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Original Article

The impacts of removing pharmaceutical co-payments for chronic conditions at primary care level: a pilot study in rural China

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Abstract

The underutilization of primary care (PC) presents a substantial challenge in enhancing the people-centeredness, quality, and efficiency of health services for patients with chronic diseases. Pharmaceutical copayments have been considered a key barrier to patient access in low- and middle-income countries. It is unclear whether the removal of pharmaceutical copayment can lead to better care and management of chronic diseases. This study sought to evaluate the impact on healthcare utilization and spending of a policy that waived fees for essential pharmaceuticals at PC facilities, piloted county-wide from 2014 in rural China. Using individual claims data from 2010 to 2017, we applied a synthetic difference-in-difference approach to estimate the policy's effects. Our sample included 9115 patients with hypertension and/or diabetes from the pilot county and 30 675 patients from the other counties in the same municipality. The policy led to a significant increase of 0.69 in the number of PC visits per patient per year (95% CI: 0.46–0.91), equivalent to a rise of 44.1%. Annual spending per person on outpatients at PC facilities increased significantly due to the policy, by 58 *yuan* (95% CI: 36–80), equivalent to a rise of 40.5%. As for outpatient visits at hospitals, there was a 25.8% significant reduction in the number of visits per year (−0.56; 95% CI: −0.95 to −0.16) and a nonsignificant increase in spending (45 *yuan*; 95% CI: −111 to 21). The annual number of admissions and spending on inpatients per person in all facilities remained stable. Using claims data, we have demonstrated that targeted removal of copayment for essential medicines successfully shifted outpatient visits and expenditure from hospitals to PC facilities but did not affect hospitalization and inpatient expenditure. Further research may be attempted to see if removing pharmaceutical copayments on people with less severe NCDs could reduce hospitalizations.

Keywords: copayment; primary care; chronic diseases; pharmaceuticals; China

Key messages

- A rural pilot in China waived drug copayment for primary care only, considering the heavy treatment burden for patients with chronic illnesses.
- PC-targeted removal of drug copayment led to an increase in outpatient visits at PC institutions and a decrease in outpatient visits at hospitals.
- Waiving drug copayment at PC had no effects on hospitalization reduction.
- Further study may explore the effectiveness of PC-targeted removal of drug copayment on patients with earlier stages of noncommunicable diseases.

Introduction

Primary care (PC) is best positioned to address the challenges facing non-communicable disease (NCD) prevention and management (Beaglehole *et al.* 2008). Continuous care required by people with NCDs can be best delivered equitably and sustainably through PC (WHO 2020). A recent study reaffirmed the positive association between strengthened PC and improved health system performance, including lower health expenditure and improved population health (Moran *et al.* 2023). Therefore, strengthening PC is imperative for the prevention and control of NCDs, especially in low- and middle-income countries (LMICs) (Haque *et al.* 2020).

Since 2009, China has been strengthening PC in terms of the prevention and control noncommunicable diseases (Xiong *et al.* 2022). However, PC utilization in China decreased relative to hospital-based care. The proportion of PC in total outpatient visits declined from 60.4% in 2009 to 54.2% in 2019, with a concurrent 13.3% points increase in the proportion of admissions to tertiary hospitals (National Health Commission 2020). Due to the lack of gatekeeping function of PC, patients can self-refer themselves to specialists, who are deemed to be equipped with

better resources and have a better quality of care, even for minor conditions (Shen *et al.* 2020a, Wu and Lam 2016). Furthermore, low reimbursement rates for outpatient prescriptions at both PC facilities and hospitals create financial obstacles that deter a subset of patients from seeking timely care, while concurrent rate parity inadvertently incentivizes others to opt for hospital-based services, potentially undermining PC utilization.

The strategic deployment of differential benefit policies has been recognized as an effective instrument for steering care-seeking behaviours toward PC services. A systematic review on differential user charges between primary and secondary care reported uncertain results on PC utilization (Hone *et al.* 2017). In urban China, the reform involving differentiated doctor visit fees between hospitals and PC facilities was found to increase the proportion of PC visits among all outpatient visits (Wang *et al.* 2023).

Another strain of literature focuses on the effects of adjusting medication benefits for healthcare utilization and outcomes. In the United States, it was found that PC visits were not significantly different between beneficiaries under Medicare plans with pharmaceutical benefit thresholds and those without (Raebel *et al.* 2008). In urban China, increasing the cap for outpatient benefits (including medication) among enrolees of the Urban Employee Basic Medical Insurance Scheme (UEBMIS) was found to reduce the hospitalization rates of patients with both hypertension and diabetes (Shen *et al.* 2020b). However, empirical investigations into adjustments to outpatient medication copayment policies in rural China remain limited, despite evidence indicating that fewer than 40% of rural patients diagnosed with hypertension or diabetes receive regular medical care—a role traditionally attributed to primary healthcare systems (Liu *et al.* 2016).

