 or above in high SIP-penetration areas tend to reduce their healthcare

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utilisation relative to those in low SIP-penetration areas, while people with diabetes aged 63 or below tend to increase their healthcare utilisation. We argue that the differential effect is due to patients' cost concerns: the SIP incentive corrects the over-use of health services by old diabetics as well as the under-use of services by young diabetics because most of the old diabetics in Australia face significantly lower marginal fees than their younger counterpart. At the same time, we do not find any negative effect on health outcomes. These results imply that notwithstanding the small reward, the guidelines set in the SIP have led to systematic diabetes management and reduce social inefficiency. A well designed P4P can increase social welfare by correcting inefficient allocation of resources due to idiosyncratic variations in treatment if not by improving health outcomes.
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1 Introduction

Financial incentives are an important policy tool for motivating desired behaviour change for rational individuals. The Service incentive payment (SIP) was introduced in Australia in 2001 as a part of Practice Incentive Program (PIP) aiming at encouraging general practitioners (GPs) "to provide earlier diagnosis and effective management of people with chronic diseases management" (Medicare Australia, 2012). The diabetes component of the SIP can be claimed by GPs when they accomplish the minimum requirements of the annual cycle of care for patients with diabetes. Each cycle of care completed attracts an incentive of A$40 per patient per year in addition to the regular consultation fee. This reward of A$40 per year is set considerably low, almost at a negligible level: for example, the amount is only slightly higher than the government reimbursement for a single typical patient visit (A$35.6 for a standard GP consultation in 2011). On the other hand, to claim A$40, GPs face considerable opportunity costs, including voluminous paperwork and extra workload required. The need to track and follow up with patients to complete all planned visits are usually hampered by the lack of time of GPs, the unavailability of nurses to provide assistance, and patients' negative attitudes.

Under the premise of standard neo-classical economic theory, it is reasonable and natural to expect that a financial incentive with a negligibly small reward would generate a negligible response, especially for one of the most intelligent most affluent groups of professionals - physicians. In the case of the diabetes SIP, the burden of tracking patients and the administrative complexity of billing, relative to the small size of the bonus, is likely to discourage GPs from actively providing the SIP cycle of care, and GPs might well opt to see another patient.

In this study, we evaluate the effects of the diabetes SIP on health care utilisation and associated costs. We advance the literature by taking advantage of the unique nature of the SIP scheme, which has almost no financial incentive for the agent. This exploration is worthwhile because of the recent burgeoning literature of nudging policies. The recent behavioural economics literature argues that humans have "bounded rationality" and make "suboptimal" decisions, which can explain why people behave in ways that deviate from rationality as defined by classical economics. Based on behavioural economics and social psychology, a variety of soft touches, termed as "nudge", has been implemented to alter people's behaviour without forbidding any options or significantly changing their economic incentives (Richard H. Thaler and Cass R. Sunstein, 2008), and quite a few nudging policies have been proven to yield desirable outcomes. Another possible theory views the SIP rules and requirements as a "guideline" or "authorisation" which GPs can rely on to "do the right thing" for better diseases management. GPs potentially change their behaviour because they gain new knowledge from the SIP rules (the guideline effect) or because they can use the SIP requirements to guide and persuade their patients (the authorisation effect). Although disentangling the underlying mechanism is beyond the scope of this paper, the Australian SIP provides an opportunity of a quasi-experiment to assess the causal effect of the incentive program by shedding light on whether the primary effect is driven by pecuniary incentives. If the SIP is shown to yield noticeable social gain, the evaluation will provide the government with a powerful, cost-effective tool to improve patients' outcomes and achieve an efficient use of healthcare resources.

Our sample is drawn from a large-scale survey of the population aged 45 years or above. The survey is linked to multiple years of comprehensive administrative medical records (2005-2011), enabling us to study a broad set of outcomes: visits to GPs and specialists, the number of glycosylated haemoglobin blood tests (HbA1c) performed, costs of medications, presentations to emergency departments of hospitals (EDs), and hospital admissions. These different outcome measures help us to assess the effects of the SIP on diabetes management, health outcomes, and health expenditures. The rich set of controls in the survey data, such as extensive health measures, helps us to control for individual heterogeneity.

Conducting a randomised experiment would be an ideal way to make a causal inference of the SIP effect. Without such randomisation, an alternative is to conduct a comparison between periods before and after the introduction of the SIP, but the administrative data available to us only cover the periods after the launch of the SIP. With only post-reform data, we can easily compare the outcomes of diabetes who completed a SIP cycle with the outcomes of those who did not, but we do not employ that approach for two reasons. First, there may be systematic self-selection into the uptake or completion of the SIP cycle, which is probably determined by some unobservable factors; therefore the estimate will suffer from selection bias. Second, more importantly, what we are interested in is not the causal effect of SIP completion but the causal effect of the introduction or existence of the SIP scheme, in which whether to participate or not is decided by each agent.

To obtain reliable causal estimates, we identify the causal effects of *SIP incentive availability* by exploiting geographical variation in the penetration of SIP completion, which is measured by the fraction of diabetics-GP pairs that claimed SIP reward in each postcode area. In particular, we compare two extreme groups - areas in the top and bottom deciles of the distribution of the SIP penetration. This approach, similar to the one used in Raj Chetty et al. (2013), is based on the idea that SIP penetration measures the average level of GPs' knowledge about and familiarity to the SIP in each area. For example, a low penetration presumably implies that GPs in the area are unaware of and psychologically distant from the SIP program as if there were not such a program in the area, and hence the existence of the SIP has a negligible impact

on the behaviours of GPs in such low SIP penetration areas. The key identification assumption is that SIP penetration is exogenous from each GP's point of view, but it influences the GP's SIP decision. We argue that this is a reasonable assumption because many GPs have a strong tie with other GPs, often working at multiple large practices so that GPs share the knowledge about the SIP. We can thus identify the causal effect of the SIP by comparing patients' outcomes across areas that differ in the SIP penetration but are otherwise comparable. Further, to account for unobservable potentially confounding differences across areas (such as regional variations in diabetes management) that are not caused by the SIP, we exploit the group of GPs who are not eligible for claiming a SIP reward as a control group to form a difference-in-differences (DID) analysis.

An estimated average treatment effect of interventions that aim at systematic and consistent diseases management may yield misleading results because of its heterogeneous effects, where the purpose of such interventions is to reduce the variability of treatment, and hence their effects are not unidirectional by nature, with heterogeneity offsetting each other. To delineate the potentially offsetting heterogeneous effects of the SIP, we utilise institutional cut-off at age 65, above which most Australians face substantially lower cost-sharing than those below 65. We predict that the old group tends to overuse health resources whereas the young group tends to underuse, and consequently, an intervention that aims at systematic disease management such as the SIP, if effective, will reduce the utilisation and costs of healthcare for the old group whereas it will increase the utilisation and costs for the young group.

We find robust and significant effects of the incentive program on patients' outcomes despite the small reward amount, and the effects appear to be socially desirable in the following two ways. First, the SIP contributes to the standardisation of care by reducing the discrepancy between the old and young groups who face substantially different marginal out-of-pocket costs. Diabetics aged 65 or above in high SIP penetration areas tend to reduce their healthcare utilisation and associated healthcare expenditure, in particular, specialist visits and diabetes-related medications, relative to those in low SIP penetration areas. Diabetics aged 63 or below tend to increase their healthcare utilisation, with more specialist visits as well as higher expenditures on

diabetes-related medications, although the estimates are marginally significant. Second, the SIP brings savings in healthcare expenditures without compromising health outcomes. The magnitude of the decrease in the costs of doctor visits and medications for the old group is larger than that of the increase for the young group. One might expect a reduction in health outcomes of the old age group, but on the contrary, we find that the old age group in high SIP penetration areas experience a significant reduction in diabetes-related hospital admissions and presentations to emergency departments – two most socially expensive healthcare items. The estimates for the young group also show a reduction, though insignificant.

These differential effects between the two age groups are consistent with our predictions based on patients' cost concerns: the SIP incentive corrects the over-use of health services by old diabetics as well as the under-use of services by young diabetics. Diabetics aged 65 or above may use fewer services due to the better management of diabetes treatment brought by the systematic cycle of care of SIP, while diabetics aged 63 or below may use more services because they are informed of the benefits of better treatment and control of diabetes by the SIP cycle of care resulting from the educational and/or authoritative nature of SIP. Thus, the SIP achieves consistent diabetes management without compromising health outcomes, notwithstanding its small reward, leading to an increase in social welfare.

Furthermore, a series of subsample analyses reveal the following three results. First, subsample analysis by education group indicates that the old group's overuse of diabetes-related medications is stronger among more educated patients, while the young group's underuse of medications, in particular, insulin, is predominantly among less educated patients. Second, the SIP effects are concentrated among the patients who have diabetes more than five years, rather than new diabetics, probably because long-term patients are more cost-concerned and because deviations from the standard care and habit formation are more likely for them compared to new diabetics. Third, the SIP effects are driven by not only those patients who completed the SIP cycle but also "non-compliers". This result suggests that the "guideline" and "authorisation" for better diseases management provided by the SIP have a

significant “spill-over” effect for the entire pool of the diabetics seen by the GP.

2 Literature

Besides the PIP scheme in Australia, other countries have introduced various forms of payment-related incentives in primary care (termed as “pay-for-performance”), in order to “improve the management of chronic diseases, engage in preventive health interventions and encourage high-quality care” (S. Willcox et al., 2011). These include the UK’s Quality and Outcomes Framework (QOF) introduced in 2004 that includes financial rewards for performance measured in terms of 131 quality indicators (H. Lester and S. Campbell, 2010), Italy’s Diabetes Management Progrom implemented in 2003 (Elisa Iezzi et al., 2014), Diabetes Management Incentive launched in Canada 2006 (Jasmin Kantarevic and Boris Kralj, 2013), a perfomrance manangement programme introduced by New Zealand’s Primary Health Organisations in 2006 (Stephen Buetow, 2008), and “hundreds” of such schemes that have been introduced in the US (A. Scott et al., 2011).[1]

An increasing number of empirical studies have sought to examine the effects of financial incentives on GP behaviour and quality of care, by evaluating the various incentives schemes in physician remuneration that have been implemented around the world. So far, inconclusive findings have been suggested - the incentive effects range from absent or negative to positive or very positive, and the reviews also conclude that the effect of financial incentives is mixed and further research is needed in this area (S. R. de Bruin et al., 2011, L. A. Petersen et al., 2006, A. Scott, P. Sivey, D. Ait Ouakrim, L. Willenberg, L. Naccarella, J. Furler and D. Young, 2011, P. Van Herck et al., 2010). For example, some work measure the improvement of quality of care by a reduction in hospitalisation rates, and some of them find a positive effect of financial incentives aiming to provide better chronic disease management, although some are modest in size (Mark Dusheiko et al., 2011, Elisa Iezzi, Matteo Lippi Bruni and Cristina Ugolini, 2014), while others suggest that

[1]Most of these incentives target for the treatments and managements in hospitals.

there is no significant effect on avoidable hospital admissions (Kathleen J. Mullen et al., 2010). Using a retrospective cohort study in the US, Gary J. Young et al. (2007) find no statistically significant effect of an incentive program conferring limited financial risk to primary care physicians. Measuring quality of care by the 17 QOF diabetes indicators, Evangelos Kontopantelis et al. (2013) report a positive association of the introduction of this incentive scheme and quality of care. Focusing on the incentive scheme QOF in the UK, Matt Sutton et al. (2010) find positive effects on targeted performance and positive spillovers onto unincentivised factors for the targeted groups of patients. Additionally, several studies focus on behaviour changes of practices and/or physicians in response to the launch of financial incentives. For example, potential gaming by physicians for QOF scheme has been explored by Hugh Gravelle et al. (2010). Jasmin Kantarevic and Boris Kralj (2013) investigate the link between the physician response to performance incentives and the existing payment system.

Factors that may influence the effect of incentives include the context within which the incentive is delivered, the amount and timing of the payment, and whether it is targeted at individuals or groups. The size of incentive has shown to be the most important design features to consider for the effectiveness of pay for performance schemes. Including 96 studies, Yewande Kofoworola Ogundeji et al. (2016) conduct a systematic review and meta-analysis on the effects of pay-for-performance schemes in health care. Their results suggest that larger incentives increase the likelihood of a positive effect and the size of that effect, with schemes that pay incentives of more than 5% of clinician's salary or institutional budget being statistically significant three times as likely to produce positive effect compared to those paying less.

Australian evidence on the effects of pay-for-performance incentives is very limited. There are several studies examining the factors that influence the uptake of financial incentives, but most of them are descriptive. For example, N. A. Zwar et al. (2005) develop a GP survey to examine the uptake of Asthma SIP and GPs' views on the barriers and facilitator to implementing the scheme. They find that the workload associated with claiming a SIP and the perceived administrative complexities are the major barriers to uptake. Similarly, M. Saunders et al. (2008) conduct semi-structured interviews with

GPs to look at the uptake of the diabetes SIP. Their results reveal that lack of support services, lack of time, and negative patient attitudes are barriers to uptake for GPs. Using data at the level of the Divisions of General Practice (DGP), A. Georgiou et al. (2004) find that the diabetes SIP claims are higher in more disadvantaged DGPs and larger practices. Another two studies evaluate the impact of incentive programs on quality of care. A. Scott et al. (2009) use GP level data to analyse the impact of the PIP participation on the quality of care that is measured by the probability of ordering an HbA1c test. An empirical model consisting of a recursive system of two equations for joining the PIP program by a practice and providing quality of care by a GP is specified, and a bivariate probit model is utilised to control for the self-selection into participating in the PIP by practices. Two exclusion restrictions are introduced to aid identification: 'the number of staff employed by the Divisions of General Practice divided by the number of practices in the Division' and 'diabetes prevalence rate per 1000 people in the population in a Division'. They find a large positive effect of the incentive – a 20% increase in the probability an HbA1c test being ordered. However, they do not directly observe practices' participation in the PIP scheme and rely on a proxy measure. Also, they use an instrumental variable framework to control for the endogeneity in the PIP participation, but it is always challenging to find valid instruments. Moreover, they only focus on one process measure (i.e. order an HbA1c test) rather than health outcomes. On the other hand, applies fixed effects regression models to a panel dataset of GPs (2000-2009) to study the impact of the PIP on provision of incentivized services, and he finds no evidence suggests that the program participation or claiming incentive payments is associated with increased diabetes testing (diabetes SIP) or increased cervical screening (cervical screening SIP). However, J. Greene (2013) fails to take GPs' potential self-selection into the SIP claims into consideration.

In summary, our study builds upon the literature of pay-for-performance incentives and efficient use of healthcare resources in three aspects. First, many previous studies focus on the relationship between pay-for-performance incentives and physicians' behaviour, but only a small number of studies evaluate the effect of incentives on the outcomes of patients regarding their

health status and health care utilisation. We aim to enrich the literature by providing more comprehensive insights into the value of this kind of financial schemes to patients. Second, we extend the literature by providing further evidence on how the incentive schemes impact the quality of primary care in Australia. There is limited evidence in this area for Australia as well as countries with the similar payment system. Although there are many findings from other countries, such as the UK and the US, it is difficult to generalise the results obtained in different countries with diverse health care systems and incentive scheme designs. Third, the use of a rich and extensive data set linked with detailed administrative medical records enables us to establish a more precise link between the financial incentives and the outcomes of care, after controlling for a large set of patients characteristics. Moreover, unlike previous studies only focus on one or two outcomes, we explore a broad spectrum of outcome variables from the perspective of patients, to more fully reflect the impact of incentives.

Our study also relates to the literature on standardization of care and physician behaviour. There is evidence that standardizing care can improve outcomes (PUT REFERENCE HERE).

3 The SIP

Diabetes mellitus (DM) is a complex condition that can result in morbidity, disability, early death, reduced quality of life, and substantial financial cost. The high and rising prevalence of diabetes is a worldwide trend (Goodarz Danaei et al., 2011). In Australia, the prevalence of diabetes has tripled over the last twenty years, increasing from 1.5% to 4.7% of the population between 1989-90 and 2014-15 (Australian Institute for Health and Welfare (AIHW), 2014), driven by an ageing population, rising levels of obesity and physical inactivity, and greater longevity of diabetics (Australian Institute for Health and Welfare (AIHW), 2013). Diabetes is predicted to be the leading cause of disease burden among males, and second only to anxiety and depression among females by 2023 (S. Begg et al., 2007), raising a significant concern for the healthcare expenditure, both for individuals and governments. In Australia, diabetes expenditure has grown rapidly, with annual costs increasing from

A$811 million in 2000-01 to A$1,507 million in 2008-09, an average annual growth rate of 10% (Australian Institute for Health and Welfare (AIHW), 2013). A good and timely management for diabetes is particularly important to monitor the condition, improve health outcomes, and reduce demands for future health services expenditure. Designing an approach that can improve the consistency and quality of diabetes management and curb the healthcare expenditure in a very cost-effective way will provide considerable benefits to societies.

In Australia, health care is provided and financed by both the government – universal health care system Medicare, and private institutions. Various health service providers are financed by Medicare, including medical practitioners, prescription pharmaceuticals, and hospital treatment as a public patient. Regarding visiting a doctor outside a hospital, Medicare reimburses 100% of the Medicare Benefits Schedule (MBS)[2] fee for a GP visit and 85% for a specialist visit. There are no necessary patient lists or registration in Australia and Medicare patients must always be referred by a GP to a specialist. Moreover, Medicare safety nets have been introduced to provide an additional rebate from Medicare to those who incur higher than usual medical costs. The private health system that supplements the Medicare system in Australia is funded by private health insurance companies. Private health insurance plans cover the cost of hospital stay and ancillary health treatment but not doctor visits.

Most GPs work in private practices in Australia, and are remunerated on a fee-for-service basis.[3] They can bill their patients for any amount they choose. If the GP accepts the MBS provided rebate as the full payment for the service, the patient makes no out-of-pocket payment; this is referred to as "bulk billing". If the GP charges above the level of the rebate, the patient has to pay the extra funds (co-payment). Most individuals aged 65 and above have a concession card, as well as those who are on low incomes or who are eligible for specific government allowances or benefits. Patients with concession cards are more likely to be bulk-billed. Since 2004 the Government has provided an additional financial incentive to GPs if they bulk-bill concession card holders

[2]MBS lists all the Medicare services that are subsidised by the Australian Government.
[3]Only a small number of GPs are salaried government employees.

as well as children aged less than 16. Over 70% of all bulk-billed GP visits are claimed by 40% of the population who either have a concession card or are children. The remaining 30% of bulk-billed visits go towards the 60% of the population (those without a concession card or aged 16 or above) (Department of Social Services (DSS), 2015, The Department of Health, 2016). Additionally, concession card holders who are typically people on low incomes are charged lower fees when they visit specialists (Meliyanni Johar et al., 2016).

In addition, the Pharmaceutical Benefits Scheme (PBS) subsidises the cost of medicine for most medical conditions for Australians. Patients pay a copayment for drugs subsidised on the PBS, which is the maximum price that a patient is required to pay for a PBS-listed drug dispensed at a pharmacy, and the government pays the rest. For drugs with a PBS price below the level of the co-payment, patients pay the full price with no government contribution. There are two patient co-payment levels in the PBS: one applies to general patients (e.g. A$34.20 in 2011) and the other for concession card holders (e.g. A$5.60 in 2011).

Australian primary care combines universal access with uncapped fee-for-service and voluntary incentive payments, at the practice and GP level. In addition to Medicare, GPs derive income through a variety of incentive programs delivered by the government and states. As a pay-for-performance scheme, the Practice Incentive Program (PIP) was introduced in Australia in 1998 and made up of 11 incentives, with an aim to improve the infrastructure of practices to provide quality care and better access and health outcomes. The PIP represents around 5.5 percent of government funding for primary care, while around 67 percent of Australian practices participated in 2008-09 (S. Willcox, G. Lewis and J. Burgers, 2011). It is voluntary for a general practice to apply to join the PIP. To be eligible for the PIP enrolment, practices are required to be accredited or registered for accreditation against the standards of the Royal Australian College of General Practitioners (RACGP). The accreditation process involves paying a fixed fee to accreditation agencies and complying with a range of organisational restructuring requirements. Once the practice is approved to be accredited for PIP, they will receive an initial PIP payment that is intended to support the practice in purchasing additional

equipment and upgrading facilities. Additionally, PIP practices also receive sign-on payments for asthma, diabetes, and cervical screening. For diabetes, the sign-on capitation payment in 2016 was A$1 per patient or A$1000 per full-time GP in the practice for the diabetes program. General practices located outside a metropolitan area receive an additional loading of 15 to 50% of the total PIP remuneration depending on the remoteness of the region of the practice.

