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Urban-rural medical insurance integration and universal health insurance coverage in China: A quasi-experimental study

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ABSTRACT

Fragmented health insurance systems create barriers to universal health coverage (UHC) and reinforce social inequalities in urban development. To address these challenges, China implemented an urban–rural medical insurance integration policy, aiming to unify fragmented schemes and equalize access to healthcare. Using data from the China Labor-force Dynamic Survey and policy implementation records across 337 prefecture-level cities, this study applies a staggered difference-in-differences (DID) design to estimate the causal effects of integration. The results show that the reform significantly increased universal health insurance coverage (UHI) in Chinese cities, raising coverage by about 5.6%. Mechanism analysis indicates that higher reimbursement rates and lower out-of-pocket expenditures enhanced individuals' incentives to enroll. Heterogeneity analysis further reveals stronger effects among disadvantaged groups, such as those with lower education levels and older adults, while no crowding-out effect on commercial insurance is observed. The findings suggest that integrating fragmented health insurance systems can advance universal coverage and promote the equalization of public services, thereby contributing to more inclusive and sustainable cities.

1. Introduction

Universal Health Insurance (UHI) refers to a health financing system in which all individuals within a country are enrolled in health insurance schemes (Ly et al., 2022). As a core mechanism for expanding financial protection and access to care, UHI is widely recognized as a key pathway toward achieving Universal Health Coverage (UHC) (Lagomarsino et al., 2012). In many countries, social health insurance systems have played a critical role in expanding healthcare coverage, reducing out-of-pocket expenditures, and enhancing protection against catastrophic health costs (Devadasan et al., 2007; Mekonen et al., 2018). Reflecting this, the World Health Organization (WHO) and the United Nations Sustainable Development Goals (SDGs) have emphasized the urgency of advancing UHI, particularly in developing countries, where disparities in healthcare access and affordability remain substantial (Evans and Etienne, 2010).

China, the world's largest developing country, has made considerable progress toward UHI through medical insurance reforms over the past two decades. In an effort to extend healthcare coverage, China established three parallel medical insurance schemes: Urban Employee

Abbreviations: UHC, Universal Health Coverage; UEBMI, Urban Employee Basic Medical Insurance; NCMS, New Rural Cooperative Medical Scheme; URBMI, Urban Resident Basic Medical Insurance; URRBMI, Urban and Rural Resident Basic Medical Insurance; CLDS, China Labor-force Dynamic Survey; DID, Difference-in-Differences; ATT, Average Treatment Effect on the Treated.

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Basic Medical Insurance (UEBMI) in 1998, the New Rural Cooperative Medical Scheme (NCMS) in 2003, and the Urban Resident Basic Medical Insurance (URBMI) in 2007. While UEBMI primarily targets formal sector employees in urban areas, NCMS and URBMI were designed to cover rural residents and urban non-working residents, respectively (Li et al., 2012). Despite efforts to expand healthcare coverage to nearly the entire population, significant disparities in benefit levels and reimbursement rates persisted between urban and rural populations (Zhao et al., 2020), resulting in fragmented medical insurance systems and regional inequalities in healthcare access in China (Li et al., 2011; Meng et al., 2015; Yip et al., 2012). Furthermore, the household registration (hukou) system restricted the portability of rural medical insurance (Qiu et al., 2011), making it difficult for rural-to-urban migrants to access medical services in their working locations (Meng and Xu, 2014).

The shortcomings of China's medical insurance system led to a relatively low enrollment rate, with the national coverage rate reaching only about 49.7% in 2006 (Li et al., 2012). In response, the Chinese government introduced an urban-rural medical insurance integration policy in 2009, aiming to promote greater equity in healthcare access between urban and rural populations (Cai et al., 2023). This reform sought to merge the Urban Resident Basic Medical Insurance (URBMI) and the New Rural Cooperative Medical Scheme (NCMS), eliminate disparities in benefits between the two systems, and enhance the overall medical insurance benefits package (Zhou et al., 2024). The newly integrated system, known as Urban and Rural Resident Basic Medical Insurance (URRBMI), was introduced as part of broader healthcare reform efforts. Following city-level pilot programs, the integration policy was progressively expanded and was largely completed by 2016, when the Chinese central government officially announced the nationwide unification of NCMS and URBMI (Huo et al., 2023).