In summary, there has been a lack of research exploring the expansion of pharmaceutical benefits limited to PC facilities (i.e. PC-targeted) in China or other LMICs. To address this gap, this study evaluated the effects on healthcare utilization and expenditures for patients with NCDs of a pilot in rural China that waived copayment for selected pharmaceuticals at PC facilities only. The study also sought to explore whether free medication might reduce disease-related hospitalizations. Our study may provide valuable insights for policymakers in low- and middle-income countries regarding the effectiveness of addressing the medication burden for chronic diseases at the PC level on addressing both the underutilization of PC services and suboptimal chronic disease management, drawing from the experience in rural China. The study's findings may help to optimize policies aiming at strengthening PC and reducing the burden of chronic diseases.

Methods

Setting

Our study was situated in Luzhai, a county located in the municipality of Liuzhou, Guangxi Zhuang Ethnic Autonomous Region in southwest China. As of 2017, the annual disposable income for rural residents in Luzhai was 12 865 RMB (US $1905 based on the 2017 exchange rate), slightly lower than the average income of rural China (13 432 RMB in 2017), which was equivalent to the level of lower-middle income economy by World Bank categorization (World Bank 2017). In 2017, the county had a total of 409 700 registered residents, 61% of whom were rural. Like most parts of rural China, more than 95% of rural residents in Luzhai and other counties of Liuzhou were covered by the New Rural Cooperative Medical Scheme (NCMS). An outpatient reimbursement programme was established in 2008 under the NCMS that reimbursed patient expenditures at proportions similar to those for inpatient care (80% for PC facilities) for patients with a broad range of chronic diseases. Eligible beneficiaries who have finished the application to the scheme are entitled to an annual deductible of 600 RMB and an annual reimbursement limit of 4500 RMB for outpatient services.

Besides, a Basic Public Health Service programme has been in place since 2009. Under the programme, township health centres and the village doctors in their catchment provided a range of health management services (e.g. follow-up monitoring of blood pressure and glucose, physical check-up, pharmaceutical consultation, referral to specialists, etc.) to patients with hypertension and/or diabetes, whether they were certified with entitlement to the extra outpatient reimbursement benefit policy or not.

The township health centres assumed administerial role of both the NCMS outpatient reimbursement programme for chronic patients, as well as the Basic Public Health Service programme. The NCMS was merged into the Urban-Rural Resident Basic Medical Insurance Scheme at the end of 2017 in Liuzhou.

'Free essential medicines for key chronic conditions at primary care facilities' policy

In April 2014, Luzhai County used local public finance to top up NCMS benefits through the Free essential medicines for key chronic conditions at primary care facilities (FMCPC) policy. The policy covered the remaining pharmaceutical co-payments (approximately 20% of the costs of such medicines) for essential antihypertensive and diabetes medicines exclusively via local PC facilities for patients who were registered in the outpatient reimbursement scheme programme for chronic diseases. In other words, such beneficiaries could receive free medication once a month through outpatient visits to township health centres or door-to-door medication delivery by village doctors. As with the outpatient reimbursement programme and the Basic Public Health Service scheme, the township health centres were the key implementation organizations that managed the FMCPC within the townships of Luzhai.

The essential medications listed in the policy were considered adequate to satisfy the priority healthcare needs of most registered hypertensive and diabetic patients. Those who did not register with the chronic disease scheme were not eligible for the waiver. Eligible patients could continue, if they wished, to buy medicines beyond the policy's list or through outpatient departments of hospitals without the additional subsidy.

The FMCPC policy aims to (i) enhance patients' access to essential medicines through the removal of financial obstacles; (ii) enhance the utilization of PC through restricting free medication access exclusively to PC settings. The study hypothesized that, after the implementation of the programme, patients would be likely to visit PC facilities more frequently to receive their free medications, which may result in a shift of outpatient visits from hospitals to PC. Furthermore, the improved access to medications and regular follow ups at PC may result in more effective disease management that potentially decreases hospital admissions for related complications.

Study design and participants

We used a synthetic difference-in-differences (SDiD) design (Arkhangelsky *et al.* 2021) to compare changes from 2010 to

2017 in the healthcare utilization health expenditure for patients registered with hypertension or diabetes from the pilot county and the other counties in Liuzhou that did not adopt FMCPC. According to the inclusion criteria of the outpatient chronic-disease reimbursement policy, patients registered with hypertension or diabetes are those who have stage III hypertension or diabetes and have been previously hospitalized.