Within the PIP framework, the SIP was introduced in 2001 with the aim of improving the management of chronic conditions, consisting of diabetes, asthma, and cervical screening SIP. The PIPs are a practice-level incentive, while the SIP comprises a payment paid to the GP, and is, therefore, an incentive directly aimed at influencing individual GP behaviour. Claims for the SIP can be made by GPs working in practices that have signed on for the PIP. A diabetes SIP can be claimed by GPs when accomplishing the minimum requirement of the annual diabetes cycle of care for patients with diabetes, including measurements of glycaemic and blood pressure level, examinations of eye and feet, and lifestyle and self-management advice, over a period of 11 months and up to 13 months (details of the requirements can be found in Appendix A, Table A.1). Each cycle of care completed attracts a diabetes SIP of A$40 per patient per year for GPs in addition to the regular consultation fee, and the payment is made quarterly. To earn the incentive payments, the GP has to bill specific MBS codes. There is also practice-level outcome incentive for practices that complete cycles of care for 20 percent or more of their patients with diabetes in a year, with A$20 per diabetes patient.

4 Empirical specification

An ideal way of estimating the causal effect of the SIP scheme is to conduct a randomised experiment in which we randomly assign an option to complete the SIP cycle to the treatment group of GPs whereas the control group of GPs do not have this opportunity. Then the comparison of various outcomes between these two groups will demonstrate causation. Without such randomisation, an alternative is to conduct a comparison between periods before and after the introduction of the SIP. Unfortunately, the linked

administrative data we use (from 2005 to 2011) only cover the periods after the launch of SIP but not those before it (SIP was introduced in 2001). Additionally, a simple before-after comparison assumes that the change in the outcome variables is due to the change in the treatment, which may suffer from confounding or selection bias induced by unobservables that influence the outcome and coincide with the timing of the treatment. With only post-reform data, we can easily compare the outcomes of those who completed SIP cycle with the outcomes of those who did not, but we do not take that approach for two reasons. First, the SIP completion status may be endogenous, determined by unobservable factors that affect outcome variables too; therefore, the estimate will suffer from selection bias. Second, more importantly, it is a conceptually different parameter of interest. What we are interested in is not the causal effect of SIP completion but the causal effect of the introduction of the SIP, in which whether to participate is up to each GP.

To estimate the causal effect of the SIP incentive availability, we take advantage of geographical variation in the penetration of SIP completion, as a proxy for the availability of SIP incentives across postal areas. It is measured by the fraction of diabetics-GP pairs that claimed SIP reward in each postal area. This approach is similar to the one used in Raj Chetty, John N. Friedman, and Emmanuel Saez (2013) in which they estimate the impact of the US Earned Income Tax Credit (EITC) on labour supply using local variation in knowledge about the EITC schedule, measured by the fraction of individuals who reported self-employment income that precisely maximizes their EITC refund. Their research design is based on the idea that individuals with no knowledge of the EITC behave as they would in the absence of the policy, and the causal effect of the EITC availability is identified by comparing labour supply across ZIP-code areas that differ in knowledge about the policy but are otherwise comparable. Similarly, our identification strategy is based on the idea that SIP penetration measures the level of GPs' knowledge about and familiarity to the SIP in each area, which is presumably exogenous from each GP's point of view but it influences the GP's SIP decision. For example, a

very low penetration presumably implies that GPs in the area are unaware of the program as if there were not such a program in the area.[4]

Our analysis proceeds in the following steps. We first distinguish two types of GPs: GPs who are eligible for claiming the SIP (termed as SIP-eligible) and who are not (SIP-ineligible). SIP-eligible GPs are GPs who work in a practice that has registered for the PIP. In the absence of the practice-level information, however, we cannot directly observe SIP eligibility status. Hence SIP-eligibility needs to be imputed from SIP claims made by GPs. We define a GP's eligibility for the SIP in year t based on claims the GP makes for any type of SIP incentives, including diabetes, asthma, and cervical screening SIPs, at least once during years $\{t-1,\ t,\ t+1\}$. Otherwise, the GP is treated as SIP-ineligible in t.

Then we measure the SIP penetration in postal area z in year t by:

$$SIP\ penetration_{tz} = \frac{N_{tz}^{SIP}}{N_{tz}} \quad , \tag{1}$$

where N_{tz} represents the number of pairs of SIP-eligible GPs and their diabetic patients (henceforth, 'SIPGP-diabetics') in area z in year t, and N_{tz}^{SIP} denotes the number of SIP-eligible GPs and diabetics pairs who claim diabetes SIP (by completing a diabetic cycle of care) in area z in year t. We use postal areas of the practices where GPs practise.

$SIP\ penetration_{tz}$ takes values between 0 and 1.[5] For the accuracy of the penetration measure, two restrictions are placed on the data: (1) we exclude GPs who see 5 or fewer diabetics in a calendar year, and (2) we exclude postal areas that have 5 or fewer SIP-eligible GPs in a calendar year. To reduce data variability due to the small sample size (i.e. the number of 'SIPGP-diabetics' pairs) in some areas, a three-year moving average over $\{t-1,\ t,\ t+1\}$ is employed for $SIP\ penetration_{tz}$. Thus the modified measure is

[4]Similarly to this approach, pre-existing geographical heterogeneity has been used in the literature to evaluate the causal effect of the launch of a program (e.g. Hoyt Bleakley, 2007), the introduction of a new technology (e.g. Richard Hornbeck, 2010), and so on, although their heterogeneity provides exogenous variation in the intensity of a treatment, whereas geographical variation in "knowledge" in our approach is intended to provide exogenous variation in the treatment assignment.

[5]In our sample 115 'SIPGP-diabetics' pairs completed two diabetes SIP cycles within one calendar year with one in January and another in the December of the same year. They are counted as a single completion for the purpose of calculating penetration.

$$(1') \qquad SIP\ penetration_{tz} = \left\{ \frac{N^{SIP}_{t+1,z}}{N_{t+1,z}} + \frac{N^{SIP}_{t,z}}{N_{t,z}} + \frac{N^{SIP}_{t-1,z}}{N_{t-1,z}} \right\} /3 \quad .$$

We divide all the postal areas into deciles depending on the distribution of SIP penetration: lowest-SIP-penetration (bottom-decile) areas, all middle groups, and highest-SIP-penetration (top-decile) areas. Our causal evaluation is based on the comparison between the lowest- and highest-SIP-penetration groups. The lowest-SIP-penetration areas provide a counterfactual in which the SIP is effectively unavailable due to the lack of SIP knowledge and familiarity. We also use quintiles to examine the robustness of our results. Using quintiles doubles the number of observations, whereas identification is not as sharp as deciles because the difference between the top and bottom groups is less clear.

The simplest estimates of the effects of the SIP availability can be obtained by comparing diabetics who see GPs practising in the top decile and the bottom decile, among the sample of diabetics who only see SIP-eligible GPs. Specifically, we estimate the following simple OLS regression:

$$(2) \qquad Y_{i,t+1,z} = X_{i,t,z}\beta + \theta^{OLS} topSIP_{i,t,z} + \tau_t + \epsilon_{i,t,z},$$

where subscripts i, t, and z denote an individual, a year (2005, 2006, … , 2010), and a postal area, respectively. $Y_{i,t+1,z}$ is the outcome variable in the next year $t+1$. $X_{i,t,z}$ is a vector of control variables that includes individual i's socio-demographic characteristics and health status as well as a constant term, and their associated coefficient parameters are denoted as β. We include year fixed effects, τ_t. $topSIP_{i,t,z}$ is an indicator that equals to one if individual i sees a GP whose practice is in a top-decile area in year t. The parameter of interest, θ^{OLS}, yields a consistent estimate of the effect of the SIP availability if $topSIP_{i,t,z}$ is orthogonal to the error term, $\epsilon_{i,t,z}$, conditional on the other controls. Standard errors are clustered at the postal area level to account for potential correlations in outcome variables (i.e. various health care utilisations) across individuals and over time within each area. The identification comes from variation in SIP penetration measure across areas and over time.

The above specification, however, may suffer from the bias due to factors behind regional variations in the SIP penetration that also affect the outcome variables. For example, diabetics in some areas may be better educated and

more likely to complete a SIP cycle than those diabetics in other areas. Another example is cross-area variation in the practice style that affects both the SIP penetration and outcomes.

To address the potential bias from area-level systematic differences, we form a DID estimator by introducing diabetics who only see SIP-ineligible GPs – as a "control group" to net out the effects of unobservable differences across areas. The key identifying assumption is that the differences in outcome variables between the top and bottom deciles of the SIP penetration distribution would on average be the same for treatment and control groups in the absence of the SIP. The DID estimator is specified as:

$$(3) \quad Y_{i,t+1,z} = X_{i,t,z}\beta + \gamma_1 topSIP_{i,t,z} + \gamma_2 S_{i,t,z} + \theta^{DD} topSIP_{i,t,z} \times S_{i,t,z} + \tau_t + \epsilon_{i,t,z},$$

where $S_{i,t,z}$ is a dummy variable that equals one if an individual is in the treatment group (seeing a SIP-eligible GP) and zero otherwise. The coefficient on the interaction term, θ^{DD}, is the parameter of interest. In our DID estimation, the postal areas included in the sample are those with both SIP-eligible and SIP-ineligible GPs, and areas with either only SIP-eligible GPs or only SIP-ineligible GPs are excluded from the analysis.

We also estimate a variant of (3), in which we include postal-area fixed effects, α_z, which absorbs the indicator for $topSIP_{i,t,z}$:

$$(4) \quad Y_{i,t+1,z} = X_{i,t,z}\beta + +\gamma_2 S_{i,t,z} + \theta^{DDFE} topSIP_{i,t,z} \times S_{i,t,z} + \alpha_z + \tau_t + \epsilon_{i,t,z}$$

If the diabetics who see SIP-eligible GPs (treatment group) and who see SIP-ineligible GPs (control group) are substantially different from each other, then the common trend assumption becomes less plausible, but it is unlikely because diabetics' choice of GPs is unlikely to be strongly related with the GP's PIP-registration status.

While the analysis discussed above will yield consistent estimates of the overall SIP effects, it is not sufficient to assess one of the stated goals of the SIP – "systematic" disease management – which is essentially about reducing idiosyncratic variations in disease management. To address this, we use the institutional threshold at age 65, above which individuals face substantially

lower marginal out-of-pocket costs. We separately present our results by age group to show whether the SIP leads to differential effects between the old and young age groups.

Exploring heterogeneity in the treatment effects by subsample analysis is useful in understanding the mechanism behind the SIP effects. We present heterogeneous treatment effects by estimating DID (Model 3) and DID with area fixed effects (Model 4) for the following two subsamples: (1) individuals with high educational attainment and low educational attainment and (2) individuals who developed diabetes within the past 5 years and those who have had diabetes for more than 5 years. We also conduct a decomposition analysis by splitting the sample into two groups by SIP cycle completion status in year $t+1$, to investigate how coefficient estimates vary by the SIP completion status. This analysis resembles the above subsample analyses but it is actually a mechanical decomposition with no strict causal interpretation because the SIP completion status is endogenously determined. This decomposition analysis illustrates whether the overall effect is driven by diabetics who completed a SIP cycle or those who did not complete a SIP cycle also contribute to the overall effect. If the latter is the case, it implies a spill-over effect of the SIP scheme.

5 Data

5.1 Data sources and sample construction

We use data from the Sax Institute's 45 and Up Study, a large-scale survey of individuals aged 45 and over in the state of New South Wales (NSW) in Australia. Around 60% of this population was randomly sampled from the enrolment database of the Department of Human Services (45 and Up Study collaborators, 2008), and 18% of them participated, comprising 267,000 respondents, or roughly 10% of the NSW population aged 45 years and over.[6] The survey was conducted between 2006 and 2009, and 85% of the respondents completed the survey in 2008. The 45 and Up Study provides rich information about the respondents' socio-economic and demographic

[6]Participants join the 45 and Up Study by completing a baseline questionnaire and giving signed consent for follow-up questionnaires and linkage of their information to several other health databases.

characteristics, chronic conditions, physical limitations, mental health, lifestyle, and other health-related factors.

We also use the following administrative medical records linked to the 45 and Up Study: Medicare Benefits Schedule (MBS) data, Pharmaceutical Benefits Scheme (PBS) data, NSW Health Admitted Patient Data Collection (APDC), and the NSW Emergency Department Data Collection (EDDC). The MBS and PBS data are administered by the Department of Human Services, and the APDC and EDCC data are supplied by the New South Wales Ministry of Health. A survey-administrative data linkage of this scale is unique in Australia. While the data we draw from the 45 and Up Study is a single cross-section, the linked administrative data is an annual panel from 2005 to 2011.

The MBS dataset consists of out-of-hospital medical services funded by Medicare, which include the number of visits to GPs, specialists, and other medical practitioners. It also provides information on the fees charged by providers for their services, the amount of Medicare subsidy, de-identified provider ID, which identifies their patient pool, and the location postcodes in which a provider practises. The PBS dataset includes the details of prescription drugs that are subsidised by the PBS, including gross price, government benefits, the quantity of prescribed medication, and the date of prescription.[7] The APDC dataset covers all hospital admission (public, private, psychiatric, and repatriation), providing details on the diagnosis and dates of admission and discharge. The EDDC dataset covers the information on presentations to the Emergency Departments of public hospitals.[8]

We extract respondents with diabetes from the survey. The diabetic population is defined as the union of diabetics identified from different data sources. From the 45 and Up Study, we use the information on self-reported chronic conditions (whether they have diabetes and the year of its onset) and diabetes-related medications used in the last four weeks. From the MBS data, we select individuals who had any medical services related to the treatment for diabetes or who had two or more claims for the HbA1c test in a calendar year t or any time before.[9,10] For the APDC data, 1 or more hospital admissions related to

[7]About 80% of prescription drugs dispensed in Australia are subsidized.
[8]There are only a few private hospital emergency departments in Australia.
[9]HbA1c is a laboratory test that indicates the average level of blood glucose over the last 8–12 weeks.

diabetes in year t or any time before is used as the criterion. For the PBS data, we regard individuals as diabetic if they had at least 3 months of treatment of insulin or an oral antidiabetic in year t or any time before. Whilst the PBS data provide the most comprehensive set of pharmaceutical use available in Australia, one limitation is that claims are only observed when the price of the dispensed drug is above the patient co-payment. For drugs that are priced below the patient co-payment, no claim record is made and therefore it is not observable in the PBS data.[11] We have listed all relevant diabetic medications to determine which of these have a price that is below the co-payment amount. It turns out that, although all insulin drugs are priced above the co-payment, some oral antidiabetics drugs are priced under the general patients' co-payment.[12] Consequently, these medicines do not appear in the PBS data for general patients.[13] For concession card holders, all prescribed drugs are observed.

We select the sample for analysis as follows. First, we focus on individuals with Type 2 diabetes because Type 1 diabetes, which makes up around 5% of all diabetes cases in our data, is a substantially different type of condition regarding cause, development of the conditions, and treatment styles.[14] We classify the type of diabetes based on information on age at diagnosis (self-reported in the survey) and medication use from PBS data in 2005-2011, following Elizabeth Jean Comino et al. (2013).[15] Second, we exclude GPs who see 5 or fewer diabetics in a given year and exclude postal areas that have 5 or fewer SIP-eligible GPs in a year, to minimize the possibility of an imprecise measure of SIP penetration due to a small sample size. Third, because end-of-life health care utilisations may be extremely high, we exclude individuals who died during 2005-2011 through the linkage with NSW Registry of Births

[10]The related MBS item numbers that are used for the identification are available upon request.
[11]This data limitation has been addressed in years after 2012 as records become available for all PBS-related dispensing.
[12]The results of this exercise are available upon request.
[13]The exception is when general patients reach the PBS Safety Net threshold by paying a certain amount of co-payment during a calendar year. Once the threshold is reached, the patient's co-payment falls to that of a concession card holder for the remainder of the year, and all oral antidiabetics drugs dispensed afterward are observed in the PBS data.
[14]For example, Type 1 diabetes is treated with insulin injections or insulin pump, while Type 2 diabetes is usually treated initially without medication or with tablets. Also, Type 1 diabetes cannot be controlled without taking insulin while sometime it is possible for Type 2 diabetes to come off diabetes medication.
[15]Specifically, participants who either are diagnosed before age of 31 years and are using insulin, or do not give age of diagnosis but are using insulin only (no consumption of other antidiabetics drugs) are classified as having Type 1 diabetes.

Deaths and Marriages (RBDM) death registrations, assuming that the SIP availability has a negligible effect on short-term mortality. Lastly, as mentioned in the previous section, we exclude from the regression analyses postal areas (and diabetics in those areas) that do not contain both SIP-eligible and SIP- ineligible GPs.[16] In the next sections, we explain how the outcome and control variables are constructed. The variable names and definitions are summarised in Table 1.

[Insert Table 1: Definitions of variables]

5.2 Outcome variables

We consider a wide range of outcomes to examine the effects of the diabetics SIP comprehensively. From the MBS data, we construct the following outcome variables: (1) the completion of a diabetes SIP cycle of care for individual i; (2) the number of HbA1c tests performed in a calendar year for individual i, which is supposed to measure quality of care in the sense that blood glucose monitoring facilitates judgments on appropriate lifestyle and medication adjustment and monitors long-term glycaemic control;[17] (3) the number of GP visits and the associated total payment charged by the GPs; and (4) an indicator for a visit to a specialist and associated total payment charged. In addition, we divide specialist visits into visits to specialists with a specialty related to diabetes treatment (such as ophthalmology, cardiology, endocrinology, and neurology) and visits to other specialists, and use their indicators and associated payments to investigate which type of visit is driving the overall effect on specialist visits. The total payments consist of government benefits (i.e. Medicare rebate) and patients' out-of-pocket (OOP) costs.

We use the PBS data to identify the use of diabetes-related medicines – the consumption of insulin and antidiabetic drugs. We study not only the cost of all diabetes-related medicines but also the cost of insulin and oral antidiabetics,

[16]Of the all postcode*year observations in the top and bottom SIP penetration deciles, XX% are excluded due to this sample restriction. The vast majority of them are the cases where no SIP-ineligible GP is observed. This restriction is not essential for the simple regression, (2), but we nevertheless apply it for the comparison purposes of DID and simple OLS.

[17]Previous studies show that a lower HbA1c value is associated with reduced incidence and progression of diabetes-related complications.

separately. Studying these two costs separately potentially provides a better understanding of the SIP effect because it has been recognised that individuals with Type 2 diabetes use insulin when the condition becomes out of control.

From the EDDC data, we construct an indicator for a presentation to the emergency department (ED).[18] We also use indicators for a high-urgency ED visit (with triage classification of urgent/emergency/resuscitation) and a low-urgency one (with triage classification of non-urgent/semi-urgent). From the APDC data, we use an indicator for diabetes-related potentially preventable hospitalisations (PPHs), which are identified as hospitalisations those with diabetes diagnosis codes, incident dialysis procedures in relation to kidney complications, and conditions for which diabetes is a risk factor, such as heart failure, blindness, and chronic skin ulcer. All of these outcome variables are measured per annum. We index the total costs to the price level in 2010.

As discussed earlier, the interpretation of the estimated SIP effects is complicated by the two potential channels: health outcomes and management. While we take advantage of the institutional discontinuity at 65 years old as the primary strategy to explore the mechanism behind the SIP effect, the use of the broad sets of cost and utilisation measures is also expected to help us explore the mechanism. While the outcomes related to consultations and prescription drugs are closely related to daily diabetes management, the use of emergency care and hospitalisation by people having chronic conditions, such as diabetes and asthma, is seen as poor health outcomes with the outbreak of severe conditions as a consequence of poor disease control. There is evidence that better management of diabetes through primary care, and particularly the receipt of processes of care, is associated with lower ED presentations and hospital admissions (Elizabeth J. Comino et al., 2013).

Table 2 reports the mean and standard deviation of the outcome variables for the treatment and control groups, in the top and bottom deciles, separately. The top panel is for the group aged 65 or above and the bottom panel is for the group aged 63 or below. These statistics are calculated over the sample used in the DID regressions based on the deciles of the SIP penetration. The

[18]We exclude ED admissions with diagnosis codes related to external causes, such as injury, poisoning, and certain other consequences of external causes.

corresponding statistics based on quintiles are shown in Appendix B (Table B.2).