This study aims to assess the impact of China's urban-rural medical insurance integration policy on universal health coverage in China. By utilizing data from the China Labor-force Dynamic Survey (CLDS) and exploiting variation in the timing of policy implementation across 337 prefecture-level cities, this study employs a staggered difference-in-differences (DID) approach to estimate the causal effects of medical insurance integration. The findings contribute to the broader discussion on medical insurance reform and provide policy implications for countries seeking to achieve UHC through the integration of fragmented medical insurance systems.

2. Policy background

China has undertaken multiple medical insurance reforms over the past two decades, aiming to establish a universal medical security system. In 1998, the Chinese government introduced a social insurance scheme for urban employees known as the Urban Employee Basic Medical Insurance (UEBMI). UEBMI primarily covers formally employed urban workers, while migrant workers, self-employed individuals, and unemployed urban residents are generally excluded from enrollment, leaving a significant portion of the population without access to medical insurance (Chen et al., 2017). To address the lack of coverage among rural residents, the government launched the New Rural Cooperative Medical Scheme (NCMS) at the end of 2003, mainly targeting rural residents. Later, in 2007, the government established the Urban Resident Basic Medical Insurance (URBMI) scheme, which was designed to cover urban residents who were not eligible for UEBMI, including children, students, the elderly, and other non-working individuals (Liu and Zhao, 2014).

However, while these three programs significantly expanded medical insurance coverage, the dual urban-rural structure of the system led to various structural challenges. There were notable disparities in benefit levels among the three schemes. Compared to URBMI and NCMS, UEBMI had greater advantages in terms of financing capacity, the sustainability of the insurance fund, and the scope of coverage (Li et al., 2012; Meng et al., 2015). In its early stages, NCMS primarily covered inpatient expenses for severe illnesses, with limited reimbursement for outpatient services, whereas URBMI was designed with reference to UEBMI, covering a broader range of medical services and offering relatively higher benefit levels (Meng et al., 2015). Additionally, as insurance eligibility was determined by employment status and household registration (hukou), rural migrant populations often could not enroll in urban insurance schemes (UEBMI/URBMI) and had to participate in NCMS based on their rural hukou status (Qiu et al., 2011). Even for those enrolled in NCMS, migrant workers in urban areas still faced difficulties in accessing reimbursements for medical expenses (Chen et al., 2017).

To eliminate urban-rural disparities in medical insurance, the Chinese government initiated the integration of NCMS and URBMI, establishing a unified Urban and Rural Resident Basic Medical Insurance (URRBMI) scheme. The implementation of the integration policy was carried out at the prefecture (city) level, with local governments responsible for initiating the integration process. Consequently, the timing of policy implementation varied substantially across cities, even within the same province. The integration process occurred in two phases: the first phase involved local pilot programs before 2016, while the second phase, after 2016, was driven by a nationwide policy initiative led by the central government. Before 2016, many prefecture-level cities, including Chongqing and Tianjin, had independently launched and completed the integration of their urban and rural insurance schemes. In 2016, the Chinese government announced the nationwide integration of NCMS and URBMI into URRBMI (Huo et al., 2023), marking the formal launch of nationwide integration.

3. Theoretical framework and hypotheses

The integration of urban and rural medical insurance in China can be situated within broader theoretical perspectives on institutional fragmentation, social equity, and urban governance. Urban governance theories emphasize that fragmented public service systems often reinforce existing social divisions, undermining inclusive and sustainable development (Mossberger et al., 2015). In China, the coexistence of multiple medical insurance schemes historically reinforced the dual structure between urban and rural populations, leaving rural residents and migrants at a disadvantage in terms of healthcare access (Lagomarsino et al., 2012). By unifying separate systems into a single framework, policy integration is expected to reduce these institutional barriers, equalize access to public services, and improve inclusiveness in urban service provision.

First, the integration reform is designed to eliminate disparities in eligibility and benefit structures across different population groups. According to theories of welfare state development and institutional inclusion, reducing systemic fragmentation can directly enhance the reach of public services and expand coverage (Esping-Andersen, 1990). In the Chinese case, merging the New Rural Cooperative Medical Scheme (NCMS) with the Urban Resident Basic Medical Insurance (URBMI) was expected to extend protection to groups that were previously disadvantaged by their hukou status (Meng et al., 2015). Thus, one core expectation is that integration increases the proportion of individuals participating in health insurance, which represents a key step toward equalizing public services at the urban level.