The study first excluded adults who were not continuously registered in the NCMS database between 2010 and 2017. The study then identified patients who had used outpatient services for hypertension or diabetes under the record of chronic outpatient reimbursement at least once during 2010–2013. This was to ensure that study participants were those who had registered for outpatient chronic-disease reimbursement before the start of the FMCPC programme. After excluding patients who were residing outside Liuzhou, and younger than 18 years, the final sample was obtained.

Our final sample included 39 790 patients, with 9115 participants from 11 townships in Luzhai county entitled to the FMCPC programme, and 30 675 from 86 townships from the other 9 counties. Considering that FMCPC was managed at the level of township and that the claims data were not decomposable to a level below the year, we used township-year as the unit of analysis.

Data

We used NCMS claims data of Liuzhou Municipality, containing all medical claims for individuals who registered with the outpatient copayment scheme for hypertension or diabetes. The claims data included beneficiaries' demographic details (e.g. gender, township of residence), along with medical diagnoses, provider institutions, usage dates and total expenditures for both outpatient and inpatient services. We used data on patient visits from 1 January 2010 to 31 December 2017. This included 48 months before the introduction of the FMCPC policy and 36 months following its launch (seen in Fig. 1). After excluding individuals who were not continuously enrolled in the NCMS from 2010 to 2017, we constructed a township-year panel dataset aggregated from individual-level data by township. For township-level covariates such as age and duration with outpatient reimbursement, the annual averages across all participants within each township were computed. Gender was operationalized as the proportion of female participants at the township level. Regarding the outcome variables, we first aggregated individual service utilization data within each township to calculate annual totals, which were then converted to per-person values for township-level representation.

Outcomes

The study primarily focused on examining the effects of FMCPC on outpatient utilization and expenditure. Therefore, we included in the analysis as dependent variables the mean number of outpatient visits per patient per year and the mean outpatient expenditure per patient per year. In this study, expenditures were defined as the total healthcare costs charged by providers in delivering services to patients. FMCPC was expected to influence patients' outpatient service-seeking behaviour. This effect was measured using variables related to outpatient utilization at different types of facilities (i.e. PC facilities versus hospitals).

The study also aimed to explore whether free medication might reduce avoidable hospitalization. Avoidable hospitalizations have been used as a metric to assess the performance of PC delivery systems and to identify possible deficiencies in the quality of outpatient care (Billings *et al.* 1996, Quan *et al.* 2017). In our case, avoidable hospitalization was measured by the mean number of hospitalizations per patient per year and the mean hospitalization expenditure per patient per year. The analysis specifically focuses on hospitalizations related to hypertension, diabetes, and CVD (including stroke, myocardial infarction, and heart failure). Hospitalizations related to these conditions were identified using corresponding ICD-10 codes, namely, I10–I13 and I15 for hypertension, E10–E13 for diabetes, and I20–I25, I50 and I60–I63, for cardiovascular diseases.

Empirical strategy

The study used the synthetic difference-in-differences (SDiD) method to estimate the effect of FMCPC on outpatient and inpatient service utilization. A synthetic control that had a parallel trend in adjusted outcomes with untreated units was modelled as the optimally weighted combination of the donor pool (i.e. 86 townships in the control group), with time weights being equal across the pretreatment period. In the SDiD approach, greater time weights are assigned to pretreatment periods which are more similar to post-treatment periods, in the sense of ensuring the consistent difference between pre- and post-treatment averages across all selected controls (Clarke *et al.* 2023).

In contrast to the conventional DiD approach, SDiD significantly enhances the robustness by constructing this synthetic control unit. By algorithmically generating counterfactual trajectories that closely match observed pretreatment dynamics, SDID alleviates the dependency on the often-stringent parallel trends assumption, thereby reducing bias in causal effect estimates (Arkhangelsky *et al.* 2021). Besides, the implementation of the FMCPC policy aligns with the 'block treatment assignment' assumption required by SDiD, as all treated townships adopt the intervention simultaneously at a single point in time. Moreover, in the construction of synthetic controls, weight allocation across donor units should adhere to a balanced distribution pattern to mitigate potential concentration bias.