[Insert Table 2: Descriptive statistics for outcome variables]

For the differences in the means of outcome variables between the treatment and control groups, the former group seems to have more GP visits, fewer specialist visits, and less consumption of medications compared to the latter group, among diabetics aged 65 or above. This applies to the sample in both top and bottom deciles, but the differences in the bottom-deciles are much smaller in magnitude. For young diabetics, individuals in the treatment group are shown to have fewer specialist consultations than the control group. Other outcome variables, such as presentations to EDs and hospital admissions, do not differ significantly between treatment and control groups.

We also plot the distribution of outcome variables against the SIP-penetration measure for treatment and control groups and for old and young diabetics, respectively (Figures 1-2). In these figures, the x-axis variable (SIP-penetration) has been grouped into equal-sized bins, and the dots in each bin represent the means of outcome variables. No evidence indicates that there are systematic differences in the association of SIP-penetration and outcome variables between the treatment and control groups, which reinforce the appropriateness of our control group.[19]

[Insert Figure 1: correlation between SIP-penetration and outcome variables – diabetics aged 65 or above]

[Insert Figure 2: correlation between SIP-penetration and outcome variables – diabetics aged 63 or below]

5.3 Independent variables

The key independent variable is $SIP\ penetration_{tz}$ defined as Equation (1'). Figure 3 illustrates the spatial variation in SIP-penetration across the 597 postal areas in the NSW state of Australia in 2011. Of the 597 areas, 435 areas, mostly less populated areas, do not have a valid value due to insufficient

[19]Given the space limitations, we only include the outcome variables of most interest. The figures for other outcome variables are available upon request.

information. The valid values of $SIP\ penetration_{2011,z}$ range from 0.032 to 0.314. To make Figure 3, we divide all the postal areas with a valid SIP penetration figure into quintiles. Quintiles with darker shades represent higher levels of SIP penetration. The Figure shows that while most areas with valid data concentrate on the coastal part, there is no clear pattern or concentration of high SIP penetration along the coastal areas, indicating that our estimates do not stem from a particular margin or a small area.

[Insert Figure 3 SIP-penetration across postal areas in NSW Australia]

If SIP penetration is assigned randomly, the comparison between the top and bottom deciles of SIP penetration provides the most reliable causal estimate, and even though non-random systematic differences between high and low SIP-penetration areas can be taken care of by our DID framework, a smaller systematic difference across areas provides greater assurance for our DID estimates. To further explore whether the SIP-penetration measure is correlated with regional characteristics systematically, we regress $SIP\ penetration_{tz}$ between 2006 and 2010 on various correlates: population density, area size, Socio-Economic Indexes for Areas Index of Relative Socio-Economic Disadvantage (SEIFA-IRSD), and remoteness index at the postal area level.[20] We also include year dummies. The results are presented in Table 3 with columns 1 and 2 for regressions using all postal areas with a valid value of $SIP\ penetration_{tz}$ and columns 3 and 4 for regressions using only postal areas used in the DID regressions (the top and bottom decile areas excluding areas used in neither old nor young DID regression due to insufficient observations in the control or treatment group). As defined in Table 1, the SEIFA-IRSD score measures the representative individual's socio-economic status in the area. We test two specifications for SEIFA-IRSD score: one is a continuous variable and the other includes binary variables for each quintile of the SEIFA-IRSD score.

[20]The data on population, area size, and SEIFA by postal area were obtained from the National Centre for Geographic Resources & Analysis in Primary Health Care (GRAPHC) - HealthLandscape Australia (http://204.12.121.118/wwwdev/hl_au/V20140711/index.cfm). The remoteness index by postal area was obtained from the Australian Bureau of Statistics: Postcode 2012 to Remoteness Area 2011, Australian Statistical Geography Standard (ASGS): Correspondences, July 2011. http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1270.0.55.006July%202011?OpenDocument [Accessed 1 October, 2016]. All these variables are for 2011 and asssumed to be time-constant.

The results show that the basic area characteristics cannot explain much of variation in SIP penetration, providing empirical support for a limited systematic difference in SIP penetration. *R*-squareds are fairly low. The models that only use the DID sample show larger *R*-squareds, but the majority of covariates show insignificant coefficient estimates: SIP penetration has no significant time trends, and the size and remoteness of an area do not explain SIP penetration. On the other hand, having a higher population density is negatively and significantly correlated with SIP penetration in the first three models. A possible explanation for the negative correlation is that GPs in areas with a higher population density tend to see more patients, and hence their time costs of completing a SIP cycle are higher. However, this coefficient turns insignificant when the SEIFA index dummies are included for the regression of the DID sample (Model 4). A couple of SEIFA index dummies show statistical significance (Models 2 and 4), but their coefficients do not follow a clear monotonic pattern. Figure C.1 in Appendix C plots the correlation between $SIP\ penetration_{tz}$ and the population density. It shows that the negative correlation is primarily driven by relatively few observations in the most highly-populated areas, probably reflecting that GPs in these areas face a high demand from patients and do not have time to provide a systematic cycle of care. Overall, these results show that the degree of SIP penetration is fairly unpredictable, but some systematic geographical differences are suggested. To address this concern, we take the advantage of our DID structure. We also estimate models with area fixed effects.

[Insert Table 3: SIP-penetration regression]

Our regression analysis also controls for the health measures and socio-demographic characteristics of individuals, as defined in Table 1. These variables are drawn from the 45 and Up Study and hence not time-varying.[21] Self-reported health status is defined by five groups: poor, fair, good, very good, and excellent health. Co-morbidities (such as cancers, heart disease, and asthma) are identified based on the self-reported medical conditions and the year of onset of each condition, hence they are time-varying. Age takes precise

[21] Including individual controls is not absolute necessity for the consistent estimation of the effects in the DID framework, but it potentially improves statistical inference. The gain from using potentially time-varying controls is an issue, but our main results are not sensitive to the inclusion of individual controls.

annual values. The number of chronic conditions is defined by four categories: no chronic conditions, one, two, and three or more chronic conditions. Body mass index (BMI) is also included.

The socio-demographic characteristics include gender, age, marital status (single, widowed, married or living with a partner, and divorced or separated), country of birth (born in Australia or overseas), current employment status (employed or not), and highest educational attainment (no education, intermediate certificate/higher school, diploma/certificate/trade, and university degree or higher).[22] We include a four-category measure for household income: lowest household income, middle household income, high household income, and very high household income.[23] Variables indicating possession of a concession card and private health insurance (no private health insurance, private health insurance with extras,[24] and private health insurance with hospital cover) are incorporated. The remoteness (major cities, inner regional areas, and outer regional and remote areas)[25] and socio-economic status represented by SEIFA-IRSD of an individual' area of residence is introduced. SEIFA-IRSD scores are grouped into quartiles where the top quartile with the highest IRSD scores represents the most advantaged areas, and the lowest quartile represents the most disadvantaged areas.

Table 4 shows the makeup of the treatment and control groups regarding the personal socio-demographic characteristics of the individuals in our sample. These statistics are based on the sample used in the DID regressions in all deciles of the SIP penetration. For both old and young diabetics, the differences between the treatment and control groups are small, suggesting that there is no discernible selection on observables into the treatment group. The only noticeable difference lies in the residential location with the treatment group being more likely to reside outside major cities than the control group, for both of the two age groups.

[Insert Table 4: Descriptive statistics of independent variables]

[22]There are only less than 3% missing values in education variable. We drop observations with missing values on the education variables.
[23]There is a fifth group for whom income in missing in the model.
[24]Private health insurance with extras generally helps with cost of ambulatory health services, such as physiotherapy, dental, acupuncture, and optical treatment.
[25]Remoteness is measured by the Accessibility/Remoteness Index of Australia Plus (ARIA+).

6 Results

6.1 Estimation results – main sample analysis

The main sample analysis is performed for the sample aged 65 or above and the sample aged 63 or below, separately. The results of DID, DID with area fixed effect (using deciles of SIP-penetration), and DID with area fixed effect (quintiles) models are displayed in Tables 5 and 6 for the old and young diabetics, respectively, with the first column showing the mean values for all outcome variables using observations in all deciles. These three model specifications rely on slightly different identification assumptions, and nevertheless, observing consistent results across three models can be interpreted as robust evidence.

We observe a significant incentive effect on patients' outcomes despite the small reward amount. The results show that diabetics aged 65 or above and diabetics aged 63 or below respond differently to the local variation in the availability of the SIP. Specifically, diabetics aged 65 or above in high SIP-penetration areas reduce their health care utilisations in terms of physician consultations, hospital visits, presentations to EDs, and the use of medications relative to those in low SIP-penetration areas, while diabetics aged 63 or below tend to increase their health care utilisation.

We find that: (1) regarding GP visits, there is a decrease in the total number of GP visits and the associated cost for diabetics aged 65 or above in the high SIP penetration areas, relative to those in the low SIP penetration areas. Diabetics aged 63 or below change their use of GPs in the opposite directions. However, these estimates are not statistically significant; (2) for the specialist consultations, diabetics aged 65 or above in the high SIP-penetration areas spend A$78, A$67, and A$32 less in the total costs for specialist visits related to diabetes treatment, on average, relative to those in the low SIP-penetration areas for DID, DID with areas fixed effect (deciles) and DID with areas fixed effect (quintiles) specifications, respectively. However, for the group aged 63 or below, individuals in the high SIP-penetration areas have larger expenditure of A$58, A$53, and A$38 than those in the low SIP-penetration areas for the three model specifications, respectively. A similar pattern is also revealed for the total number of specialist visits, the total cost of all specialist visits, and

the number of visits to other specialists; (3) concerning medications for diabetes treatment, the expenditure on all diabetes-related medicines, insulin, and oral antidiabetics rise by A$206, A$80, and A$126, respectively, among diabetics aged 65 or above in the high SIP penetration areas than those in low SIP penetration areas using the DID with area fixed effect (deciles) model. However, the young diabetics group have a rising cost of A$67, A$39, and A$27 on these medications instead. The statistics for the other two model specifications show similar patterns.

Cost concerns are a plausible explanation for the differences between the two age groups. Most of the people aged 65 or above are concession card holders who face lower fees for medication and are more likely to be bulk-billed for GP and specialist visits than the general public that includes those who are aged 63 or below. Therefore, due to the differences in costs, diabetics aged 65 or above tend to over-use health services while those aged 63 or below are under-users in the absence of the SIP. The introduction of the SIP corrects these usages.

A higher probability of completing a diabetes SIP cycle of care in next year is observed in high SIP penetration areas for both of the two age groups. The completion of a SIP cycle of care requires doing at least one HbA1c test, and as a consequence, there is a higher number of HbA1c test performed in the high SIP penetration areas than the low SIP penetration areas for the two age groups as well.

Both of the two age groups experience a decline in hospital admissions due to diabetes and presentations to EDs in the high SIP penetration areas, with the estimated treatment effects being highly significant for the old diabetics group. The reduction in the need for emergency care or hospitalisation implies a good control of the condition brought by the SIP cycle of care.

The results of using deciles and quintiles of SIP-penetration measure are consistent with each other. It is as expected that the disparity between high and low SIP penetration areas is larger for regressions using deciles than that for using quintiles in the sense that the two extreme groups are more different from each other in the deciles specification; this results in estimates in larger magnitude in the model specification using deciles. Full sets of estimates are

available in tabular forms in Appendix B (Tables B.4 and B.5 for sample aged 65 or above and 63 or below, respectively).

The last column in Tables 5 and 6 displays the treatment effect for the simple OLS (Model 2): the simple cross-neighbourhood comparison of various health care utilisations between the sample in postal areas with high and low levels of SIP-penetration (i.e. top- and bottom-deciles) among individuals who only see SIP-eligible GPs (i.e. treatment group). The fact that the reduced-form regressions and three specifications for the DID regressions produce broadly similar results is reassuring and suggests that our results are robust and reliable. The differences between them justify the importance of and the need for introducing a causal framework. The results of reduced-form regression and DID models using quintiles of SIP penetration are robust and are displayed in Appendix B (Table B.3).

[Insert Table 5: Estimated effects of SIP availability – diabetics aged 65 or above]

[Insert Table 6: Estimated effects of SIP availability – diabetics aged 63 or below]

6.2 Estimation results – subsample analysis

To further examine the heterogeneity of the effect of the SIP, we run regressions for subsamples by individual characteristics. We posit that individual characteristics, such as socioeconomic status, would influence patients' knowledge and uptake willingness of the SIP cycle of care. It is also possible that GPs vary their referral behaviours or treatment decisions by patients' characteristics. Another motivation of the subsample analysis is to understand which group generates the main effect of the incentive.

Given the educational nature of the SIP scheme (e.g. training in self-management of disease), it would be interesting to examine whether the effect of the incentive differs by different education levels. The results of subsample analysis by education are displayed in Table 7 with the left panel for diabetics aged 65 or above and the right panel for diabetics aged 63 or below, comparing the treatment effects for high-education (completed higher school, trade/apprenticeship, certificate/diploma, or university degree or higher) and

low-education (had school or intermediate certificate or had no school certificate) groups within each age group. Among old diabetics, noticeable behaviour changes are observed for the high-education group: they are prone to reduce the use of specialists in the high SIP penetration areas, compared to those in the low SIP penetration areas. The estimates for the low-education subgroup are negative as well but insignificant. Among young diabetics, the high-education group are found to have greater use of specialists while no such obvious behaviour adjustments are found for the low-education group. One plausible explanation is that it is expensive to see specialists, and hence the cost concerns still exist for the low-education group that usually possesses low income even after the introduction of SIP, particularly for the young diabetics who face a relatively higher cost. As a result, they do not correct the use of specialists accordingly. Another possible hypothesis is related to GPs' referral behaviours: for mild cases, GPs are more likely to refer their high-education patients to consult a specialist, and in the meantime, high-educated individuals are more cautious in disease treatment and more active in seeking advanced care. This can also explain the findings that, among the young diabetics, only high-education individuals increase the use of specialists as a response to the incentive, but not the low-education ones. Previous evidence has demonstrated that well-educated or high-income individuals have higher probabilities of using speciality care (Geir Godager et ao., 2015; D. Shea et al., 1999).

Regarding medication consumption, we observe a significant decrease in the use of diabetes-related medications for old diabetics, which applies to both high- and low-education subgroups. There is an increase in insulin use for individuals with low-education among the young diabetics. A better disease control that is indicated by a decline in hospital admissions related to diabetes only occurs for diabetics with high educational attainment among the diabetics 65 years of age and older.

Patients with relatively lower educational attainment may not have a good understanding of the benefits of the systematic SIP cycle of care and the plus of self-management of diabetes; therefore well-educated individuals are more likely to follow doctors' advice while low educated patients tend to ignore or divert from doctors' instructions. As a result, most of the estimated incentive

effects for the low-education group are statistically insignificant, suggesting that there are no marked adjustments to their behaviours.[26] We also estimate the models by different income groups and similar results are obtained as education subsample analysis.[27]

[Insert Table 7: Estimated effects of SIP availability by education]

Table 8 illustrates subsample analysis results by the number of years that diabetes has been developed. On the one hand, the years of diabetes can capture the severity of diabetes, to some degree, with longer years being associated with a more severe case. On the other hand, patients with a longer duration of diabetes may have formed their preferred ways of managing diabetes, and it is harder for them to change the treatment plans. Two subgroups are defined: patients with five or fewer years of diabetes and those with more than five years of diabetes. The results suggest that the policy impact is more prominent and larger for the group that developed diabetes for more than five years.[28] This implies that the SIP is more beneficial to patients with longer diabetes duration.

[Insert Table 8: Estimated effects of SIP availability by years of diabetes]

In summary, the incentive scheme with small reward is shown to induce better diabetes management and improve the quality of care by adjusting the healthcare utilisation for diabetics who deviate from the standard treatment before.

6.3 Estimation results – decomposition analysis

The main results (Tables 5 and 6) show a significant effect of the incentive program with a small reward. One plausible scenario is that doctors respond to the incentive regardless of the amount of reward and the main SIP effect is driven only by those doctors and patients who complete the SIP cycle. The alternative hypothesis for our findings is that the availability of the SIP affects the behaviour of the doctors and patients regardless of the SIP completion

[26]We also attempt to use different cut-off points for education subgroups and robust results are obtained.
[27]It is the household income rather than an individual's personal income annually that is reported in the 45 and Up survey. The results by income groups are available upon request.
[28]We also classify the diabetics into two groups: those who have developed diabetes for less than 10 years and those for more than 10 years. Consistent results are obtained and are available upon request.

status. In other words, the incentive program changes the behaviour of doctors including non-compliers. If the alternative hypothesis is the case, it suggests that the introduction of SIP can affect individuals' behaviour even if they do not participate, suggesting a spill-over effect. To investigate which hypothesis is the most likely one, we model how the incentive effects vary by the SIP completion status in year $t + 1$. This investigation is important and can help us to figure out how the incentive program works and what is the main impulse behind the incentive effect.

Specifically, we split the treatment group into two groups by SIP completion status: those who complete a SIP cycle in the next year and those who do not, and the same control group is used in the model for each of the two treatment groups. Note that, unlike the subsample analyses conducted in the previous section, the SIP completion status depends on the SIP availability and is endogenous. Therefore causal interpretation cannot be made here, and it is rather a mechanical decomposition. Even though it does not have a rigorous causal interpretation, observing significant effects for non-compliers will suggest the existence of "spill-over" effects.

The results of the decomposition analysis using DID with area fixed effect models are listed in Table 9. We find that the SIP significantly affects not only the outcomes of the group that complete a SIP cycle in year $t + 1$, but also the outcomes of those who do not complete a cycle of care, although the effects for the latter one (non-compliers) are smaller in magnitude. The results imply that the pecuniary reward is not the main driving force behind the significant incentive effect as opposed to the hypothesis that GPs are very elastic to incentive, so that small bonus can motivate their behaviour changes. The evidence suggests that the significant SIP effects are mainly driven by the "guideline" setting by the SIP scheme, but not by GPs' responses to the pecuniary reward. It seems that the "guideline" for better diseases management provided by the SIP rules and requirements has a large "spill-over" effect for non-compliers.

One small caveat comes from our definition of "non-compliers". Here, they may include doctors and/or patients who are not interested in the SIP completion at all. They may also include those doctors and patients who make

efforts to complete the SIP cycle of care but fail (e.g. some doctors and/or patients withdraw from the SIP cycle of care in the midway). The data limitation does not allow us to disentangle the two groups of individuals. However, it will not cause a big concern in the sense that there is no clear borderlines between the two groups and the mix of these two groups make no differences in the interpretation of the results.

[Insert Table 9: Estimated effects of SIP availability by SIP completion status]

7 Conclusions

This study evaluates a financial incentive in Australia targeting at the improvement of the quality of primary care by stimulating GPs to deliver chronic care for diabetics through systematic disease management. We have taken advantage of a comprehensive data set by linking a large population survey data with detailed administrative medical records. Although the financial reward of the diabetes SIP scheme is small, the significant incentive effect is observed. The findings suggest that cycle of care of SIP can bring better diabetes management and improve the quality of care by adjusting deviated health care utilisation.

The success or performance of financial incentives in primary care sector depends on doctors' and patients' attitude and the underlying payment system. Studies that evaluate the effect of incentives can help us to gain insight into the design characteristics, such as the optimum magnitude, frequency, measures of performance, and duration of financial incentives.

There are two underlying mechanisms behind the observed incentive effects: GPs' behaviour change is driven by new knowledge obtained from the SIP rules (the guideline effect) or by using the SIP requirements to guide and persuade their patients (the authorisation effect). The data available does not allow us to disentangle them, and it is left for future research. Future research may also involve the examination of long-run implications of the incentive scheme to test whether the health improvement or changes in healthcare utilisations are sustained over time or not. Another direction of future research is to perform an economic evaluation of the SIP incentive to weigh reductions

in health care expenditure and health care resources against the money invested in the SIP scheme.

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Ethics approval

The study was part of a research program approved by the University of Technology Sydney Human Research Ethics Committee (UTS HREC REF NO. 2009-143P).

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Reference

45 and Up Study collaborators. 2008. "Cohort Profile: The 45 and up Study." *International Journal of Epidemiology*, 37, 941-47.

Australian Institute for Health and Welfare (AIHW). 2013. "Diabetes Expenditure in Australia 2008-09," *Cat. no. CVD 62.* Canberra: AIHW,

____. 2014. "How Many Australians Have Diabetes?," AIHW,

Begg, S.; T. Vos; B. Barker; C. Stevenson; L. Stanley and A. Lopez. 2007. "The Burden of Disease and Injury in Australia 2003," *Cat. No. PHE 82.* Canberra: AIHW,

Buetow, Stephen. 2008. "Pay-for-Performance in New Zealand Primary Health Care." *Journal of Health Organization and Management*, 22(1), 36-47.