H1. : Urban–rural medical insurance integration significantly increases health insurance coverage.

Second, beyond coverage, institutional reforms also alter the financial mechanisms underpinning social protection. Urban policy research highlights that equitable service provision depends not only on whether individuals are included but also on the generosity and adequacy of benefits (Mossberger et al., 2015). In fragmented systems, rural residents often face lower reimbursement rates and heavier financial burdens than their urban counterparts, reinforcing social exclusion. By harmonizing reimbursement policies, integration can improve benefit generosity and reduce households' out-of-pocket expenditures (Yang

et al., 2022). These changes are expected to strengthen individuals' incentives to participate in health insurance and thereby increase overall coverage.

H2. : Urban–rural medical insurance integration promotes higher health insurance coverage through increasing reimbursement rates and reducing household out-of-pocket medical expenditures.

Third, health economics and social policy studies highlight the possibility of a "crowding-out effect," whereby the expansion of public insurance may reduce demand for private insurance (Barr, 2020). However, in developing countries, public insurance typically provides only basic coverage, leaving significant gaps in high-cost treatments, specialized services, and waiting times (Meng et al., 2015; Yip et al., 2012). Private insurance thus continues to serve as a supplementary mechanism rather than being displaced by public programs (Folland et al., 2024). In this context, the integration of urban and rural medical insurance is expected to increase participation in government-sponsored schemes without diminishing the role of commercial insurance.

H3. : Urban–rural medical insurance integration increases participation in public insurance programs without significantly crowding out enrollment in commercial insurance.

Finally, theories of social inequality and urban inclusion suggest that disadvantaged groups tend to benefit disproportionately from reforms that expand public services (Anttiroiko and de Jong, 2020; Brik and Brown, 2024). In the Chinese context, disadvantaged groups, such as individuals with lower educational attainment and older adults, have historically been more reliant on government-sponsored health programs (Wagstaff et al., 2009), with fewer alternatives in the form of employer-provided or commercial insurance. Integration, therefore, has the potential to narrow gaps by improving access for these groups in particular, reducing health-related vulnerability and fostering greater inclusiveness in urban development (Huo et al., 2023). Specifically, the reform is expected to have relatively stronger effects on disadvantaged populations, particularly individuals with lower educational attainment and older adults, who face greater health risks.

H4. : Urban–rural medical insurance integration has stronger positive effects on disadvantaged groups, such as individuals with lower education levels and older adults.

4. Method

4.1. Data source

Our research data are structured at two levels: the individual and the city. At the city level, we collected information on the timing of urban–rural medical insurance integration for each prefecture-level city in China by reviewing publicly available policy documents from legal databases and official government websites. These documents, issued by local governments, specify the official implementation dates of the integrated insurance system. Based on this information, we successfully compiled the policy implementation dates for all 337 prefecture-level administrative regions across China.

At the individual level, we utilized data from the China Labor-force Dynamic Survey (CLDS), a nationally representative database designed and conducted by the Center for Social Survey at Sun Yat-sen University. Since its launch in 2012, the CLDS has been conducted across 29 provincial-level administrative regions in China (excluding Hong Kong, Macao, Taiwan, Tibet, and Hainan) and is designed to cover the working-age population aged 15–64 years (Wang et al., 2017). The CLDS adopts a multistage, stratified probability sampling design with probability proportional to size (PPS), ensuring national representativeness of the working-age population. Importantly, the CLDS follows a panel design in which a subset of respondents is repeatedly surveyed across waves and assigned unique individual identifiers, allowing researchers to track the same individuals over time. For this study, we analyzed survey data from 2012, 2014, and 2016, and merged the cleaned individual-level data with prefecture-level policy implementation records based on city identifiers. After data processing, we obtained a final sample of 14,454 observations.

4.2. Measurement

4.2.1. Dependent variable: universal health insurance (UHI)

Consistent with previous empirical work on China's health insurance reforms (Yu, 2015), we operationalize universal health insurance (UHI) at the individual level as enrollment in government-led public medical insurance schemes, which constitute the institutional foundation of universal health insurance coverage in China. Specifically, UHI is coded as 1 if an individual is enrolled in any of the following public insurance programs: the New Rural Cooperative Medical Scheme (NCMS), the Urban Resident Basic Medical Insurance (URBMI), the Urban and Rural Resident Basic Medical Insurance (URRBMI), the Urban Employee Basic Medical Insurance (UEBMI), or government-funded free medical services. Otherwise, UHI is coded as 0.