A two-way fixed effects regression model was used to model the relationship between outcome variables and the policy effect, including township-fixed effects, time-fixed effects, and covariates. To account for observable differences across townships and improve comparability between treatment and control groups, we incorporated a set of covariates including the average age of patients, the proportion of female patients, and the average duration of enrolment in the outpatient reimbursement scheme between 2010 and 2013 at the township level into the SDiD analysis. For the inference procedure, the premutation method was used with 50 placebo iterations to obtain standard errors. This approach is preferable for a small number of treated units (Arkhangelsky *et al.* 2021). All expenditure variables from 2010 to 2017 were adjusted to 2017 values in Chinese *yuan* using the consumer price index for healthcare in China (National Health Commission 2020). All statistical analyses were conducted in Stata (version 17.0). We report the average treatment effects of the treated with 95% confidence interval.

Besides, the validity of the SDiD estimator hinges on the assumption that, once the reform occurs, policy exposure is the sole driver of any divergence in outcomes between treated and control units. We implemented two tests to probe this assumption. First, we carried out a placebo analysis by pretending

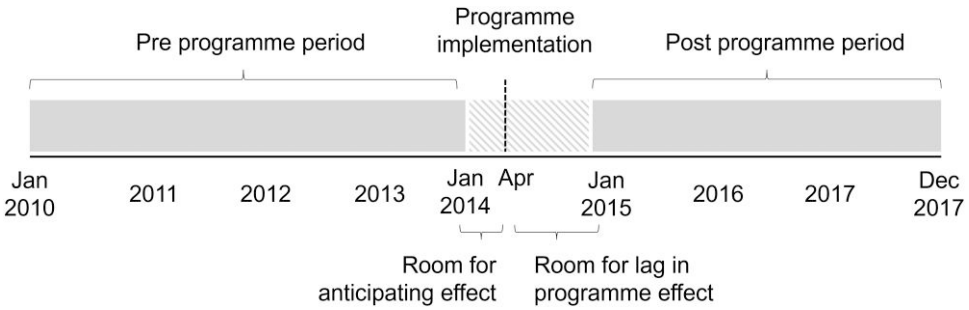

Figure 1. Specification of the study period.

Table 1. Baseline characteristics of patients in treatment and control groups (2010).

	Total		Treatment		Control	
	Mean	SD	Mean	SD	Mean	SD
Number of townships (N, %)	97	100	11	11	86	89
Observations (N, %)	39 790	100	9115	23	30 675	77
Male (%)	44.61	0.10	48.19	0.30	44.15	0.10
Age (year)	52.70	6.14	55.46	2.08	52.35	6.39
Length with outpatient reimbursement per patient scheme* (year)	3.01	0.82	3.09	0.76	3.00	0.83

Numbers are presented as mean and standard deviation (SD) unless otherwise stated. *Characteristics were measured during the period prior to the implementation of FMCPC (i.e. 2010–2013).

Table 2. Effect of FMCPC on outpatient utilization and expenditure per patient per year.

	Before		After		ATT	*P*-value	95% CI
	Intervention	Control	Intervention	Control			
Number of outpatient visits							
PC	0.867	0.405	2.028	0.700	0.685	.000***	0.458 to 0.911
Hospitals	2.147	1.874	2.94	2.98	−0.555	.005**	−0.953 to 0.156
Outpatient expenditure (yuan)							
PC	85.48	44.22	179.71	69.54	58.09	.000***	36.33 to 79.85
Hospitals	459.28	484.84	468.06	538.02	−45.14	.061	−111.70 to 21.42

ATT, average treatment effects on treated; 95% CI, 95% confidence interval. The table provides the SDiD results of outpatient utilization and expenditures.***$P < 0.001$, **$P < 0.01$.

that the intervention took place 1 or 2 years before its actual start date. Second, we perform a placebo test by pretending that the intervention took place in patients not in the register.

Results

Participant characteristics

As shown in Table 1, the 39 790 patients participating in the chronic disease outpatient reimbursement scheme from 97 townships had a mean age of 52.70 years (SD: 6.14), and 44.61% were male. Nine thousand one hundred and fifteen patients from 11 townships in Luzhai where the FMCPC policy was implemented formed the treatment group, while 30 675 patients from the other 86 townships formed the control group. The average length with the outpatient reimbursement scheme between 2010 and 2013 was 3.01 years for both the treatment and control groups.

Within both groups, outpatient visits per patient per year were greater at hospitals compared to PC, with the mean number of hospital outpatient visits per patient being more than twice that at PC. The distribution of mean outpatient expenditures per patient per year mirrored the visit pattern, with a similar proportion of total expenditure allocated to hospitals versus PC. In terms of inpatient utilization, the treatment group also exhibited significantly higher annual inpatient utilization and associated costs per patient.