Chetty, Raj; John N. Friedman and Emmanuel Saez. 2013. "Using Differences in Knowledge across Neighborhoods to Uncover the Impacts of the EITC on Earnings." *The American Economic Review*, 103(7), 2683-721.

Comino, Elizabeth J.; Duong Thuy Tran; Jane R. Taggart; Siaw-Teng Liaw; Warwick Ruscoe; Jill M. Snow and Mark F. Harris. 2013. "A Preliminary Study of the Relationship between General Practice Care and Hospitalisation Using a Diabetes Register, Cardiab." *Australian Health Review*, 37(2), 210-17.

Comino, Elizabeth Jean; Duong Thuy Tran; Marion Haas; Jeff Flack; Bin Jalaludin; Louisa Jorm and Mark Fort Harris. 2013. "Validating Self-Report of Diabetes Use by Participants in the 45 and up Study: A Record Linkage Study." *BMC Health Services Research*, 13(1), 1-9.

Danaei, Goodarz; Mariel M. Finucane; Yuan Lu; Gitanjali M. Singh; Melanie J. Cowan; Christopher J. Paciorek; John K. Lin; Farshad Farzadfar; Young-Ho Khang; Gretchen A. Stevens, et al. 2011. "National, Regional, and Global Trends in Fasting Plasma Glucose and Diabetes Prevalence since 1980: Systematic Analysis of Health Examination Surveys and Epidemiological Studies with 370 Country-Years and 2·7 Million Participants." *The Lancet*, 378(9785), 31-40.

de Bruin, S. R.; C. A. Baan and J. N. Struijs. 2011. "Pay-for-Performance in Disease Management: A Systematic Review of the Literature." *BMC Health Serv Res*, 11, 272.

Department of Human Services. 2013. "Diabetes Incentive Guidelines,"

Department of Social Services (DSS). 2015. "Demographics December 2015,"

Dusheiko, Mark; Hugh Gravelle; Stephen Martin; Nigel Rice and Peter C. Smith. 2011. "Does Better Disease Management in Primary Care Reduce Hospital Costs? Evidence from English Primary Care." *Journal of Health Economics*, 30(5), 919-32.

Georgiou, A.; J. Burns and M. Harris. 2004. "Gp Claims for Completing Diabetes 'Cycle of Care'." *Aust Fam Physician*, 33(9), 755-7.

Godager, Geir; Tor Iversen and Ching-to Albert Ma. 2015. "Competition, Gatekeeping, and Health Care Access." *Journal of Health Economics*, 39, 159-70.

Gravelle, Hugh; Matt Sutton and Ada Ma. 2010. "Doctor Behaviour under a Pay for Performance Contract: Treating, Cheating and Case Finding?*." *The Economic Journal*, 120(542), F129-F56.
Greene, J. 2013. "An Examination of Pay-for-Performance in General Practice in Australia." *Health Services Research*, Published online: 27 JAN 2013, DOI: 10.1111/475-6773.12033.
Iezzi, Elisa; Matteo Lippi Bruni and Cristina Ugolini. 2014. "The Role of Gp's Compensation Schemes in Diabetes Care: Evidence from Panel Data." *Journal of Health Economics*, 34, 104-20.
Johar, Meliyanni; Chunzhou Mu; Kees Van Gool and Chun Yee Wong. 2016. "Bleeding Hearts, Profiteers, or Both: Specialist Physician Fees in an Unregulated Market." *Health Econ*, published online.
Kantarevic, Jasmin and Boris Kralj. 2013. "Link between Pay for Performance Incentives and Physician Payment Mechanisms: Evidence from the Diabetes Management Incentive in Ontario." *Health Econ*, 22(12), 1417-39.
Kontopantelis, Evangelos; David Reeves; Jose M Valderas; Stephen Campbell and Tim Doran. 2013. "Recorded Quality of Primary Care for Patients with Diabetes in England before and after the Introduction of a Financial Incentive Scheme: A Longitudinal Observational Study." *BMJ Quality & Safety*, 22(1), 53-64.
Lester, H. and S. Campbell. 2010. "Developing Quality and Outcomes Framework (Qof) Indicators and the Concept of 'Qofability'." *Qual Prim Care*, 18(2), 103-9.
Medicare Australia. 2012. "Practice Incentive: Program Diabetes Incentive Guidelines - July 2012,"
Mullen, Kathleen J.; Richard G. Frank and Meredith B. Rosenthal. 2010. "Can You Get What You Pay For? Pay-for-Performance and the Quality of Healthcare Providers." *The RAND Journal of Economics*, 41(1), 64-91.
Ogundeji, Yewande Kofoworola; John Martin Bland and Trevor Andrew Sheldon. 2016. "The Effectiveness of Payment for Performance in Health Care: A Meta-Analysis and Exploration of Variation in Outcomes." *Health Policy*, 120(10), 1141-50.
Petersen, L. A.; L. D. Woodard; T. Urech; C. Daw and S. Sookanan. 2006. "Does Pay-for-Performance Improve the Quality of Health Care?" *Ann Intern Med*, 145(4), 265-72.
Saunders, M.; P. Schattner and M. Mathews. 2008. "Diabetes 'Cycles of Care' in General Practice - Do Government Incentives Help?" *Aust Fam Physician*, 37(9), 781-4.
Scott, A.; S. Schurer; P. H. Jensen and P. Sivey. 2009. "The Effects of an Incentive Program on Quality of Care in Diabetes Management." *Health Econ*, 18(9), 1091-108.
Scott, A.; P. Sivey; D. Ait Ouakrim; L. Willenberg; L. Naccarella; J. Furler and D. Young. 2011. "The Effect of Financial Incentives on the Quality of Health Care Provided by Primary Care Physicians." *Cochrane Database Syst Rev*, (9), CD008451.
Shea, D.; B. Stuart; J. Vasey and S. Nag. 1999. "Medicare Physician Referral Patterns." *Health Services Research*, 34(1 Pt 2), 331-48.
Sutton, Matt; Ross Elder; Bruce Guthrie and Graham Watt. 2010. "Record Rewards: The Effects of Targeted Quality Incentives on the Recording of Risk Factors by Primary Care Providers." *Health Econ*, 19(1), 1-13.

Thaler, Richard H. and Cass R. Sunstein. 2008. *Nudge: Improving Decisions About Health, Wealth, and Happiness*. New Haven, CT: Yale University Press.
The Department of Health. 2016. "Annual Medicare Statistics – Financial Year 1984-85 to 2015-16 "
Van Herck, P.; D. De Smedt; L. Annemans; R. Remmen; M. B. Rosenthal and W. Sermeus. 2010. "Systematic Review: Effects, Design Choices, and Context of Pay-for-Performance in Health Care." *BMC Health Serv Res*, 10, 247.
Willcox, S.; G. Lewis and J. Burgers. 2011. "Strengthening Primary Care: Recent Reforms and Achievements in Australia, England, and the Netherlands." *Issue Brief (Commonw Fund)*, 27, 1-19.
Young, Gary J.; Mark Meterko; Howard Beckman; Errol Baker; Bert White; Karen M. Sautter; Robert Greene; Kathy Curtin; Barbara G. Bokhour; Dan Berlowitz, et al. 2007. "Effects of Paying Physicians Based on Their Relative Performance for Quality." *Journal of General Internal Medicine*, 22(6), 872-76.
Zwar, N. A.; E. J. Comino; I. Hasan and M. F. Harris. 2005. "General Practitioner Views on Barriers and Facilitators to Implementation of the Asthma 3+ Visit Plan." *Med J Aust*, 183(2), 64-7.

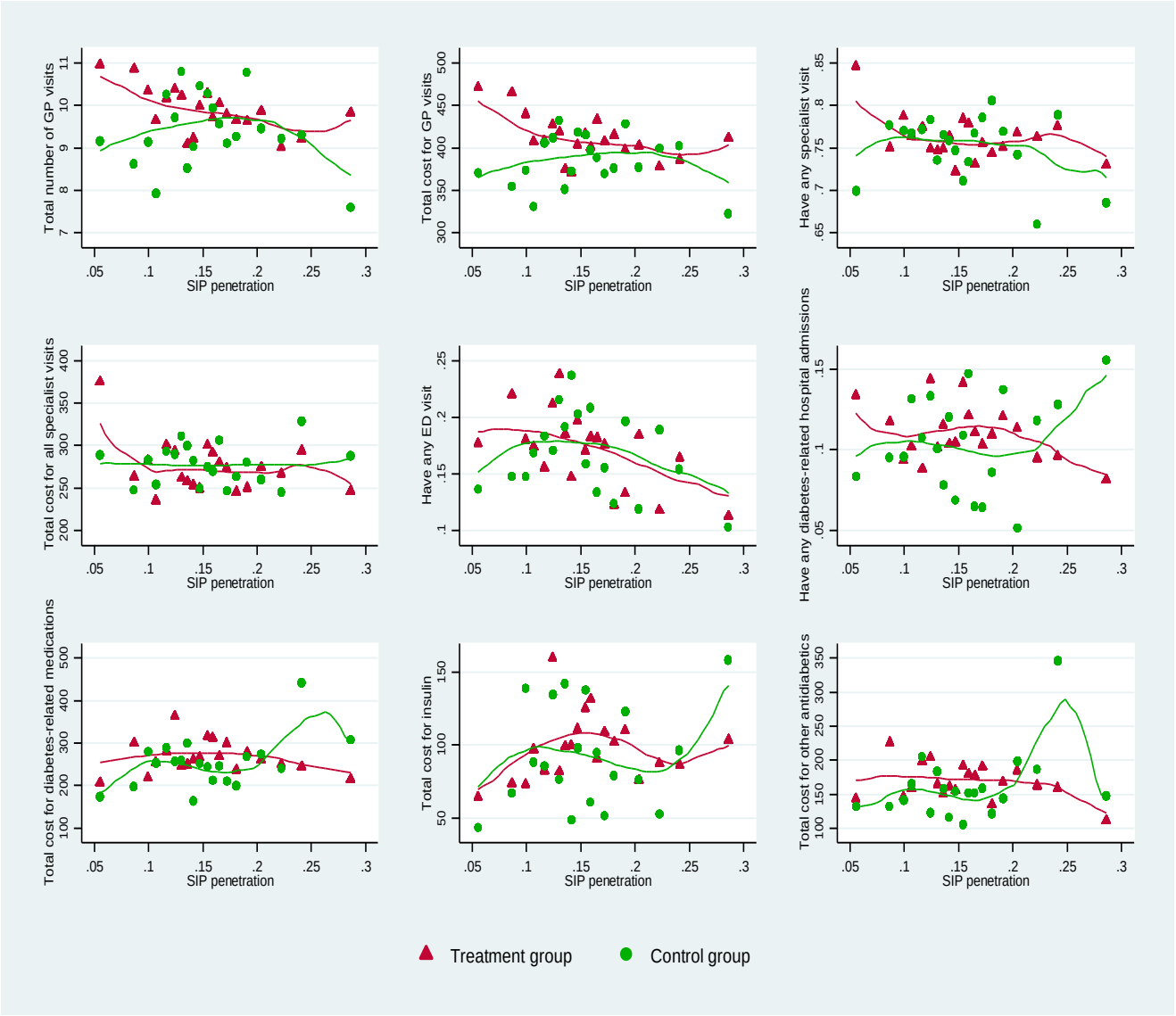

Figure 1: Correlation between SIP-penetration and outcome variables – diabetics aged 65 or above

Notes: This figure is drawn by grouping the x-axis variable (SIP-penetration) into 20 equal-sized bins and computing the means of the x-axis and y-axis variables within each bin. Postal areas with both SIP-eligible GPs and SIP-ineligible GPs are included. The solid lines represent smooth polynomial lines.

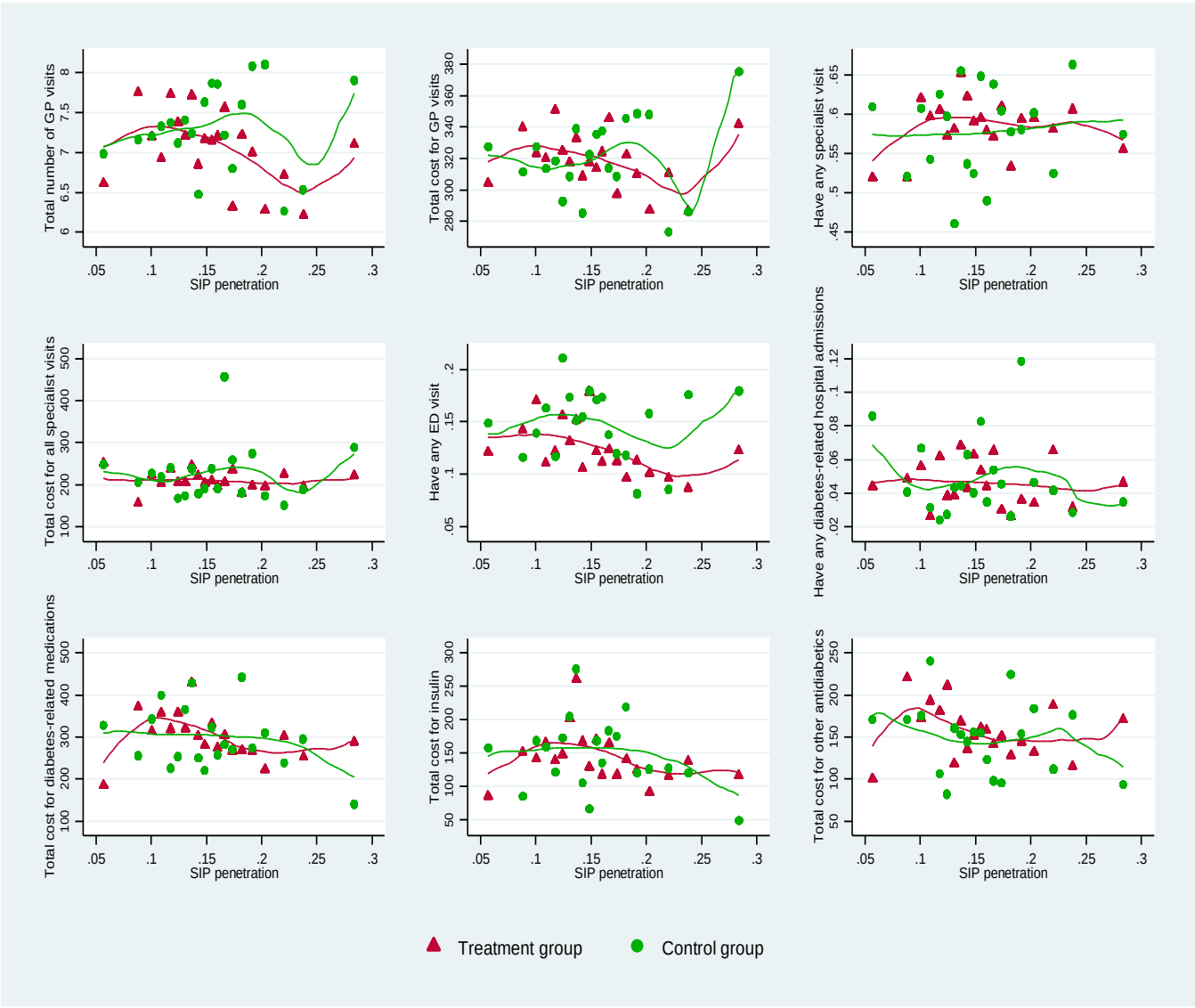

Figure 2: Correlation between SIP-penetration and outcome variables – diabetics aged 63 or below

Notes: This figure is drawn by grouping the x-axis variable (SIP-penetration) into 20 equal-sized bins and computing the mean of the x-axis and y-axis variables within each bin. Postal areas with both SIP-eligible GPs and SIP-ineligible GPs are included. The solid lines represent smooth polynomial lines.

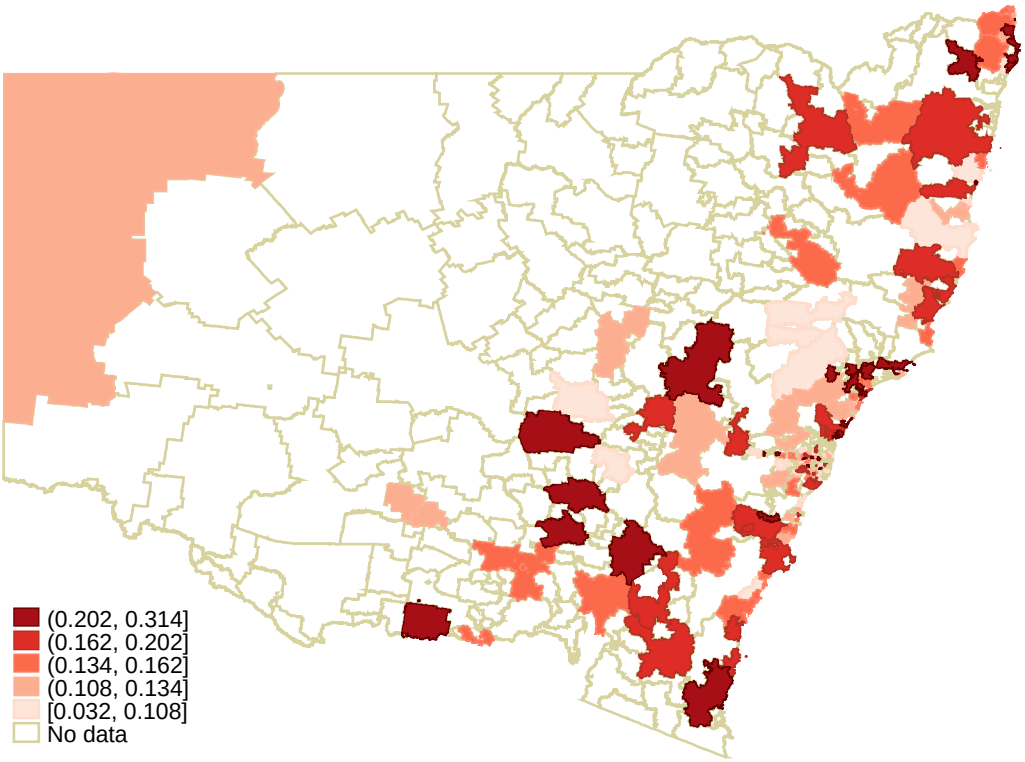

Figure 3: SIP-penetration across postal areas in NSW Australia

Notes: Based on data for 2011. Of the 597 areas, 435 areas, mostly unpopulated areas, do not have a valid value due to insufficient information.