4.2.2. Main independent variable: urban-rural medical insurance integration

A binary variable was set according to whether the medical insurance integration policy was implemented in the respondent's city, where 1 indicates that the medical insurance integration policy was implemented and 0 indicates that it was not. This variable is the main independent variable in this study.

4.2.3. Control variables

Drawing on existing literature (Huo et al., 2023), we controlled for socio-demographic variables. For the hukou variable, urban hukou is assigned a value of 0, and rural hukou is given a value of 1. For the education variable, education level is assigned a value of 1 for elementary school and below, 2 for junior high school, 3 for high school, vocational high school, junior college, and technical school, and 4 for bachelor's degree and above. Regarding marital status, no spouse (widowed, unmarried, divorced, cohabiting) has a value of 0 and the spouse has a value of 1. In addition, the age variable is the actual age of the respondent, and the personal income variable is the logarithm of the annual personal income.

4.2.4. Mechanism variables

To examine the potential mechanisms, we focus on two key financial protection channels: medical reimbursement rates and out-of-pocket (OOP) medical expenditures. Reimbursement rates are constructed separately for outpatient and inpatient services using individual-level information from the CLDS. For outpatient care, respondents who reported having sought medical treatment in the past two weeks were asked to report their total medical expenditure, out-of-pocket payments, and the amount reimbursed by medical insurance. For inpatient care, analogous questions were asked with reference to hospitalization experiences during the past twelve months. The reimbursement rate is then calculated as the ratio of reimbursed expenditure to total medical expenditure for the corresponding service. These differences in reference periods reflect the survey design of the CLDS and are standard in household health surveys. Moreover, OOP medical expenditure is defined as individuals' self-paid medical spending over the past year, as directly reported in the CLDS. Given the highly right-skewed distribution of medical expenditures and the presence of zero values, we apply a logarithmic transformation, $\log(1 + \text{OOP})$, in the regression analyses. This transformation mitigates the influence of extreme values while retaining observations with zero out-of-pocket spending.

4.3. Data analysis

Our statistical analysis was conducted in five stages to comprehensively evaluate the effects of the medical insurance integration policy. In the first stage, we performed a descriptive statistical analysis to summarize key characteristics of the data and examine the distribution of variables. In the second stage, we employed a staggered difference-in-differences (DID) framework based on a two-way fixed effects (TWFE) specification as the baseline model. Exploiting the panel structure of the CLDS, which follows the same individuals across survey waves, we incorporated individual fixed effects and year fixed effects to control for time-invariant unobserved individual heterogeneity and common temporal shocks. All regression analyses were estimated using individual-level sampling weights provided by the CLDS to account for unequal selection probabilities and to restore national representativeness.

In the third stage, to ensure the robustness of our results, we conducted four types of robustness tests: (1) Parallel trend test: The validity of DID estimation relies on the parallel trend assumption. To verify this, we plotted dynamic treatment effects and confirmed the existence of parallel trends. (2) Treatment effect heterogeneity test: Since the integration policy was implemented at different times across cities, staggered adoption could introduce heterogeneity in treatment effects, potentially biasing the average treatment effect on the treated (ATT) estimated by the traditional DID model (Goodman-Bacon, 2021). To address this, we re-estimated ATT using a robust estimator (Callaway and Sant'Anna, 2021).

(3) Placebo test: To further assess whether the estimated effects could be attributed to spurious correlations, pre-existing trends, or unrelated outcome dynamics rather than the insurance integration policy itself, we conducted two placebo tests. First, we implemented a placebo treatment test by artificially advancing the policy implementation year by three years and examining whether this pseudo-treatment variable had any significant effect on medical insurance participation. Second, we conducted a placebo outcome test by replacing the main dependent variable with individual educational attainment, an outcome that is predetermined and should not plausibly be affected by the timing of medical insurance integration. (4) City-specific time trends. Given that the urban–rural medical insurance integration policy was implemented at the prefecture (city) level and that substantial variation existed in the timing of policy implementation across cities, we further conducted a robustness test by incorporating city-specific linear time trends. This approach helps account for unobserved time-varying confounders and contemporaneous policy shocks that may differentially affect cities. Allowing each city to follow its own underlying trajectory in medical insurance participation over time mitigates concerns that the estimated policy effects are driven by other concurrent health reforms or gradual structural changes.