Main results

Table 2 shows the results of the SDiD regression on outpatient visits and expenditure per patient per year. As compared with the control group, patients in the intervention townships experienced an increase in PC outpatient visits of 0.685 (95% CI: 0.458–0.911) per patient per year, equivalent to 44.1% over baseline. Hospital outpatient visits per patient per year decreased by 0.555 (95% CI: −0.953 to −0.156), equivalent to a relative decrease of 25.8% compared to the pre-intervention level in the treatment group. As compared with the control group, annual PC outpatient expenditure per patient increased by 58.09 *yuan* (95% CI: 36.33–79.85), equivalent to 40.5% over baseline. There was a nonsignificant decrease in the

Table 3. Main results for inpatient utilization and expenditure per patient per year.

	Before		After		ATT	*P*-value	95%CI
	Intervention	Control	Intervention	Control			
Inpatient utilization							
All-cause	1.050	0.472	0.943	0.329	−0.135	.076	−0.284 to 0.013
Hypertension	0.032	0.022	0.024	0.018	0.000	.132	−0.008 to 0.008
Diabetes	0.024	0.015	0.025	0.013	0.004	.146	−0.002 to 0.011
Cardiovascular diseases	0.178	0.073	0.173	0.069	0.003	.211	−0.030 to 0.036
Inpatient expenditure (yuan)							
All-cause	4229.20	1524.22	4005.99	1754.48	−611.54	.083	−1485.26 to 262.18
Hypertension	69.08	37.81	51.68	27.98	−0.12	.140	−18.71 to 18.48
Diabetes	75.49	42.05	71.31	36.60	13.02	.155	−207.79 to 62.89
Cardiovascular diseases	581.1	247.3	477.18	222.88	−72.45	.204	−5.93 to 31.98

The table provides the SDiD results of inpatient utilization and expenditures. The standard errors are at the individual level.

annual outpatient expenditure at hospitals per patient of 45.14 *yuan* (95% CI: −111.70 to 21.42).

Table 3 displays the regression results of the effects of FMCPC on inpatient utilization and expenditure per patient per year. It shows nonsignificant decreases in the number of all-cause hospitalizations per patient per year (−0.135; 95% CI: −0.284 to 0.013). There was also no significant change in annual number per patient of hypertension-specific hospitalizations (0.000; 95% CI: −0.008 to 0.008), diabetes-specific hospitalizations (0.004; 95% CI: −0.002 to 0.011), and CVD-specific hospitalizations (0.003; 95% CI: −0.030 to 0.036).

There were nonsignificant decreases in the mean hospitalization expenditure per patient per year (−611.54; 95% CI: −1485.26 to 262.18) and those due to hypertension (−0.12; 95% CI: −18.71 to 18.48) and cardiovascular diseases (−72.45; 95% CI: −207.79 to 62.89), while the annual expenditure of hospitalizations due to diabetes per patient had a nonsignificant increase (13.02; 95% CI: −5.93 to 31.98).

Outcome trends

The key assumption for causal inference in the SDiD approach is that the treatment group would have followed the same trend as the control group in the absence of the treatment. Figures 2 and 3 show the trends of our main outcome variables for the treatment group and synthetic control group. The pretreatment trends under SDiD seem fairly similar for all outcome variables.

Robustness check

Proper weight distribution is a necessary condition for satisfying SDID's identifying assumptions, as dispersed weights constrain the synthetic counterfactual's comparability. The unit-specific weights in SDiD are weights assigned to control units (i.e. townships) to create a weighted combination that closely matches the treated townships in pretreatment outcomes and covariates. The weights are determined by resolving a quadratic optimization problem that minimizes the difference between the treated units and the synthetic control groups, with two constraints for the weights, namely, non-negative contributions and summing up to 1. Supplementary Figure S1 presents the distribution of unit-specific weights assigned to each control township under the outcome of the mean number of outpatient visits at PC. As can be seen from Supplementary Figure S1, SDiD does not give any township particularly a high weight. This suggests that we have achieved the desired 'parallel trends' without including excessive variance in the estimator by using concentrated weights.

Another concern is that other policies may affect the outcome trends between the treatment and control groups. We address this concern by implementing placebo tests, assuming that the policy had happened 1 or 2 years earlier, or had targeted patients not in the register. If our main results are affected by other policies, a placebo result would be similar to the main results. Supplementary Table S1 shows the test results of the placebo test for the outcome of outpatient visits at PC, and all of the 'placebo' reform exposure estimates support our finding that a significant increase in outpatient visits to PC is caused by the FMCPC policy.

Discussion

Summary of findings

As far as we are aware, this is the first study evaluating the effects of a PC-targeted waiver of outpatient pharmaceutical copayment on healthcare utilization and expenditures. The FMCPC policy led to a significant increase in both outpatient visits and expenditure at PC facilities and a significant decrease in hospital outpatient visits. Disappointingly, we did not find any significant effects of the waiver on hospital admissions and expenditures.