Table 1: Definitions of variables

Variable name	Definition
Dependent variables	
SIP cycle completion	=1 if complete a diabetes SIP cycle of care;=0 otherwise
Num GP visits	Total number of GP visits
Cost GP visits	Cost of GP visits (Government rebate + out-of-pocket costs)
Num HbA1c blood tests	Total number of HbA1c tests performed
Any specialist visit	=1 if have one or more specialist visits; =0 otherwise
Cost specialist visits	Cost of specialist visits
Any specialist visit: DM	=1 if have any visits to specialists with a specialty directly related to the treatment of diabetes
Cost specialist visits: DM	Cost of visits to specialists with a specialty directly related to the treatment of diabetes
Any specialist visit: other	=1 if have any visits to specialists with a specialty unrelated to the treatment of diabetes
Cost specialist visits: other	Cost of visits to other specialists with a specialty unrelated to the treatment of diabetes
Cost DM medications	Cost of all diabetes-related medications purchased
Cost DM medications: insulin	Cost of insulin purchased
Cost DM medications: antidiabetics	Cost of oral antidiabetics purchased
Any ED visit	=1 if have any presentations to ED; =0 otherwise
Any ED visit: high-urgency	=1 if have any high-urgency ED visits; =0 otherwise
Any ED visit: low-urgency	=1 if have any low-urgency ED visits; =0 otherwise
Any DM hospital admission	=1 if have any potentially preventable diabetes-related hospital admissions
Explanatory variables	
Age	Age in years
Australia born	=1 born in Australia; =0 born overseas
Male	=1 male; = 0 female
Marital status	
Single (base group)	=1 if single
Widowed	=1 if widowed
Married or de facto	=1 if married or de facto
Divorced or separated	=1 if divorced or separated
BMI	Body mass index
Highest educational level	
No education (base group)	=1 if no school certificate or other qualifications
Intermediate certificate/higher school	=1 if have intermediate certificate or high school diploma

Diploma/certificate/trade	=1 if have trade/apprenticeship or have certificate/diploma
University degree or higher	=1 if have university degree or higher
Self-reported health status	
Poor (base group)	=1 if have poor self-reported health
Fair	=1 if have fair self-reported health
Good	=1 if have good self-reported health
Very good	=1 if have very good self-reported health
Excellent health	=1 if have excellent self-reported health
Number of long-term conditions	
0 (base group)	=1 if have no chronic conditions
1 chronic condition	=1 if have 1 chronic condition
2 chronic conditions	=1 if have 2 chronic conditions
3 or more chronic conditions	=1 if have 3 or more chronic conditions
Private health insurance	
No private health insurance (base group)	=1 if have no private health insurance
Private health insurance – without extras	=1 if private insurance does not include extra covers (only hospital cover)
Private health insurance – with extras	=1 if private insurance includes extra covers
Employed	=1 if full-time, part-time or self-employed; =0 otherwise
Remoteness of household residency	
Major city	=1 if live in a major city
Inner regional areas	=1 if live in inner regional areas
Outer regional, remote, and very remote areas (base group)	=1 if live in outer regional, remote, or very remote areas
Household income	
Low household income (base group)	=1 if household income is less than $20,000 per year
Middle household income	=1 if household income is $20,000-$40,000 per year
High household income	=1 if household income is $40,000-$70,000 per year
Very high household income	=1 if household income is greater than $70,000 per year
Concession card	=1 if have health care concession card; =0 otherwise
SEIFA Index of Relative Socio-economic Disadvantage (IRSD)	
25th percentile and below (base group – the most disadvantaged)	=1 if in 25th percentile or below of SEIFA-IRSD
25th-50th percentile	=1 if in 25th-50th percentile of SEIFA-IRSD
50th-75th percentile	=1 if in 50th-75th percentile of SEIFA-IRSD
Above 75th percentile (the most advantaged)	=1 if in 75th percentile or above of SEIFA-IRSD

Table 2: Descriptive statistics for outcome variables

Sample: diabetics aged 65 or above	Top decile of SIP penetration					Bottom decile of SIP penetration					Difference1 - Difference2
	Treatment group (*N*: 861)		Control group (*N*: 288)		Difference1	Treatment group (*N*: 498)		Control group (*N*: 486)		Difference2	
Variable name	Mean	SD	Mean	SD		Mean	SD	Mean	SD		
SIP cycle completion	0.520	(0.500)	0.003	(0.059)	0.517	0.191	(0.393)	0.006	(0.078)	0.185	0.332
Num GP visits	9.426	(6.283)	8.580	(6.146)	0.846	9.884	(7.191)	9.658	(6.622)	0.226	0.620
Cost GP visits	399.297	(259.442)	370.576	(274.697)	28.721	431.415	(329.867)	396.356	(278.139)	35.059	-6.338
Num HbA1c blood tests	1.204	(1.140)	1.003	(1.128)	0.201	0.837	(1.019)	0.786	(1.031)	0.051	0.150
Any specialist visit	0.758	(0.428)	0.743	(0.438)	0.015	0.771	(0.421)	0.809	(0.394)	-0.038	0.053
Cost specialist visits	261.211	(289.264)	321.374	(334.645)	-60.163	326.067	(351.013)	321.624	(338.541)	4.443	-64.606
Any specialist visit: DM	0.628	(0.484)	0.653	(0.477)	-0.025	0.622	(0.485)	0.667	(0.472)	-0.045	0.020
Cost specialist visits: DM	148.593	(197.544)	194.961	(217.215)	-46.368	184.073	(234.297)	188.569	(231.071)	-4.496	-41.872
Any specialist visit: other	0.417	(0.493)	0.451	(0.498)	-0.034	0.482	(0.500)	0.496	(0.500)	-0.014	-0.020
Cost specialist visits: other	112.618	(196.563)	126.413	(207.453)	-13.795	141.994	(234.402)	133.055	(209.763)	8.939	-22.734
Cost DM medications	225.272	(436.250)	336.162	(521.079)	-110.890	261.736	(456.362)	233.555	(409.239)	28.181	-139.071
Cost DM medications: insulin	80.650	(314.570)	148.190	(401.519)	-67.540	65.283	(243.941)	76.370	(259.819)	-11.087	-56.453
Cost DM medications: antidiabetics	144.622	(294.191)	187.972	(359.097)	-43.350	196.452	(369.200)	157.185	(304.747)	39.267	-82.617
Any ED visit	0.150	(0.357)	0.142	(0.350)	0.008	0.171	(0.377)	0.173	(0.378)	-0.002	0.010
Any ED visit: high-urgency	0.093	(0.290)	0.080	(0.272)	0.013	0.094	(0.293)	0.119	(0.325)	-0.025	0.038
Any ED visit: low-urgency	0.078	(0.268)	0.094	(0.292)	-0.016	0.108	(0.311)	0.070	(0.255)	0.038	-0.054
Any DM-related hospital admission	0.095	(0.294)	0.122	(0.327)	-0.027	0.124	(0.330)	0.103	(0.304)	0.021	-0.048

Sample: diabetics aged 63 or below	Top decile of SIP penetration					Bottom decile of SIP penetration					Difference1 - Difference2
	Treatment group (*N*: 499)		Control group (*N*: 250)		Difference1	Treatment group (*N*: 396)		Control group (*N*: 402)		Difference2	
Variable name	Mean	SD	Mean	SD		Mean	SD	Mean	SD		
SIP cycle completion	0.453	(0.498)	0.008	(0.089)	0.445	0.162	(0.369)	0.005	(0.070)	0.157	0.288
Num GP visits	6.455	(5.191)	6.208	(4.950)	0.247	6.947	(5.277)	7.378	(5.713)	-0.431	0.678
Cost GP visits	316.311	(228.493)	304.861	(236.694)	11.450	318.378	(225.357)	320.116	(251.559)	-1.738	13.188
Num HbA1c blood tests	1.134	(1.141)	0.904	(1.009)	0.230	0.821	(1.019)	0.699	(0.974)	0.122	0.108
Any specialist visit	0.601	(0.490)	0.552	(0.498)	0.049	0.540	(0.499)	0.627	(0.484)	-0.087	0.136
Cost specialist visits	224.853	(323.955)	297.841	(1666.664)	-72.988	203.018	(347.199)	250.820	(339.846)	-47.802	-25.186
Any specialist visit: DM	0.429	(0.495)	0.344	(0.476)	0.085	0.396	(0.490)	0.480	(0.500)	-0.084	0.169
Cost specialist visits: DM	115.893	(191.464)	84.322	(151.211)	31.571	117.268	(206.462)	148.433	(238.279)	-31.165	62.736
Any specialist visit: other	0.337	(0.473)	0.340	(0.475)	-0.003	0.290	(0.455)	0.341	(0.475)	-0.051	0.048
Cost specialist visits: other	108.961	(253.060)	213.519	(1663.100)	-104.558	85.750	(252.004)	102.387	(208.853)	-16.637	-87.921
Cost DM medications	309.713	(600.947)	263.610	(514.565)	46.103	251.446	(571.025)	282.132	(527.620)	-30.686	76.789
Cost DM medications: insulin	148.985	(446.327)	99.604	(341.701)	49.381	116.667	(463.683)	108.117	(358.366)	8.550	40.831

Cost DM medications: antidiabetics	160.729	(355.043)	164.006	(360.496)	-3.277	134.778	(317.717)	174.015	(374.446)	-39.237	35.960
Any ED visit	0.104	(0.306)	0.136	(0.343)	-0.032	0.152	(0.359)	0.144	(0.352)	0.008	-0.040
Any ED visit: high-urgency	0.056	(0.230)	0.084	(0.278)	-0.028	0.081	(0.273)	0.095	(0.293)	-0.014	-0.014
Any ED visit: low-urgency	0.058	(0.234)	0.060	(0.238)	-0.002	0.078	(0.269)	0.070	(0.255)	0.008	-0.010
Any DM-related hospital admission	0.046	(0.210)	0.044	(0.206)	0.002	0.061	(0.239)	0.052	(0.223)	0.009	-0.007

Notes: This table shows the mean and standard deviation of the outcome variables used in this study for the treatment group and control group, in the top- and bottom-deciles, separately. The top panel is for the group aged 65 and above and the bottom panel is for the group aged 63 and under. These statistics are based on the sample used in the DID regressions based on SIP penetration deciles.

Table 3: SIP-penetration regression

	Dependent variable: $SIP\ penetration_{tz}$			
	Sample: All postal areas		Sample: Postal areas used in the DID regressions [b]	
Variables	(1)	(2)	(3)	(4)
Year indicators (base is year 2006)				
Year 2007	0.004	0.003	0.000	0.011
	(0.009)	(0.009)	(0.048)	(0.048)
Year 2008	-0.006	-0.007	-0.020	-0.015
	(0.009)	(0.009)	(0.047)	(0.046)
Year 2009	-0.007	-0.008	-0.021	-0.013
	(0.009)	(0.009)	(0.048)	(0.046)
Year 2010	0.002	0.001	0.003	0.012
	(0.009)	(0.009)	(0.047)	(0.046)
Area (sq km)/1000000	-0.369	-0.288	16.652	15.252
	(0.285)	(0.287)	(14.315)	(14.753)
Population density/1000 [a]	-0.007***	-0.006***	-0.021**	-0.015
	(0.002)	(0.002)	(0.010)	(0.011)
Remoteness index (base is outer regional area)				
Inner regional	0.003	0.003	-0.019	-0.032
	(0.009)	(0.009)	(0.042)	(0.042)
Major city	0.013	0.013	0.032	0.000
	(0.010)	(0.010)	(0.051)	(0.052)
SEIFA-IRSD score/1000 (the larger the more advantaged)	0.005		0.209	
	(0.040)		(0.236)	
SEIFA-IRSD score quintiles based on national data (base is Quintile 1: 20th percentile or below, the least advantaged)				
Quintile 2 (20th-40th percentile)		0.012*		0.080*
		(0.006)		(0.042)
Quintile 3 (40th-60th percentile)		0.004		0.067
		(0.007)		(0.046)
Quintile 4 (60th-80th percentile)		0.003		0.045
		(0.009)		(0.051)
Quintile 5 (80th percentile or above, the most advantaged)		0.016**		0.116**
		(0.008)		(0.046)
Constant	0.154***	0.151***	-0.034	0.110*
	(0.039)	(0.011)	(0.228)	(0.062)
Number of observations	634	634	103	103
R-squared	0.0239	0.0341	0.0850	0.1639

Notes: [a]Population density = usual resident population/area(sq km).

[b]This includes postal areas in the DID regressions using deciles of SIP penetration for diabetics aged 65 or above and diabetics aged 63 or below.

All these independent variables except year indicators are measured in 2011. Numbers in parentheses are standard errors. * p<0.10, ** p<0.05, *** p<0.01.

Table 4: Descriptive statistics of independent variables

Sample: observations in all deciles	Diabetics aged 65 or above					Diabetics aged 63 or below				
	Treatment group (*N*: 10,541)		Control group (*N*: 5,028)		Difference	Treatment group (*N*: 7,918)		Control group (*N*: 4,344)		Difference
Variable	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Male	0.588	(0.492)	0.616	(0.487)	-0.028	0.532	(0.499)	0.561	(0.496)	-0.029
Age	73.424	(6.070)	73.637	(6.110)	-0.213	56.468	(4.855)	56.403	(4.834)	0.065
Australia born	0.757	(0.429)	0.654	(0.476)	0.103	0.795	(0.404)	0.715	(0.452)	0.080
SEIFA-IRSD										
25th percentile and below	0.279	(0.449)	0.275	(0.447)	0.004	0.279	(0.449)	0.299	(0.458)	-0.020
25th-50th percentile	0.350	(0.477)	0.324	(0.468)	0.026	0.341	(0.474)	0.291	(0.454)	0.050
50th-75th percentile	0.270	(0.444)	0.225	(0.417)	0.045	0.283	(0.450)	0.227	(0.419)	0.056
Above 75th percentile	0.100	(0.300)	0.176	(0.381)	-0.076	0.097	(0.296)	0.183	(0.387)	-0.086
Remoteness of household residency										
Major city	0.315	(0.465)	0.509	(0.500)	-0.194	0.298	(0.457)	0.504	(0.500)	-0.206
Inner regional areas	0.494	(0.500)	0.338	(0.473)	0.156	0.493	(0.500)	0.335	(0.472)	0.158
Outer regional, remote, or very remote areas	0.191	(0.393)	0.153	(0.360)	0.038	0.210	(0.407)	0.161	(0.368)	0.049
Self-reported health status										
Poor	0.033	(0.179)	0.038	(0.192)	-0.005	0.050	(0.217)	0.056	(0.229)	-0.006
Fair	0.196	(0.397)	0.236	(0.425)	-0.040	0.222	(0.415)	0.244	(0.430)	-0.022
Good	0.457	(0.498)	0.434	(0.496)	0.023	0.427	(0.495)	0.426	(0.495)	0.001
Very good	0.267	(0.443)	0.252	(0.434)	0.015	0.251	(0.434)	0.237	(0.425)	0.014
Excellent	0.047	(0.211)	0.041	(0.197)	0.006	0.050	(0.219)	0.037	(0.188)	0.013
Marital status										
Single	0.044	(0.206)	0.046	(0.209)	-0.002	0.086	(0.280)	0.080	(0.271)	0.006
Widowed	0.161	(0.368)	0.169	(0.375)	-0.008	0.031	(0.174)	0.032	(0.177)	-0.001
Married or de facto	0.716	(0.451)	0.709	(0.454)	0.007	0.771	(0.420)	0.767	(0.422)	0.004
Divorced or separated	0.078	(0.268)	0.076	(0.265)	0.002	0.112	(0.316)	0.120	(0.325)	-0.008
Number of chronic conditions										
No chronic conditions	0.185	(0.389)	0.194	(0.396)	-0.009	0.224	(0.417)	0.256	(0.436)	-0.032
1 chronic condition	0.276	(0.447)	0.282	(0.450)	-0.006	0.332	(0.471)	0.339	(0.473)	-0.007
2 chronic conditions	0.258	(0.437)	0.251	(0.434)	0.007	0.251	(0.433)	0.230	(0.421)	0.021
3 or more chronic conditions	0.281	(0.449)	0.272	(0.445)	0.009	0.193	(0.395)	0.176	(0.381)	0.017
Highest educational level										
No education	0.195	(0.396)	0.228	(0.419)	-0.033	0.138	(0.345)	0.134	(0.341)	0.004
Intermediate certificate/higher school	0.371	(0.483)	0.328	(0.469)	0.043	0.348	(0.476)	0.332	(0.471)	0.016
Diploma/certificate/trade	0.320	(0.466)	0.316	(0.465)	0.004	0.325	(0.469)	0.341	(0.474)	-0.016
University or higher	0.115	(0.319)	0.129	(0.335)	-0.014	0.189	(0.391)	0.192	(0.394)	-0.003
Household income										
Low Household income (<$20,000)	0.504	(0.500)	0.509	(0.500)	-0.005	0.233	(0.423)	0.223	(0.416)	0.010

Middle Household income ($20,000 - $40,000)	0.314	(0.464)	0.299	(0.458)	0.015	0.211	(0.408)	0.199	(0.400)	0.012
High Household income ($40,000 - $70,000)	0.119	(0.324)	0.128	(0.334)	-0.009	0.253	(0.434)	0.260	(0.439)	-0.007
Very high household income (>$70,000)	0.063	(0.243)	0.064	(0.245)	-0.001	0.303	(0.460)	0.317	(0.465)	-0.014
Concession card	0.532	(0.499)	0.554	(0.497)	-0.022	0.287	(0.452)	0.253	(0.435)	0.034
Private health insurance										
No private insurance	0.470	(0.499)	0.503	(0.500)	-0.033	0.400	(0.490)	0.415	(0.493)	-0.015
Private health insurance – without extras	0.162	(0.369)	0.135	(0.341)	0.027	0.113	(0.316)	0.101	(0.302)	0.012
Private health insurance – with extras	0.368	(0.482)	0.362	(0.481)	0.006	0.487	(0.500)	0.484	(0.500)	0.003
Employed	0.112	(0.316)	0.126	(0.332)	-0.014	0.561	(0.496)	0.598	(0.490)	-0.037
BMI	28.950	(5.116)	28.863	(4.997)	0.087	31.398	(5.916)	31.182	(5.983)	0.216

Table 5: Estimated effects of SIP availability – diabetics aged 65 or above

Sample: diabetics aged 65 or above	Sample mean	DID (deciles)		DID with area FE (deciles)		DID with area FE (quintiles)		Simple OLS	
Outcome variable	(1)	(2)		(3)		(4)		(5)	
SIP cycle completion	0.250	0.322***	(0.029)	0.297***	(0.036)	0.219***	(0.030)	0.317***	(0.027)
Num GP visits	9.733	-0.901	(0.763)	-0.807	(0.752)	-1.066*	(0.600)	-1.200**	(0.560)
Cost GP visits	402.036	-57.469	(35.519)	-54.924	(32.949)	-63.952**	(25.389)	-57.107*	(31.518)
Num HbA1c blood tests	0.970	0.217	(0.165)	0.166	(0.165)	0.261**	(0.107)	0.402***	(0.106)
Any specialist visit	0.760	-0.018	(0.039)	-0.020	(0.041)	-0.028	(0.032)	-0.054*	(0.030)
Cost specialist visits	275.960	-126.790***	(38.711)	-109.141***	(34.740)	-43.027*	(24.839)	-99.171***	(25.089)
Any specialist visit: DM	0.635	-0.072	(0.046)	-0.074	(0.048)	-0.042	(0.039)	-0.027	(0.029)
Cost specialist visits: DM	166.635	-78.138***	(27.774)	-67.505**	(27.213)	-32.878*	(18.995)	-53.676***	(15.722)
Any specialist visit: other	0.439	-0.060	(0.044)	-0.052	(0.048)	-0.059*	(0.033)	-0.101**	(0.039)
Cost specialist visits: other	109.325	-48.651**	(20.471)	-41.637**	(19.683)	-10.149	(12.734)	-45.494***	(15.595)
Cost DM medications	263.511	-169.985**	(74.009)	-206.686***	(68.252)	-100.788**	(46.180)	-44.413	(31.044)
Cost DM medications: insulin	99.834	-51.732	(47.532)	-80.015	(48.936)	-35.377	(31.318)	11.668	(18.812)
Cost DM medications: antidiabetics	163.677	-118.253**	(47.077)	-126.671**	(50.662)	-65.411**	(32.448)	-56.080**	(25.785)
Any ED visit	0.183	-0.027	(0.032)	-0.049	(0.032)	-0.051*	(0.030)	-0.054**	(0.022)
Any ED visit: high-urgency	0.112	0.006	(0.029)	-0.001	(0.030)	-0.045*	(0.025)	-0.018	(0.019)
Any ED visit: low-urgency	0.100	-0.072***	(0.021)	-0.087***	(0.025)	-0.026	(0.025)	-0.056***	(0.019)
Any DM hospital admission	0.115	-0.084***	(0.023)	-0.074***	(0.025)	-0.034	(0.021)	-0.051**	(0.021)
N postcodes: top/bottom quantiles		22/29		22/29		37/51		22/29	
N postcode*year: top/bottom quantiles		45/49		45/49		87/104		45/49	
N individuals	15,569	2,133		2,133		4,691		1,359	

Notes: The mean values are calculated over all deciles of the SIP penetration.
Standard errors robust to heteroscedasticity and postal area clusters are in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 6: Estimated effects of SIP availability – diabetics aged 63 or below

Sample: diabetics aged 63 or below	Sample mean	DID (deciles)		DID with area FE (deciles)		DID with area FE (quintiles)		Simple OLS	
Outcome variable	(1)	(2)		(3)		(4)		(5)	
SIP cycle completion	0.198	0.278***	(0.039)	0.265***	(0.039)	0.210***	(0.029)	0.282***	(0.030)
Num GP visits	7.197	0.559	(0.441)	0.503	(0.444)	0.122	(0.441)	-0.468	(0.381)
Cost GP visits	320.900	15.099	(23.735)	15.617	(25.193)	4.858	(21.193)	-0.090	(16.549)
Num HbA1c blood tests	0.881	0.140	(0.108)	0.101	(0.115)	0.100	(0.101)	0.297***	(0.080)
Any specialist visit	0.584	0.137***	(0.047)	0.121**	(0.048)	0.039	(0.039)	0.057	(0.043)
Cost specialist visits	215.205	-51.613	(116.103)	-35.603	(104.682)	3.361	(55.798)	9.192	(31.634)
Any specialist visit: DM	0.437	0.172***	(0.052)	0.153***	(0.050)	0.074*	(0.039)	0.036	(0.046)
Cost specialist visits: DM	116.777	58.887**	(28.203)	53.903*	(28.982)	38.158*	(20.590)	-4.169	(21.638)
Any specialist visit: other	0.327	0.034	(0.058)	0.023	(0.062)	0.010	(0.043)	0.038	(0.035)
Cost specialist visits: other	98.428	-110.501	(121.576)	-89.505	(110.420)	-34.797	(56.767)	13.361	(17.642)
Cost DM medications	318.245	84.612*	(47.701)	67.361	(52.112)	29.965	(44.666)	46.556	(32.465)
Cost DM medications: insulin	161.917	46.702	(30.750)	39.381	(36.109)	13.840	(36.802)	16.670	(26.955)
Cost DM medications: antidiabetics	156.328	37.910	(42.321)	27.980	(45.298)	16.126	(30.225)	29.886	(20.422)
Any ED visit	0.148	-0.025	(0.039)	-0.051	(0.043)	-0.025	(0.028)	-0.050**	(0.019)
Any ED visit: high-urgency	0.081	-0.006	(0.027)	-0.012	(0.031)	0.006	(0.018)	-0.020	(0.018)
Any ED visit: low-urgency	0.088	-0.004	(0.031)	-0.028	(0.034)	-0.019	(0.026)	-0.030	(0.019)
Any DM hospital admission	0.051	-0.004	(0.021)	-0.008	(0.023)	0.007	(0.015)	-0.016	(0.011)
N postcodes: top/bottom quantiles		22/27		22/27		36/50		22/27	
N postcode*year: top/bottom quantiles		42/47		42/47		88/101		42/47	
N individuals	12,262	1,547		1,547		3,562		895	

Notes: The mean values are calculated over all deciles of the SIP penetration.
Standard errors robust to heteroscedasticity and postal area clusters are in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 7: Estimated effects of SIP availability by education

	Sample: diabetics aged 65 or above						Sample: diabetics aged 63 or below					
	High education			Low education			High education			Low education		
Outcome variable	Sample mean	DID with area FE		Sample mean	DID with area FE		Sample mean	DID with area FE		Sample mean	DID with area FE	
SIP cycle completion	0.244	0.329***	(0.049)	0.239	0.235***	(0.061)	0.186	0.255***	(0.044)	0.198	0.350***	(0.085)
Num GP visits	9.298	-0.729	(0.798)	10.219	-1.310	(1.377)	6.709	0.673	(0.589)	8.207	0.177	(1.309)
Cost GP visits	387.049	-54.615*	(32.066)	418.447	-76.208	(57.810)	304.794	23.085	(35.598)	352.734	-21.429	(45.538)
Num HbA1c blood tests	0.978	0.404**	(0.199)	0.957	-0.174	(0.210)	0.841	-0.006	(0.151)	0.947	0.386	(0.417)
Any specialist visit	0.774	-0.046	(0.047)	0.747	0.005	(0.098)	0.579	0.154***	(0.051)	0.596	-0.024	(0.132)
Cost specialist visits	287.982	-105.452**	(44.356)	266.477	-113.418*	(61.781)	221.055	-23.999	(132.799)	207.115	-63.430	(50.903)
Any specialist visit: DM	0.649	-0.050	(0.053)	0.621	-0.147	(0.094)	0.431	0.190***	(0.051)	0.455	0.073	(0.193)
Cost specialist visits: DM	174.424	-60.482**	(29.784)	160.144	-65.564	(44.980)	116.289	77.083**	(32.784)	119.796	14.508	(44.397)
Any specialist visit: other	0.449	-0.050	(0.072)	0.432	-0.073	(0.077)	0.322	0.046	(0.076)	0.333	-0.171	(0.133)
Cost specialist visits: other	113.559	-44.970	(27.863)	106.333	-47.854	(30.507)	104.766	-101.082	(127.980)	87.319	-77.938	(55.416)
Cost DM medications	256.680	-245.484**	(115.721)	276.467	-129.865	(110.784)	287.602	23.718	(71.462)	379.700	328.288	(207.110)
Cost DM medications: insulin	92.467	-151.570*	(77.004)	108.610	53.940	(53.890)	141.633	2.615	(45.339)	198.811	311.114***	(111.231)
Cost DM medications: antidiabetics	164.213	-93.914	(80.004)	167.857	-183.805**	(83.393)	145.969	21.103	(50.166)	180.889	17.174	(140.801)
Any ED visit	0.166	-0.038	(0.037)	0.202	-0.057	(0.070)	0.133	-0.020	(0.048)	0.178	-0.044	(0.096)
Any ED visit: high-urgency	0.104	0.001	(0.028)	0.121	-0.029	(0.062)	0.073	0.041	(0.029)	0.098	-0.051	(0.125)
Any ED visit: low-urgency	0.087	-0.095***	(0.032)	0.114	-0.064	(0.048)	0.078	-0.044	(0.034)	0.109	-0.014	(0.053)
Any DM hospital admission	0.115	-0.074**	(0.037)	0.115	-0.101*	(0.053)	0.048	0.030	(0.020)	0.055	-0.082	(0.065)
N postcode*year: top/bottom deciles		43/44			30/38			40/43			22/26	
N individuals	7,959	1,156		6,692	734		7,337	1,045		3,992	353	

Notes: The difference-in-difference regressions are based on the SIP penetration deciles. High education is defined as having completed higher school, trade/apprenticeship, certificate/diploma, or university degree or higher, and low education is defined as having school or intermediate certificate or having no school certificate. The mean values are calculated over all deciles of the SIP penetration.
Standard errors robust to heteroscedasticity and postal area clusters are in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 8: Estimated effects of SIP availability by years of diabetes

	Sample: diabetics aged 65 or above						Sample: diabetics aged 63 or below					
	Developed diabetes for 5 years or less			Developed diabetes for more than 5 years			Developed diabetes for 5 years or less			Developed diabetes for more than 5 years		
Outcome variable	Sample mean	DID with area FE		Sample mean	DID with area FE		Sample mean	DID with area FE		Sample mean	DID with area FE	
SIP cycle completion	0.257	0.343***	(0.087)	0.278	0.306***	(0.048)	0.209	0.241***	(0.080)	0.200	0.323***	(0.063)
Num GP visits	8.562	0.074	(1.604)	10.118	-0.162	(1.156)	6.682	-0.050	(1.078)	7.567	0.489	(1.084)
Cost: GP visits	353.112	56.038	(73.591)	417.291	-44.641	(53.508)	300.072	-12.117	(55.246)	335.337	35.538	(56.345)
Num HbA1c blood tests	0.948	-0.080	(0.351)	1.131	0.248	(0.266)	0.872	-0.082	(0.253)	0.998	0.162	(0.174)
Any specialist visit	0.741	0.061	(0.131)	0.786	0.003	(0.054)	0.524	0.049	(0.118)	0.633	0.014	(0.072)
Cost specialist visits	240.888	-103.694	(85.039)	296.131	-122.956**	(50.332)	175.565	-481.964	(413.756)	240.739	130.596*	(66.032)
Any specialist visit: DM	0.592	-0.007	(0.151)	0.677	-0.081	(0.063)	0.370	0.035	(0.107)	0.501	0.103	(0.082)
Cost specialist visits: DM	140.667	-28.188	(48.922)	185.891	-84.890**	(38.375)	87.790	-54.642	(35.058)	144.479	68.325*	(39.477)
Any specialist visit: other	0.411	-0.113	(0.145)	0.440	-0.098	(0.069)	0.297	-0.058	(0.118)	0.331	0.017	(0.081)
Cost specialist visits: other	100.221	-75.507	(62.452)	110.239	-38.066	(29.240)	87.775	-427.322	(429.392)	96.261	62.271	(54.831)
Cost DM medications	98.963	-17.133	(72.870)	401.597	-236.889*	(127.929)	145.013	91.535	(83.784)	523.937	89.783	(105.092)
Cost DM medications: insulin	16.065	28.379	(41.113)	162.462	-70.235	(78.819)	42.916	31.487	(18.690)	289.342	78.568	(110.002)
Cost DM medications: antidiabetics	82.898	-45.512	(56.240)	239.135	-166.654*	(98.414)	102.096	60.048	(81.778)	234.595	11.215	(96.990)
Any ED visit	0.158	0.117	(0.079)	0.188	-0.109**	(0.045)	0.121	-0.058	(0.077)	0.164	-0.090	(0.067)
Any ED visit: high-urgency	0.087	0.098	(0.068)	0.115	-0.053	(0.041)	0.060	-0.041	(0.061)	0.093	-0.004	(0.054)
Any ED visit: low-urgency	0.087	0.012	(0.070)	0.105	-0.120***	(0.043)	0.075	0.010	(0.050)	0.098	-0.067	(0.048)
Any DM hospital admission	0.090	-0.075	(0.065)	0.122	-0.094**	(0.042)	0.035	-0.057	(0.044)	0.059	0.042	(0.043)
N postcode*year: top/bottom deciles		30/29			40/37			35/29			31/39	
N individuals	2,177	302		7,651	1,038		3,123	413		5,162	622	

Notes: The difference-in-difference regressions are based on the SIP penetration deciles. The mean values are calculated over all deciles of the SIP penetration.
Standard errors robust to heteroscedasticity and postal area clusters are in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 9: Estimated effects of SIP availability by SIP completion status

	Sample: diabetics aged 65 or above						Sample: diabetics aged 63 or below					
	SIP cycle completed in year t+1			SIP cycle uncompleted in year t+1			SIP cycle completed in year t+1			SIP cycle uncompleted in year t+1		
Outcome variable	Sample mean	DID with area FE		Sample mean	DID with area FE		Sample mean	DID with area FE		Sample mean	DID with area FE	
Num GP visits	10.150	-2.045**	(1.002)	9.556	-0.662	(0.845)	7.815	0.013	(0.983)	7.027	0.370	(0.577)
Cost GP visits	418.089	-105.980**	(47.670)	392.421	-56.145	(37.755)	342.905	-1.653	(40.686)	311.450	6.874	(30.426)
Num HbA1c blood tests	1.072	0.143	(0.266)	0.838	-0.001	(0.105)	0.992	0.174	(0.258)	0.769	-0.123	(0.103)
Any specialist visit	0.775	-0.033	(0.060)	0.757	-0.025	(0.049)	0.599	0.019	(0.079)	0.580	0.142***	(0.053)
Cost specialist visits	282.209	-131.442***	(44.402)	283.253	-90.035**	(38.996)	221.206	-180.979	(137.019)	219.185	30.111	(106.869)
Any specialist visit: DM	0.653	-0.066	(0.063)	0.631	-0.102*	(0.057)	0.461	0.053	(0.072)	0.428	0.161***	(0.054)
Cost specialist visits: DM	171.708	-74.045**	(31.049)	170.492	-64.661**	(30.931)	124.457	-15.747	(34.006)	116.622	67.001**	(27.526)
Any specialist visit: other	0.443	-0.190***	(0.061)	0.447	0.025	(0.053)	0.322	-0.036	(0.080)	0.333	0.069	(0.059)
Cost specialist visits: other	110.501	-57.397**	(27.388)	112.762	-25.375	(21.722)	96.748	-165.233	(143.709)	102.563	-36.891	(110.171)
Cost DM medications	287.549	-276.485***	(83.307)	246.514	-212.373***	(68.913)	356.755	70.257	(104.151)	296.966	28.723	(59.121)
Cost DM medications: insulin	109.465	-52.162	(52.255)	93.912	-87.219	(54.156)	182.950	25.935	(80.000)	151.171	16.495	(42.413)
Cost DM medications: antidiabetics	178.084	-224.322***	(66.217)	152.602	-125.154**	(52.606)	173.805	44.323	(78.594)	145.796	12.228	(39.674)
Any ED visit	0.180	-0.056	(0.049)	0.188	-0.028	(0.037)	0.154	-0.052	(0.080)	0.150	-0.057	(0.042)
Any ED visit: high-urgency	0.111	-0.031	(0.039)	0.117	0.026	(0.033)	0.083	-0.023	(0.041)	0.083	-0.007	(0.033)
Any ED visit: low-urgency	0.098	-0.083*	(0.044)	0.101	-0.083***	(0.028)	0.091	-0.004	(0.055)	0.088	-0.039	(0.035)
Any DM hospital admission	0.116	-0.081**	(0.038)	0.116	-0.077***	(0.028)	0.053	-0.068	(0.045)	0.050	0.009	(0.026)
N postcode*year: top/bottom deciles		45/49			45/49			42/47			42/47	
N individuals	8,562	1,317		11,702	1,590		6,347	942		9,864	1,257	

Notes: The difference-in-difference regressions are based on the SIP penetration deciles. The mean values are calculated over all deciles of the SIP penetration.
Standard errors robust to heteroscedasticity and postal area clusters are in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Appendices: For Online Publication

A The minimum requirements of the SIP cycle of care

The Service Incentive Payment (SIP) for diabetes was introduced in 2001 to "encourage GPs to provide earlier diagnosis and effective management of people with established diabetes mellitus". A diabetes SIP can be claimed by GPs for each cycle of care completed for patients with established diabetes mellitus. The minimum requirement of the annual diabetes cycle of care must be completed over a period of 11-13 months (see Table A.1 for the details).

Table A.1: Minimum requirements of the diabetes SIP cycle of care

Activity	Frequency and description
Assess diabetes control by measuring HbA1c	At least once
Carry out a comprehensive eye examination	The patient must have had at least one comprehensive eye examination over the current and previous cycle of care. The examination is not needed if the patient is blind or doesn't have both eyes
Measure weight and height and calculate Body Mass Index (BMI)	Measure height and weight and calculate the BMI on the patient's first visit and weigh them at least twice more
Measure blood pressure	At least twice
Examine feet	At least twice. This is not needed if the patient does not have both feet
Measure total cholesterol, triglycerides and HDL cholesterol	At least once
Test for microalbuminuria	At least once
Measurement of the patient's estimated Glomerular Filtration Rate (eGFR)	At least once
Provide self-care education	Provide patient education about diabetes management
Review diet	Review the patient's diet and give them information on appropriate dietary choices
Review levels of physical activity	Review the patient's physical activity and give them information on appropriate levels of physical activity
Check smoking status	Encourage the patient to stop smoking
Review medication	Review patient's medicine

Note: Adapted from (Department of Human Services (2013)), Practice Incentives Program Diabetes Incentive Guidelines, October 2013.

B Appendix Tables

Table B.2: Descriptive statistics for outcome variables based on SIP penetration quintiles

Sample: diabetics aged 65 or above	Top quintile of SIP penetration					Bottom quintile of SIP penetration					Difference1 - Difference2
	Treatment group (*N*: 1,787)		Control group (*N*: 573)		Difference1	Treatment group (*N*: 1,308)		Control group (*N*: 1,023)		Difference2	
Variable name	Mean	SD	Mean	SD		Mean	SD	Mean	SD		
SIP cycle completion	0.498	(0.500)	0.012	(0.110)	0.486	0.237	(0.425)	0.007	(0.082)	0.230	0.256
Num GP visits	9.314	(6.359)	9.422	(7.001)	-0.108	9.592	(6.970)	9.669	(6.319)	-0.077	-0.031
Cost GP visits	387.316	(261.607)	407.055	(315.252)	-19.739	411.93	(310.100)	396.700	(272.140)	15.230	-34.969
Num HbA1c blood tests	1.202	(1.126)	0.867	(1.041)	0.335	0.844	(1.043)	0.804	(1.043)	0.040	0.295
Any specialist visit	0.757	(0.429)	0.759	(0.428)	-0.002	0.758	(0.429)	0.799	(0.401)	-0.041	0.039
Cost specialist visits	258.831	(288.061)	305.227	(329.418)	-46.396	274.780	(297.092)	313.372	(331.970)	-38.592	-7.804
Any specialist visit: DM	0.636	(0.481)	0.647	(0.478)	-0.011	0.613	(0.487)	0.670	(0.471)	-0.057	0.046
Cost specialist visits: DM	152.575	(199.826)	190.199	(231.109)	-37.624	156.359	(198.295)	182.254	(218.146)	-25.895	-11.729
Any specialist visit: other	0.410	(0.492)	0.450	(0.498)	-0.040	0.472	(0.499)	0.483	(0.500)	-0.011	-0.029
Cost specialist visits: other	106.256	(186.599)	115.029	(189.025)	-8.773	118.421	(194.141)	131.118	(211.330)	-12.697	3.924
Cost DM medications	230.587	(440.485)	294.010	(482.180)	-63.423	249.009	(477.155)	254.369	(456.690)	-5.360	-58.063
Cost DM medications: insulin	78.447	(305.173)	112.202	(349.709)	-33.755	78.301	(312.064)	100.501	(344.957)	-22.200	-11.555
Cost DM medications: antidiabetics	152.141	(309.421)	181.808	(337.980)	-29.667	170.708	(328.060)	153.867	(283.967)	16.841	-46.508
Any ED visit	0.143	(0.350)	0.168	(0.374)	-0.025	0.179	(0.383)	0.181	(0.385)	-0.002	-0.023
Any ED visit: high-urgency	0.083	(0.277)	0.115	(0.320)	-0.032	0.099	(0.299)	0.119	(0.324)	-0.020	-0.012
Any ED visit: low-urgency	0.078	(0.269)	0.091	(0.288)	-0.013	0.109	(0.311)	0.095	(0.293)	0.014	-0.027
Any DM-related hospital admission	0.107	(0.309)	0.131	(0.338)	-0.024	0.106	(0.307)	0.109	(0.311)	-0.003	-0.021

Sample: diabetics aged 63 or below	Top quintile of SIP penetration					Bottom quintile of SIP penetration					Difference1 - Difference2
	Treatment group (*N*: 1,158)		Control group (*N*: 452)		Difference1	Treatment group (*N*: 1,120)		Control group (*N*: 832)		Difference2	
Variable name	Mean	SD	Mean	SD		Mean	SD	Mean	SD		
SIP cycle completion	0.419	(0.494)	0.013	(0.115)	0.406	0.204	(0.403)	0.008	(0.091)	0.196	0.210
Num GP visits	6.440	(5.122)	6.796	(5.656)	-0.356	6.722	(5.374)	7.474	(6.061)	-0.752	0.396
Cost GP visits	306.706	(220.906)	313.460	(247.116)	-6.754	307.403	(233.277)	327.744	(265.776)	-20.341	13.587
Num HbA1c blood tests	1.054	(1.080)	0.867	(0.974)	0.187	0.809	(1.031)	0.737	(0.983)	0.072	0.115
Any specialist visit	0.578	(0.494)	0.571	(0.496)	0.007	0.563	(0.496)	0.619	(0.486)	-0.056	0.063
Cost specialist visits	194.974	(284.260)	253.787	(1255.233)	-58.813	189.374	(298.960)	238.419	(329.644)	-49.045	-9.768
Any specialist visit: DM	0.422	(0.494)	0.381	(0.486)	0.041	0.408	(0.492)	0.469	(0.499)	-0.061	0.102
Cost specialist visits: DM	109.296	(185.456)	98.648	(177.092)	10.648	109.141	(194.891)	142.864	(237.114)	-33.723	44.371

Any specialist visit: other	0.307	(0.462)	0.330	(0.471)	-0.023	0.302	(0.459)	0.337	(0.473)	-0.035	0.012
Cost specialist visits: other	85.678	(198.283)	155.140	(1244.385)	-69.462	80.233	(202.759)	95.555	(198.422)	-15.322	-54.140
Cost DM medications	277.072	(557.026)	285.397	(560.975)	-8.325	314.986	(623.431)	326.246	(659.574)	-11.260	2.935
Cost DM medications: insulin	122.714	(402.086)	129.068	(402.880)	-6.354	152.483	(481.700)	142.877	(524.353)	9.606	-15.960
Cost DM medications: antidiabetics	154.358	(348.007)	156.329	(338.806)	-1.971	162.503	(352.721)	183.369	(385.763)	-20.866	18.895
Any ED visit	0.100	(0.300)	0.124	(0.330)	-0.024	0.153	(0.360)	0.154	(0.361)	-0.001	-0.023
Any ED visit: high-urgency	0.053	(0.223)	0.069	(0.253)	-0.016	0.079	(0.271)	0.093	(0.290)	-0.014	-0.002
Any ED visit: low-urgency	0.060	(0.238)	0.064	(0.245)	-0.004	0.089	(0.285)	0.084	(0.278)	0.005	-0.009
Any DM-related hospital admission	0.044	(0.205)	0.049	(0.215)	-0.005	0.050	(0.218)	0.060	(0.238)	-0.010	0.005

Notes: This table shows the mean and standard deviation of the outcome variables used in this study for the treatment group and control group, in the top- and bottom- quintiles, separately. The top panel is for the group aged 65 or above and the bottom panel is for the group aged 63 or below. These statistics are based on the sample used in the DID regressions based on SIP penetration quintiles. For the differences in the means of outcome variables between the treatment and control groups, the former group seems to have fewer specialist visits and less consumption of medications compared to the latter group, among diabetics aged 65 or above. This applies to the sample in both top- and bottom-quintiles, but the differences in the bottom-quintiles are much smaller in magnitude. For young diabetics, individuals in the treatment group are shown to have fewer specialist consultations than the control group. Other outcome variables, such as presentations to EDs and hospital admissions, do not differ significantly between treatment and control groups. Numbers in parentheses are standard deviations.