Interpretation of findings in relation to previous studies

Our findings are consistent with previous studies which showed that implementing reimbursement policies for outpatient services favouring PC over secondary care promotes PC utilization. For instance, Powell-Jackson *et al.* (2015) found that redesigning the rural insurance package to shift incentives from inpatient to outpatient care led to a 47% increase in visits to village clinics. Similarly, Wang *et al.* (2023) evaluated a policy that set different doctor visit fees and copayments by provider level, and found a 2.6% point increase in primary care use—equivalent to 8.7–10.4% of the baseline rate—driven by more visits to community health centres and fewer to tertiary hospitals. The magnitude of the effect observed in our study—a 44.1% increase in primary care visits and an 18.0% reduction in hospital visits—is broadly consistent with prior findings from rural China, though it is substantially larger than those typically reported in urban settings. This suggests that the role of a waiver of essential medicines payment for NCDs may have a stronger impact in rural areas, where price sensitivity is higher.

Consistent with Shen *et al.* (2020a), our study detected no significant change in admission rates despite the enhancement

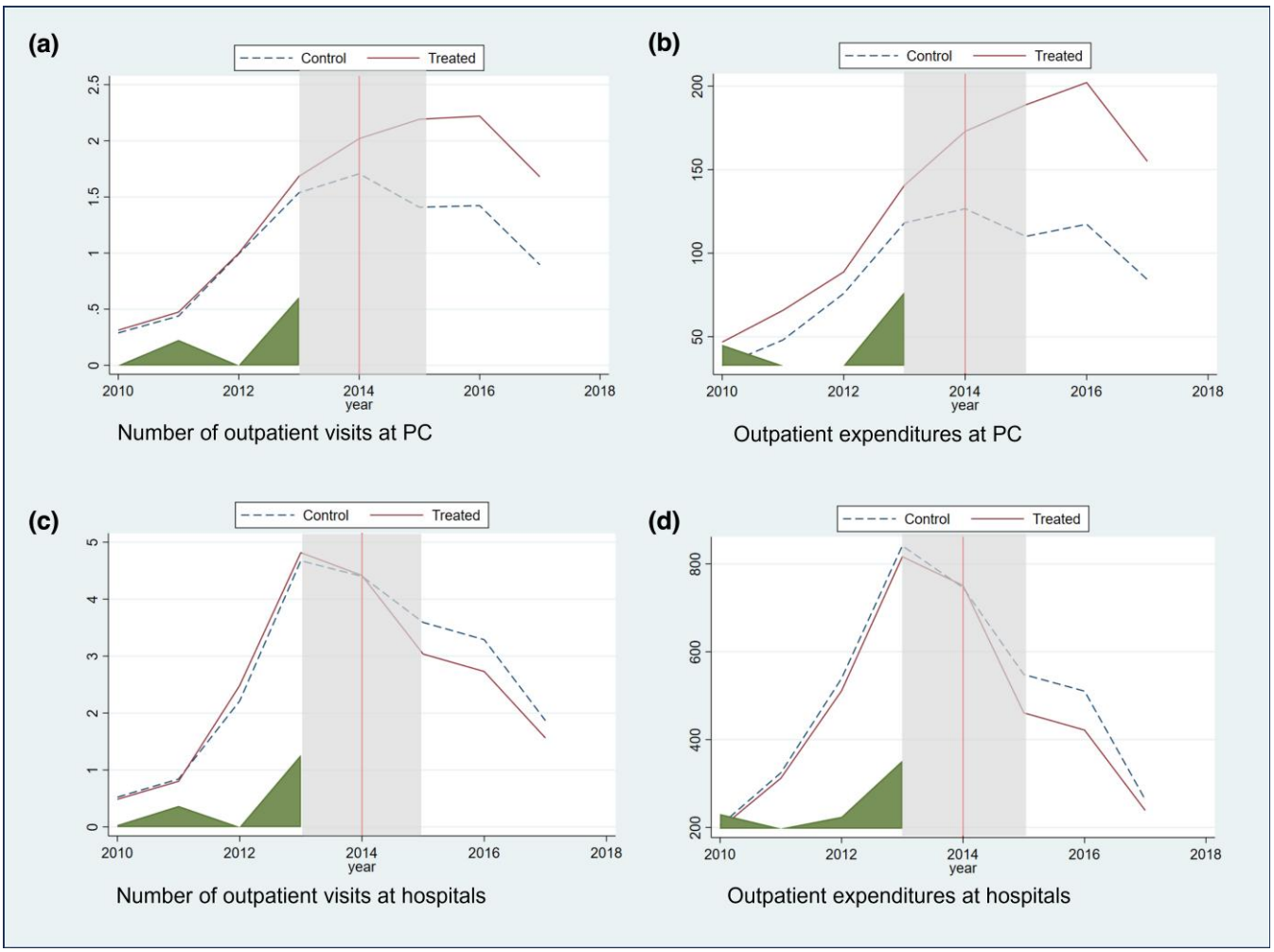

Figure 2. Trends of outpatient outcomes per patient per year before and after the reform from SDiD analysis, (a) number of outpatient visits at PC; (b) outpatient expenditures at PC; (c) number of outpatient visits at hospitals; (d) outpatient expenditures at hospitals.

of primary–care benefits. The similar effects in the same type of patients may stem from the difficulty for PC to prevent hospitalizations among those with more severe conditions (Wu *et al.* 2019).

Implications for practice and research

PC-targeted removal of outpatient pharmaceutical copayment, like other policies that increase healthcare benefits provided via PC, incentivizes patients to seek ambulatory care at the primary level rather than at higher-level institutions, with additional improvement in the accessibility to medicines. This strategy offers an example for policymakers in LMICs as well as rural China, which faces high NCD burdens, low treatment rates, and strained hospital services, to achieve better NCD management through strengthening PC (Haque *et al.