Table B.3: Results of reduced-form regression – diabetics aged 65 or above and diabetics aged 63 or below (use quintiles of SIP penetration)

Use quintiles of SIP penetration	Sample: diabetics aged 65 or above						Sample: diabetics aged 63 or below					
Variables	Simple OLS		DID		DID with area FE		Simple OLS		DID		DID with area FE	
SIP cycle completion	0.260***	(0.025)	0.253***	(0.025)	0.219***	(0.030)	0.223***	(0.022)	0.212***	(0.026)	0.210***	(0.029)
GP visits	-1.040***	(0.362)	-1.130*	(0.646)	-1.066*	(0.600)	-0.237	(0.346)	0.418	(0.525)	0.122	(0.441)
Cost: GP visits	-48.926***	(18.251)	-71.832**	(27.559)	-63.952**	(25.389)	3.664	(15.147)	16.916	(22.993)	4.858	(21.193)
HbA1c tests performed	0.427***	(0.094)	0.317***	(0.113)	0.261**	(0.107)	0.275***	(0.076)	0.132	(0.090)	0.100	(0.101)
Any specialist visit	-0.033	(0.023)	-0.012	(0.033)	-0.028	(0.032)	0.010	(0.030)	0.062	(0.038)	0.039	(0.039)
Cost: specialist visits	-40.772**	(18.086)	-49.070*	(24.899)	-43.027*	(24.839)	-6.238	(19.366)	-25.575	(67.056)	3.361	(55.798)
Any diabetes-related specialist visit	-0.002	(0.026)	-0.020	(0.038)	-0.042	(0.039)	0.013	(0.033)	0.102**	(0.039)	0.074*	(0.039)
Cost: diabetes-related specialist visits	-15.940	(11.276)	-37.411**	(18.122)	-32.878*	(18.995)	-4.903	(14.977)	39.653**	(19.165)	38.158*	(20.590)
Any other specialist visit	-0.094***	(0.029)	-0.063*	(0.033)	-0.059*	(0.033)	-0.001	(0.023)	0.004	(0.039)	0.010	(0.043)
Cost: other specialist visits	-24.831**	(11.111)	-11.660	(13.204)	-10.149	(12.734)	-1.335	(9.882)	-65.228	(69.519)	-34.797	(56.767)
Any ED visit	-0.061***	(0.018)	-0.045	(0.029)	-0.051*	(0.030)	-0.047***	(0.016)	-0.003	(0.026)	-0.025	(0.028)
Any high-urgency ED visit	-0.034**	(0.014)	-0.033	(0.023)	-0.045*	(0.025)	-0.022**	(0.011)	0.010	(0.016)	0.006	(0.018)
Any low-urgency ED visit	-0.045***	(0.013)	-0.033	(0.023)	-0.026	(0.025)	-0.029**	(0.013)	0.001	(0.023)	-0.019	(0.026)
Any diabetes-related hospital admission	-0.009	(0.012)	-0.033*	(0.019)	-0.034	(0.021)	-0.005	(0.008)	0.007	(0.015)	0.007	(0.015)
Any diabetic PPH	0.001	(0.007)	-0.011	(0.010)	-0.022**	(0.011)	-0.001	(0.005)	0.007	(0.007)	0.009	(0.007)
Any other hospital admission	-0.006	(0.012)	-0.031	(0.019)	-0.029	(0.021)	-0.010	(0.008)	-0.003	(0.014)	-0.003	(0.013)
Any insulin use	0.002	(0.015)	-0.010	(0.028)	-0.025	(0.028)	-0.017	(0.016)	-0.014	(0.032)	-0.005	(0.032)
Cost: diabetes-related medications	-17.286	(22.020)	-79.114	(48.218)	-100.788**	(46.180)	-34.848	(31.224)	22.346	(46.257)	29.965	(44.666)
Cost: insulin use	0.686	(14.735)	-14.306	(30.049)	-35.377	(31.318)	-27.639	(20.699)	-4.526	(37.144)	13.840	(36.802)
Cost: other antidiabetics	-17.972	(14.911)	-64.808**	(31.020)	-65.411**	(32.448)	-7.210	(18.839)	26.872	(31.363)	16.126	(30.225)
Number of postcodes (top quintile)	37		37		37		36		36		36	
Number of postcodes (bottom quintile)	51		51		51		50		50		50	
Number of postcode/year (top quintile)	87		87		87		88		88		88	
Number of postcode/year (bottom quintile)	104		104		104		101		101		101	
Number of individuals	3,095		4,691		4,691		2,278		3,562		3,562	

Notes: This table shows the results of OLS regression, DID, and DID with area fixed effects using quintiles of SIP penetration. Robust results are found
Standard errors robust to heteroscedasticity and postal area clusters are in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table B.4: Full sets of estimates for reduced-form and DID models - diabetics aged 65 or above

	Simple OLS (use deciles of SIP penetration)							DID with area FE (use deciles of SIP penetration)						
Sample: diabetics aged 65 or above	Cost: GP visits	Cost: specialist visits	Any ED visit	Any diabetes-related hospital admission	Cost: diabetes-related medications	Cost: insulin use	Cost: other antidiabetics	Cost: GP visits	Cost: specialist visits	Any ED visit	Any diabetes-related hospital admission	Cost: diabetes-related medications	Cost: insulin use	Cost: other antidiabetics
Male	-4.222	6.295	0.017	-0.003	46.461*	-23.632	70.094***	-7.145	12.789	0.014	0.014	80.448*	14.404	66.044***
	(19.141)	(20.991)	(0.021)	(0.013)	(26.839)	(19.715)	(20.618)	(13.260)	(18.597)	(0.015)	(0.013)	(41.335)	(26.384)	(22.256)
Age	4.725*	1.143	0.001	0.003*	-8.350***	-4.663***	-3.687	4.739**	0.414	0.001	0.004***	-5.456***	-4.123***	-1.333
	(2.644)	(2.199)	(0.002)	(0.002)	(2.782)	(1.378)	(2.296)	(1.777)	(1.478)	(0.001)	(0.001)	(1.852)	(1.537)	(1.469)
Australia born	-35.907**	-16.149	-0.028	-0.001	-35.956	-6.362	-29.595	-27.448	10.057	-0.036	0.013	-14.419	9.587	-24.006
	(17.850)	(13.715)	(0.028)	(0.020)	(30.646)	(24.144)	(21.077)	(20.834)	(17.217)	(0.022)	(0.016)	(29.698)	(18.923)	(22.098)
SEIFA-IRSD (base is 0-25th percentile)														
25-50th percentile	-13.354	40.290*	0.064*	0.050**	-17.144	-65.044**	47.900**	-65.016	-37.493	0.023	0.020	-95.504	-90.336	-5.168
	(39.836)	(22.092)	(0.035)	(0.022)	(32.719)	(27.151)	(20.749)	(44.734)	(44.459)	(0.032)	(0.022)	(68.642)	(58.946)	(43.164)
50-75th percentile	4.960	48.571*	0.069	0.050	-27.162	-44.052	16.890	-57.620	-12.145	0.005	0.027	-95.007	-40.016	-54.991
	(39.491)	(25.786)	(0.043)	(0.032)	(40.834)	(27.684)	(28.937)	(37.926)	(49.350)	(0.054)	(0.026)	(103.343)	(78.916)	(39.830)
75-100th percentile	6.408	44.187	0.062	0.025	11.562	-5.716	17.278	-44.730	-43.298	0.005	-0.049	-155.246	-88.244	-67.002
	(46.375)	(34.186)	(0.044)	(0.024)	(65.293)	(39.722)	(38.348)	(46.818)	(73.183)	(0.058)	(0.032)	(134.443)	(93.553)	(56.128)
Remoteness (base is outer regional or remote areas)														
Major city	84.150**	117.007***	0.050	0.020	18.032	-12.652	30.684	-51.241	-10.566	0.013	0.012	-58.659	14.638	-73.298
	(32.374)	(28.598)	(0.034)	(0.023)	(56.971)	(27.587)	(43.716)	(49.319)	(35.127)	(0.055)	(0.038)	(79.769)	(48.789)	(57.256)
Inner regional	44.935	58.090**	0.050	-0.002	19.599	3.833	15.766	-95.633***	-70.311*	0.024	-0.012	-12.118	36.848	-48.966
	(37.979)	(26.369)	(0.040)	(0.031)	(49.778)	(23.227)	(39.998)	(32.717)	(36.128)	(0.044)	(0.040)	(57.180)	(54.240)	(40.981)
Self-reported health status (base is poor)														
Fair	-88.855	10.520	-0.075	-0.055	-181.375	-164.493	-16.881	-65.384	-23.458	-0.131**	-0.087	-29.090	-63.986	34.896
	(64.882)	(61.490)	(0.051)	(0.063)	(165.965)	(107.736)	(90.417)	(44.815)	(64.281)	(0.056)	(0.063)	(142.916)	(82.528)	(80.245)
Good	-140.995**	-74.878	-0.154***	-0.091	-364.468**	-250.877**	-113.591	-124.790**	-114.637*	-0.191***	-0.121*	-170.254	-140.279*	-29.975
	(67.213)	(60.958)	(0.052)	(0.056)	(154.482)	(101.547)	(79.894)	(47.524)	(61.946)	(0.052)	(0.062)	(135.243)	(76.269)	(75.535)
Very good	-197.212***	-112.508*	-0.215***	-0.115**	-412.942**	-283.247**	-129.695	-173.772***	-163.750**	-0.251***	-0.146**	-216.046	-169.879**	-46.167
	(68.474)	(63.836)	(0.049)	(0.057)	(162.672)	(110.110)	(81.330)	(44.834)	(64.307)	(0.054)	(0.062)	(138.069)	(82.722)	(74.580)
Excellent	-250.665***	-236.742***	-0.259***	-0.155**	-478.444***	-297.478**	-180.966**	-241.630***	-226.553***	-0.276***	-0.177***	-237.207	-147.059	-90.148
	(73.798)	(77.866)	(0.075)	(0.068)	(174.865)	(114.038)	(89.387)	(54.026)	(65.998)	(0.068)	(0.066)	(158.305)	(96.303)	(83.786)
Marital status (base is single)														

Widowed	-11.356	25.811	-0.006	-0.059	41.672	8.746	32.926	13.947	-8.817	-0.004	-0.027	-0.297	41.357	-41.654
	(41.537)	(34.785)	(0.044)	(0.046)	(48.102)	(27.576)	(37.040)	(28.882)	(32.804)	(0.038)	(0.035)	(62.696)	(44.508)	(50.071)
Married or de facto	5.381	100.073***	0.001	0.003	79.335	48.550*	30.785	25.644	44.213	-0.024	-0.001	18.984	33.810	-14.826
	(34.730)	(29.232)	(0.041)	(0.039)	(59.504)	(27.074)	(52.820)	(24.813)	(28.019)	(0.036)	(0.029)	(54.179)	(30.834)	(55.905)
Divorced or separated	-54.304	7.208	0.031	0.023	209.090**	73.519*	135.571	7.350	-17.381	0.008	0.012	95.751	73.551	22.200
	(60.183)	(44.791)	(0.059)	(0.048)	(94.432)	(41.859)	(84.107)	(36.406)	(38.214)	(0.051)	(0.036)	(76.660)	(56.293)	(67.200)
# chronic conditions (base is no chronic conditions)														
1 chronic condition	56.278**	26.346	0.066**	-0.014	36.638	34.560**	2.078	38.343**	13.279	0.060**	-0.005	-2.978	-8.875	5.897
	(24.738)	(28.938)	(0.031)	(0.026)	(38.321)	(16.696)	(33.048)	(18.870)	(26.898)	(0.025)	(0.023)	(47.781)	(30.560)	(29.970)
2 chronic conditions	67.795***	35.259	0.045	0.007	-32.307	4.997	-37.304	44.345**	28.233	0.071**	-0.005	-46.663	-42.131	-4.532
	(23.292)	(31.892)	(0.038)	(0.033)	(38.080)	(18.105)	(37.852)	(21.870)	(25.334)	(0.032)	(0.029)	(32.815)	(38.071)	(32.920)
3 or more chronic conditions	106.151***	68.158***	0.059	0.018	-65.526*	3.510	-69.036**	102.088***	37.353*	0.094***	0.027	-65.870*	-28.013	-37.857
	(25.232)	(23.650)	(0.040)	(0.036)	(38.486)	(22.172)	(32.186)	(21.797)	(19.946)	(0.031)	(0.033)	(37.523)	(30.082)	(28.618)
Educational attainment (base is no education)														
Intermediate certificate/higher school	21.613	-21.825	-0.027	0.004	33.308	-2.236	35.544*	8.376	-25.160	-0.037	0.003	41.289	16.440	24.849
	(26.284)	(26.886)	(0.022)	(0.024)	(28.377)	(19.229)	(20.905)	(22.345)	(19.643)	(0.023)	(0.020)	(29.026)	(27.941)	(25.273)
Diploma/certificate/trade	-0.200	-12.110	-0.015	-0.016	64.181	54.993**	9.189	2.105	-11.385	-0.007	0.009	46.938	57.670*	-10.732
	(19.926)	(26.907)	(0.024)	(0.020)	(43.864)	(25.047)	(29.394)	(23.338)	(18.762)	(0.024)	(0.019)	(38.761)	(30.423)	(33.174)
University or higher	-68.205	-58.523	-0.083***	0.005	-39.617	-20.841	-18.776	-67.157*	-89.836***	-0.065**	0.026	-18.977	0.394	-19.371
	(41.745)	(35.574)	(0.030)	(0.029)	(34.242)	(20.689)	(29.882)	(35.976)	(27.913)	(0.029)	(0.028)	(40.221)	(29.784)	(30.376)
Household income (base is low Household income (<$20,000))														
Middle Household income ($20,000 - $40,000)	-67.329**	-27.955	0.016	-0.038*	3.023	-17.756	20.778	-39.595**	-9.616	0.002	-0.018	-12.610	-20.677	8.066
	(25.717)	(29.817)	(0.024)	(0.022)	(39.735)	(24.364)	(29.528)	(17.570)	(20.527)	(0.021)	(0.022)	(26.902)	(21.622)	(23.627)
High Household income ($40,000 - $70,000)	-35.997	24.570	0.048	0.008	-8.245	19.792	-28.037	-10.230	37.056	0.035	0.010	-34.683	17.873	-52.556
	(40.087)	(30.913)	(0.037)	(0.041)	(53.203)	(35.117)	(39.117)	(27.067)	(30.574)	(0.025)	(0.026)	(50.749)	(42.471)	(31.739)
Very high household income (>$70,000)	-3.384	-11.702	-0.025	-0.049	-17.974	17.227	-35.200	-17.012	1.674	-0.042	-0.084**	-70.689	-9.743	-60.946
	(46.814)	(53.306)	(0.045)	(0.045)	(67.691)	(53.099)	(55.597)	(32.144)	(40.948)	(0.039)	(0.032)	(57.363)	(50.740)	(46.223)

Concession card	3.518	-21.179	-0.002	0.018	50.308*	19.057	31.250	9.719	-0.720	0.005	0.012	30.078	42.847**	-12.769
	(17.509)	(18.842)	(0.022)	(0.023)	(26.796)	(23.277)	(20.037)	(16.315)	(20.337)	(0.017)	(0.015)	(24.225)	(16.975)	(17.080)
Private health insurance (base is no private insurance)														
Without extras	-0.660	38.454	-0.066**	-0.030	37.645	29.943	7.702	7.487	56.014**	-0.080***	-0.031	-0.477	10.356	-10.833
	(33.142)	(30.763)	(0.031)	(0.029)	(50.242)	(26.935)	(36.354)	(26.115)	(26.347)	(0.027)	(0.023)	(34.814)	(22.286)	(26.375)
With extras	32.564	68.543***	-0.047*	-0.011	27.099	16.521	10.578	44.336	90.644***	-0.067***	-0.009	18.996	20.043	-1.047
	(29.654)	(22.070)	(0.027)	(0.027)	(49.176)	(23.634)	(44.461)	(26.921)	(21.618)	(0.024)	(0.023)	(32.633)	(20.377)	(28.368)
Employed	-36.725	-24.525	0.015	0.003	-13.370	-21.662	8.292	-42.999*	-28.778	0.006	0.005	-9.031	-1.478	-7.552
	(29.529)	(35.315)	(0.033)	(0.031)	(35.269)	(19.900)	(28.934)	(23.145)	(26.278)	(0.027)	(0.025)	(41.860)	(34.557)	(21.354)
BMI	1.274	-0.827	-0.002	0.002	7.178***	2.943	4.234**	2.365	0.841	-0.002	0.002	12.611***	5.505***	7.106***
	(2.098)	(1.936)	(0.002)	(0.002)	(2.629)	(1.846)	(1.674)	(1.591)	(1.660)	(0.002)	(0.001)	(2.454)	(1.805)	(1.842)
Year dummies (base is the year 2006)														
Year 2007	-38.162	-37.460	0.004	-0.013	-19.009	-3.537	-15.472	-29.681	-30.368	0.040	-0.008	-28.867*	-6.061	-22.806
	(46.713)	(31.727)	(0.048)	(0.033)	(58.508)	(17.650)	(61.093)	(42.480)	(41.455)	(0.042)	(0.041)	(14.805)	(31.239)	(34.747)
Year 2008	-58.162	-49.314	-0.038	0.008	-13.859	6.943	-20.803	-49.507	-28.041	0.007	0.026	-38.785*	12.901	-51.686
	(41.158)	(32.512)	(0.045)	(0.029)	(61.507)	(20.174)	(69.309)	(33.242)	(31.260)	(0.042)	(0.043)	(19.454)	(30.019)	(44.068)
Year 2009	-78.642*	-21.722	-0.049	-0.001	5.940	31.956	-26.016	-25.544	30.934	0.012	0.029	28.404	22.441	5.963
	(43.822)	(39.080)	(0.036)	(0.028)	(68.131)	(29.138)	(69.719)	(34.708)	(38.644)	(0.037)	(0.039)	(22.827)	(31.839)	(39.820)
Year 2010	-52.067	-44.534	0.020	0.035	1.361	44.856**	-43.495	-32.093	27.434	0.076*	0.064	9.890	12.800	-2.910
	(42.239)	(29.914)	(0.036)	(0.037)	(67.579)	(20.061)	(70.350)	(33.885)	(35.340)	(0.041)	(0.055)	(18.929)	(31.191)	(40.589)
Top decile	-57.107*	-99.171***	-0.054**	-0.051**	-44.413	11.668	-56.080**							
	(31.518)	(25.089)	(0.022)	(0.021)	(31.044)	(18.812)	(25.785)							
Treatment group * top decile								-54.924	-109.141***	-0.049	-0.074***	-206.686***	-80.015	-126.671**
								(32.949)	(34.740)	(0.032)	(0.025)	(68.252)	(48.936)	(50.662)
Treatment group								94.660***	63.903***	0.045**	0.027*	85.790**	11.255	74.534*
								(25.890)	(23.653)	(0.020)	(0.015)	(37.657)	(18.852)	(41.123)
Constant	182.515	181.802	0.241	-0.105	885.655***	520.888***	364.767	340.366*	404.411***	0.384**	-0.183	643.034**	355.454	287.580
	(215.363)	(158.413)	(0.173)	(0.157)	(321.942)	(180.386)	(235.688)	(189.535)	(125.234)	(0.189)	(0.178)	(282.332)	(227.619)	(222.329)
# postcodes (top decile)	22	22	22	22	22	22	22	22	22	22	22	22	22	22
# postcodes (bottom decile)	29	29	29	29	29	29	29	29	29	29	29	29	29	29
# postcode/year (top decile)	45	45	45	45	45	45	45	45	45	45	45	45	45	45
# postcode/year (bottom decile)	49	49	49	49	49	49	49	49	49	49	49	49	49	49
# individuals	1,359	1,359	1,359	1,359	1,359	1,359	1,359	2,133	2,133	2,133	2,133	2,133	2,133	2,133

R-squared	0.1130	0.1144	0.0656	0.0383	0.1156	0.0869	0.0790	0.1695	0.1551	0.1052	0.0644	0.1286	0.0996	0.1028

Notes: This table shows the full sets of estimates for the reduced-form model and DID with area fixed effects model for the old diabetics group. We only present the estimates for outcome variables of most interest here and the results of others are available upon request. The results suggest: Individuals with better self-reported health status tend to use fewer health care services in terms of GP and specialist visits, ED visits, and medication use than those who report poor health. A higher number of chronic conditions is associated with more GP and specialist visits and more presentations to EDs, but it leads to fewer consumption of medications. Diabetics with private health insurances are greater users of specialists care than those without private health insurances; however, the insurance affects the presentations to EDs in the opposite direction.

Standard errors robust to heteroscedasticity and postal area clusters are in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table B.5: Full sets of estimates for reduced-form and DID models - diabetics aged 63 or below

	Simple OLS (use deciles of SIP penetration)							DID with area FE (use deciles of SIP penetration)						
Sample: diabetics aged 63 or below	Cost: GP visits	Cost: specialist visits	Any ED visit	Any diabetes-related hospital admission	Cost: diabetes-related medications	Cost: insulin use	Cost: other antidiabetics	Cost: GP visits	Cost: specialist visits	Any ED visit	Any diabetes-related hospital admission	Cost: diabetes-related medications	Cost: insulin use	Cost: other antidiabetics
Male	-60.724***	-45.281*	0.001	0.006	117.108**	32.972	84.136***	-66.405***	-80.073*	-0.015	0.031**	98.937**	35.310	63.628**
	(17.088)	(26.645)	(0.026)	(0.017)	(47.041)	(36.675)	(28.714)	(10.869)	(42.890)	(0.019)	(0.013)	(44.223)	(30.613)	(25.183)
Age	4.549***	1.587	0.001	0.001	-2.233	-1.395	-0.838	3.602**	1.002	-0.000	0.001	-0.411	-3.243	2.832
	(1.459)	(2.397)	(0.002)	(0.001)	(4.868)	(3.868)	(2.376)	(1.487)	(1.977)	(0.002)	(0.001)	(5.021)	(3.709)	(2.161)
Australia born	-21.455	43.544**	0.012	0.008	90.905*	89.993**	0.912	4.142	90.376**	-0.001	0.014	111.776**	82.420***	29.356
	(23.239)	(21.066)	(0.025)	(0.017)	(47.474)	(33.782)	(28.767)	(22.455)	(35.344)	(0.021)	(0.014)	(45.510)	(26.450)	(28.043)
SEIFA-IRSD (base is 0-25th percentile)														
25-50th percentile	23.190	-12.990	0.003	0.035*	-20.516	-3.427	-17.089	27.953	-9.350	-0.006	0.029	55.294	12.741	42.553
	(21.660)	(33.351)	(0.042)	(0.021)	(62.118)	(39.390)	(36.615)	(25.728)	(28.984)	(0.028)	(0.019)	(91.582)	(69.149)	(48.075)
50-75th percentile	-8.483	20.318	-0.008	-0.008	-55.464	-16.765	-38.699	36.021	35.392	-0.023	0.012	-18.440	-63.870	45.430
	(24.036)	(33.060)	(0.038)	(0.020)	(58.715)	(42.834)	(36.872)	(26.115)	(41.474)	(0.024)	(0.020)	(61.128)	(46.219)	(49.247)
75-100th percentile	43.113	67.431*	-0.034	0.005	-49.936	9.560	-59.496	59.384**	71.491	0.038	0.025	10.867	29.521	-18.654
	(28.780)	(39.335)	(0.047)	(0.021)	(68.238)	(55.612)	(51.040)	(28.534)	(55.850)	(0.036)	(0.023)	(62.297)	(56.908)	(51.926)
Remoteness (base is outer regional or remote areas)														
Major city	63.415**	80.457***	0.050**	0.031	129.849**	66.518	63.331**	37.406	71.328	0.025	0.054*	-69.760	-60.643	-9.117
	(24.548)	(27.060)	(0.025)	(0.020)	(50.600)	(44.640)	(27.896)	(41.085)	(53.083)	(0.053)	(0.028)	(97.518)	(79.975)	(49.560)
Inner regional	42.246*	48.252*	0.106***	0.013	124.214**	40.932	83.282***	95.864***	35.749	0.036	0.036	101.407	15.880	85.527*
	(21.716)	(27.503)	(0.030)	(0.018)	(53.646)	(39.177)	(26.022)	(24.409)	(30.892)	(0.061)	(0.028)	(98.343)	(69.114)	(47.645)
Self-reported health status (base is poor)														
Fair	-152.790**	44.324	0.065	-0.018	-75.045	-94.318	19.273	-133.213**	9.185	-0.043	-0.000	-92.908	-40.838	-52.070
	(73.330)	(63.397)	(0.072)	(0.064)	(139.209)	(131.101)	(69.350)	(58.096)	(67.582)	(0.063)	(0.049)	(101.887)	(104.619)	(69.875)
Good	-212.551***	-96.045*	0.025	-0.038	-159.908	-153.898	-6.010	-190.964***	-171.217***	-0.072	-0.025	-184.232**	-99.200	-85.032
	(60.383)	(48.819)	(0.072)	(0.061)	(137.336)	(122.066)	(69.899)	(51.080)	(62.998)	(0.063)	(0.045)	(88.446)	(88.395)	(56.538)
Very good	-237.710***	-140.269***	-0.053	-0.060	-213.377*	-209.641*	-3.736	-215.455***	-183.675***	-0.113*	-0.052	-263.175***	-152.380**	-110.794*
	(61.068)	(46.266)	(0.070)	(0.059)	(119.589)	(105.536)	(72.133)	(48.840)	(52.588)	(0.060)	(0.045)	(78.961)	(75.357)	(65.070)
Excellent	-263.497***	-160.106***	-0.027	-0.076	-72.633	-87.438	14.804	-255.370***	-197.407***	-0.089	-0.079*	-230.199**	-102.174	-128.025
	(64.143)	(58.077)	(0.072)	(0.058)	(167.166)	(155.904)	(83.754)	(52.983)	(53.906)	(0.076)	(0.046)	(107.181)	(113.292)	(77.064)
Marital status (base is single)														

Widowed	115.952	-4.937	0.046	-0.086*	-118.468	-140.440	21.973	93.015	44.154	0.049	-0.007	-35.255	-38.057	2.802
	(78.438)	(70.306)	(0.115)	(0.044)	(162.142)	(104.440)	(115.740)	(62.562)	(82.384)	(0.084)	(0.044)	(124.996)	(82.757)	(82.047)
Married or de facto	5.128	67.051	0.045	0.011	42.461	70.402	-27.941	-16.686	37.468	0.050*	-0.003	33.501	50.742	-17.241
	(33.112)	(40.559)	(0.041)	(0.039)	(117.126)	(94.314)	(64.934)	(34.273)	(30.901)	(0.028)	(0.032)	(99.233)	(78.797)	(48.487)
Divorced or separated	-51.207	34.464	0.008	-0.009	-36.782	-6.165	-30.617	-90.382***	-8.555	-0.019	-0.020	-24.023	3.264	-27.286
	(39.554)	(55.136)	(0.055)	(0.043)	(128.090)	(112.553)	(66.049)	(32.792)	(41.669)	(0.047)	(0.030)	(100.697)	(84.735)	(57.333)
Number of chronic conditions (base is no chronic conditions)														
1 chronic condition	18.177	31.101	-0.005	-0.012	-66.172	-11.175	-54.997	-0.714	-26.870	-0.015	-0.009	-101.524**	-5.985	-95.539***
	(18.598)	(28.679)	(0.021)	(0.014)	(53.365)	(36.612)	(37.556)	(16.869)	(27.687)	(0.021)	(0.012)	(45.792)	(32.341)	(34.213)
2 chronic conditions	46.054*	97.586***	0.035	0.014	-9.407	21.102	-30.509	24.185	122.920*	-0.001	0.021	-82.150	-11.338	-70.813*
	(24.494)	(30.765)	(0.032)	(0.023)	(69.833)	(57.659)	(43.510)	(21.163)	(68.617)	(0.026)	(0.021)	(56.994)	(38.428)	(41.688)
3 or more chronic conditions	61.247*	145.524**	0.118***	0.053	65.652	59.330	6.322	62.921*	73.180	0.084***	0.040**	-28.736	31.030	-59.766
	(30.898)	(57.519)	(0.037)	(0.035)	(87.981)	(61.041)	(43.095)	(34.305)	(59.928)	(0.030)	(0.020)	(72.254)	(56.588)	(38.891)
Educational attainment (base is no education)														
Intermediate certificate/higher school	-48.683	0.250	-0.039	-0.010	-2.879	3.181	-6.060	-26.687	-1.047	-0.062*	-0.011	21.184	-31.924	53.108
	(33.290)	(37.718)	(0.047)	(0.027)	(87.024)	(52.223)	(57.565)	(20.834)	(50.894)	(0.033)	(0.019)	(91.074)	(65.137)	(53.049)
Diploma/certificate/trade	-29.137	8.153	-0.015	-0.027	-21.328	-27.107	5.779	-21.302	-47.988	-0.031	-0.007	-8.488	-78.958	70.470
	(31.505)	(42.717)	(0.047)	(0.026)	(85.255)	(67.861)	(47.531)	(24.740)	(45.606)	(0.040)	(0.020)	(88.845)	(76.042)	(43.705)
University or higher	-20.487	27.808	-0.037	-0.004	-57.322	-36.831	-20.492	-19.001	-82.659	-0.051	0.004	-39.432	-82.759	43.327
	(31.450)	(62.296)	(0.048)	(0.028)	(83.649)	(58.104)	(70.996)	(25.958)	(79.731)	(0.046)	(0.022)	(78.381)	(71.078)	(57.046)
Household income (base is low Household income (<$20,000))														
Middle Household income ($20,000 - $40,000)	-40.530	34.771	-0.036	-0.004	-104.406	-40.685	-63.721	-39.639	25.056	-0.030	0.009	-44.064	-10.983	-33.081
	(32.622)	(51.940)	(0.040)	(0.031)	(122.699)	(98.873)	(55.233)	(24.175)	(67.529)	(0.031)	(0.027)	(78.852)	(63.504)	(41.542)
High Household income ($40,000 - $70,000)	-13.455	-31.271	0.018	0.008	-19.134	63.316	-82.450*	-17.433	9.768	0.018	0.004	41.531	55.104	-13.573
	(28.312)	(60.061)	(0.055)	(0.035)	(125.572)	(112.674)	(45.327)	(25.888)	(52.553)	(0.036)	(0.025)	(100.124)	(96.615)	(42.553)
Very high household income (>$70,000)	-23.683	-11.830	-0.013	-0.008	-15.540	3.391	-18.930	-22.800	69.518	-0.018	-0.011	-7.810	1.050	-8.860
	(28.928)	(61.464)	(0.053)	(0.031)	(110.799)	(91.968)	(60.333)	(21.545)	(48.264)	(0.044)	(0.022)	(80.969)	(70.595)	(51.356)

Concession card	34.383	-23.770	0.035	0.027	140.416*	82.932	57.484	27.794	18.040	0.051**	0.022	43.012	30.002	13.010
	(26.493)	(41.863)	(0.025)	(0.030)	(83.176)	(55.186)	(43.160)	(22.890)	(36.984)	(0.023)	(0.024)	(51.784)	(37.332)	(29.730)
Private health insurance (base is no private insurance)														
Without extras	41.613	-13.317	-0.051	-0.029	-180.408**	-137.728***	-42.680	48.414	-10.989	-0.027	-0.021	-158.267***	-82.923***	-75.344**
	(34.336)	(29.727)	(0.046)	(0.027)	(73.544)	(48.300)	(45.045)	(32.580)	(30.362)	(0.029)	(0.025)	(44.310)	(24.714)	(32.961)
With extras	-17.284	51.110*	-0.040	-0.015	-97.942	-80.758*	-17.184	-8.541	46.592*	-0.017	-0.004	-123.644***	-44.035	-79.610**
	(18.110)	(29.533)	(0.032)	(0.018)	(64.767)	(43.891)	(41.759)	(15.016)	(24.521)	(0.022)	(0.013)	(42.755)	(29.393)	(32.785)
Employed	-8.399	-21.620	-0.021	-0.012	-10.829	13.714	-24.544	-1.724	2.320	-0.017	-0.024*	-62.890*	-30.172	-32.718
	(19.705)	(38.640)	(0.025)	(0.018)	(51.473)	(34.517)	(31.618)	(20.883)	(56.195)	(0.016)	(0.014)	(36.932)	(28.983)	(30.703)
BMI	2.176	0.464	-0.001	0.001	4.536	3.089	1.447	2.057	4.732	0.001	-0.001	8.061***	4.250**	3.811***
	(1.831)	(2.822)	(0.002)	(0.001)	(3.328)	(2.604)	(1.966)	(1.704)	(4.854)	(0.002)	(0.001)	(2.590)	(1.965)	(1.311)
Year dummies (base is the year 2006)														
Year 2007	-36.282	77.635**	0.030	-0.020	30.495	50.844	-20.349	-27.034*	253.908	-0.013	-0.040***	5.320	15.304	-9.985
	(24.468)	(35.250)	(0.042)	(0.030)	(55.839)	(38.802)	(31.657)	(15.233)	(183.906)	(0.028)	(0.012)	(54.690)	(37.595)	(23.026)
Year 2008	-51.511*	17.080	-0.021	-0.017	25.301	99.303*	-74.002	-62.132***	81.485	-0.033	-0.007	-11.140	25.647	-36.787
	(28.539)	(27.364)	(0.034)	(0.030)	(84.725)	(52.323)	(46.597)	(17.625)	(71.681)	(0.035)	(0.013)	(60.207)	(39.661)	(27.972)
Year 2009	-57.044*	12.972	-0.020	-0.002	22.141	59.144	-37.003	-51.110**	113.785*	-0.017	-0.013	-31.323	-2.436	-28.887
	(30.142)	(34.067)	(0.036)	(0.034)	(84.786)	(49.906)	(52.457)	(21.226)	(64.980)	(0.034)	(0.023)	(64.138)	(40.116)	(35.158)
Year 2010	-51.464*	8.872	-0.020	-0.054*	13.428	24.091	-10.663	-41.441*	142.008*	-0.006	-0.036	-88.227	-25.088	-63.140
	(28.645)	(34.494)	(0.046)	(0.031)	(98.419)	(45.091)	(69.894)	(24.294)	(72.219)	(0.054)	(0.024)	(80.485)	(43.717)	(53.901)
Top decile	-0.090	9.192	-0.050**	-0.016	46.556	16.670	29.886							
	(16.549)	(31.634)	(0.019)	(0.011)	(32.465)	(26.955)	(20.422)							
Treatment group * top decile								15.617	-35.603	-0.051	-0.008	67.361	39.381	27.980
								(25.193)	(104.682)	(0.043)	(0.023)	(52.112)	(36.109)	(45.298)
Treatment group								2.296	-16.306	0.007	0.011	-21.783	1.185	-22.968
								(14.500)	(27.919)	(0.028)	(0.018)	(31.177)	(26.190)	(26.657)
Constant	246.700**	-43.719	0.098	-0.007	243.266	37.378	205.888	307.741***	-129.972	0.251*	0.006	480.342	381.553	98.789
	(104.125)	(201.030)	(0.164)	(0.117)	(272.155)	(251.813)	(153.985)	(102.445)	(241.044)	(0.137)	(0.093)	(295.868)	(268.686)	(146.566)
# postcodes (top decile)	22	22	22	22	22	22	22	22	22	22	22	22	22	22
# postcodes (bottom decile)	27	27	27	27	27	27	27	27	27	27	27	27	27	27
# postcode/year (top decile)	42	42	42	42	42	42	42	42	42	42	42	42	42	42
# postcode/year (bottom decile)	47	47	47	47	47	47	47	47	47	47	47	47	47	47
# individuals	895	895	895	895	895	895	895	1,547	1,547	1,547	1,547	1,547	1,547	1,547

R-squared	0.1907	0.1302	0.0886	0.0558	0.0894	0.0703	0.0719	0.2102	0.0714	0.0983	0.0803	0.1288	0.0893	0.1065

Notes: This table shows the full sets of estimates for the reduced-form model and DID with area fixed effects model for the young diabetics group. We only present the estimates for outcome variables of most interest here and the results of others are available upon request. The results suggest: Individuals with better self-reported health status tend to use fewer health care services in terms of GP and specialist visits, ED visits, and medication use than those who report poor health. A higher number of chronic conditions is associated with more GP and specialist visits and more presentations to EDs, but it leads to fewer consumption of medications. Male diabetics are shown to have more GP and specialist attendances but less drug use than their female counterparts. Diabetics with private health insurances are more likely to consume less medication.

Standard errors robust to heteroscedasticity and postal area clusters are in parentheses. * p<0.10, ** p<0.05, *** p<0.01

C Appendix Figures

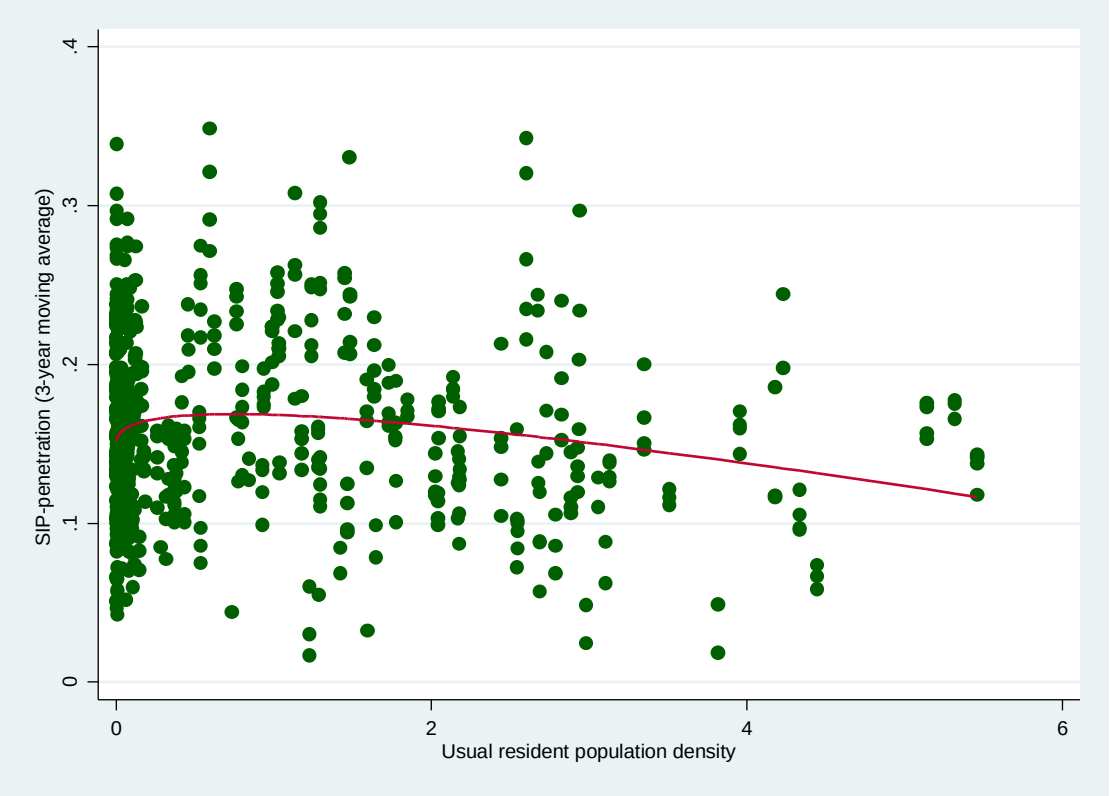

Figure C.1: The correlation between SIP-penetration and usual resident population density