* 2020). Considering the lack of effectiveness on hospitalization, studies in the future may evaluate the effectiveness of a similar intervention on patients with earlier NCDs, e.g. less severe hypertension/diabetes, when PC is likely more effective.

Limitations

Our study has several limitations. First, the lack of individual-level information on the usage of free medicines through the FMCPC hampered our ability to further explore the mechanism behind the policy effects. In other words, we cannot separate the effects on hospital outpatient and inpatient care use and expenditure due to the increased use of drugs and those due to enhanced management with more PC use. Second, as not all eligible NCMS members in Luzhai actually registered with the FMCPC, its benefits would likely have been greater if there had been better awareness of the programme. However, it is plausible that the lack of awareness might have been related to budget constraints facing local administrators and providers, which would be expected to be the reality in many places, and which would reduce incentives to publicize the programme. Third, due to the absence of individual-level variables in our claims data—such as comorbidity profiles, socioeconomic status, and lifestyle factors—we were unable to perform risk adjustment across townships beyond age, sex, and duration of participation in the outpatient reimbursement scheme. Those unmeasured individual-level variables may produce ecological fallacies when aggregating to the township scale, attenuate our ability to detect heterogeneous treatment effects, and limit causal interpretation. Caution is also needed in generalizing our findings, as the study was restricted to one city. Moreover, the absence of PC capacity and quality metrics limited our ability to explore potential influences on findings. Collecting these data in the future would enable a deeper investigation into these mechanisms and provide a more nuanced understanding of the observed outcomes.

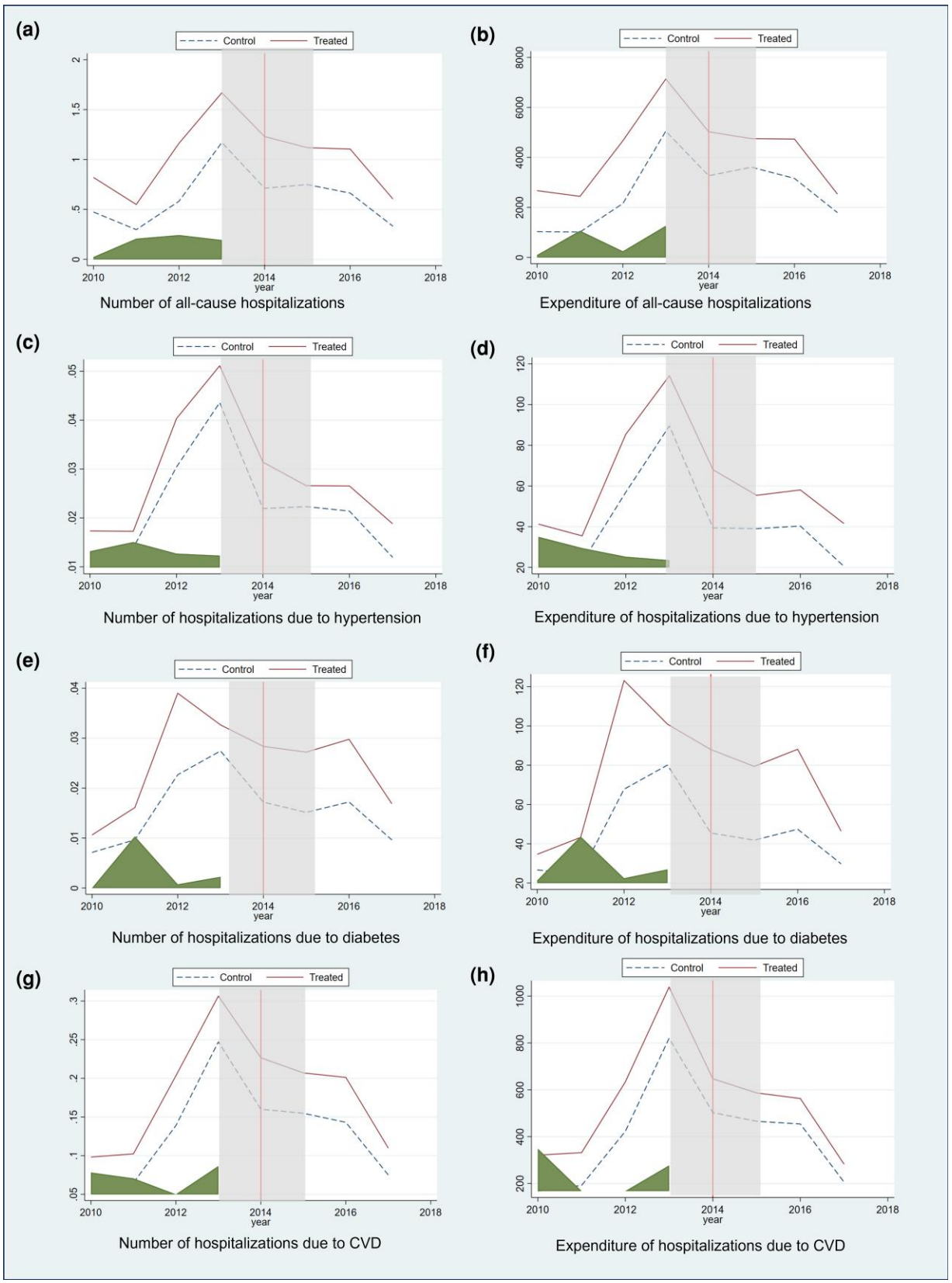

Figure 3. Trends of inpatient outcomes per patient per year before and after the reform from SDiD analysis, (a) number of all-cause hospitalizations; (b) expenditures of all-cause hospitalizations; (c) number of hospitalizations due to hypertension; (d) expenditures of hospitalizations due to hypertension; (e) number of hospitalizations due to diabetes; (f) expenditures of hospitalizations due to diabetes; (g) number of hospitalizations due to CVD; (h) expenditures of hospitalizations due to CVD.
Note: Treated group: patients from the FMCPC policy intervention county. Control group: patients from the county without FMCPC policy. The vertical red line indicates the introduction of the FMCPC policy in 2014. The share of each part of the area shaded green at the bottom of each graph indicates the time-specific weight for treatment and synthetic control outcomes for each period.

Conclusion

This study has evaluated a pioneer reform that extended coverage of social health insurance to patients with registered hypertension and diabetes in rural China. Using claims data, we have demonstrated that targeted removal of copayment for essential medicines successfully shifted outpatient visits and expenditure from hospitals to PC facilities but did not affect hospitalization and inpatient expenditure. Further research may be attempted to see if removing pharmaceutical copayments on people with less severe NCDs could reduce hospitalizations.

Supplementary data

Supplementary data is available at *Health Policy and Planning* online.

Author contributions

Conceptualization: J.X., W.L., Q.M., A.M., T.P.-J.; Literature review: W.L., J.X.; Methodology: W.L., T.P.-J., J.X.; Data collection: J.X., Q.W., H.X., B.Y., P.H., Q.M.; Data analysis: W.L., J.X., T.P.; Interpretation: W.L., J.X., T.P., A.M., Q.M.; Drafting of manuscript: W.L., J.X.; Supervision: J.X.; Revision of the manuscript: J.X., W.L., T.P., A.M., Q.M.; Final review and approval: All authors.

Reflexivity statement

Our team comprises male and female researchers of varying seniority levels, from early-career scholars to seasoned experts. This gender balance and diversity of experience have enriched our discussions and decision-making processes. Geographically, our authorship spans China and the UK, integrating insights from different healthcare systems and enhancing our understanding of both high-income and low- and middle-income contexts.

Ethical approval

This study was approved by the Peking University Institutional Review Board (Reference number: IRB00001052-21097).

Conflict of interest

There are no conflicts of interest regarding the publication of this paper.

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Data availability

The data underlying this article cannot be shared publicly due to the privacy policy of claims database.

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