In the fourth stage, we explored potential mechanisms through which the integration policy affects insurance participation. Specifically, we estimated separate DID regressions with reimbursement rates and out-of-pocket medical expenditures as outcome variables. These analyses are intended to provide quantitative evidence consistent with the proposed channels, rather than to conduct formal causal mediation analysis, as these variables are direct policy outcomes and are observed only for selected subsamples. In the fifth stage, we performed a heterogeneity analysis. Specifically, we conducted a subgroup difference-in-differences (DID) analysis by estimating separate DID regressions for different subgroups (e.g., education groups and age groups). Each subgroup-specific model includes individual fixed effects and year fixed effects. This approach allows treatment effects to vary flexibly across subgroups, permits subgroup-specific baseline outcome levels and differential responses to common time shocks, and controls for time-invariant individual characteristics, while accounting for pre-existing differences in insurance participation and access conditions across subgroups. All statistical analyses were conducted using STATA 18.0, with $p < 0.05$ set as the threshold for statistical significance.

5. Result

5.1. Descriptive analysis

Table 1 presents the descriptive analysis of the key variables in the study. 91% of individuals in the sample were enrolled in public medical insurance. The average age of respondents was 44.26 years. Approximately 91% of respondents had a spouse, and the average education level corresponded to junior high school or above. Additionally, 78% of the sample had rural hukou status, and the average logarithm of annual personal income was 9.77.

5.2. The impact of urban–rural medical insurance integration on universal health insurance coverage

Column (1) in Table 2 presents the baseline regression results. The estimated coefficient on insurance integration in the baseline model is positive and statistically significant at the 1% level, with a magnitude of 0.056, implying that the integration policy increases medical insurance participation by approximately 5.6%.

5.3. Robustness analysis

5.3.1. Parallel trend test

To assess the parallel trends assumption, we examined dynamic treatment effects while controlling for individual fixed effects, year fixed effects, and all control variables. Fig. 1 presents the estimated dynamic treatment effects over time. The results indicate that no significant pre-treatment effects were observed before the implementation of the integration policy, confirming that treated and untreated groups followed similar trends prior to the policy intervention. However, following the introduction of the policy, a significant treatment effect emerges, suggesting that the observed impact is attributable to the integration policy rather than pre-existing trends. These findings provide no evidence of violations of the parallel trend assumption, supporting credibility to the DID identification strategy.

5.3.2. Treatment effect heterogeneity

The staggered DID approach may lead to biased estimates of the average treatment effect on the treated (ATT) due to the heterogeneity of treatment effects (Goodman-Bacon, 2021). To address this issue, we re-estimated the ATT using the robust estimators (Callaway and Sant'Anna, 2021). The estimation results are reported in column (2) of Table 2. The regression coefficient is 0.071, which is larger than the baseline estimate (0.056) after accounting for treatment heterogeneity. This result further strengthens the evidence that the urban-rural medical insurance integration policy significantly increases insurance participation, reaffirming the robustness of our baseline findings.

5.3.3. Placebo test

The results of the placebo tests are reported in columns (3) and (4) of Table 2. When the policy implementation year is artificially shifted forward by three years, the estimated placebo treatment effect is small in magnitude and statistically insignificant, indicating that insurance participation does not respond to the pseudo-policy timing. Similarly,

Table 1
Descriptive analysis of the key variables.

	Mean	Standard deviation	Min	Max
Universal health insurance	0.91	0.28	0.00	1.00
Insurance integration	0.28	0.45	0.00	1.00
Age	44.26	10.48	15.00	64.00
Education	2.13	1.01	1.00	4.00
Marriage	0.91	0.29	0.00	1.00
lncome	9.77	1.11	2.48	15.60
Hukou	0.78	0.42	0.00	1.00

Table 2
The impact of urban–rural medical insurance integration on universal health insurance coverage.

	Universal health insurance coverage				
	Baseline	Robust DID	Placebo treatment	Placebo outcome	City trend
	(1)	(2)	(3)	(4)	(5)
Integration	0.056***	0.071***	−0.005	0.02	0.081**
	(0.01)	(0.02)	(0.01)	(0.03)	(0.02)
Control variables	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes
N	14454	11199	14454	14454	14454

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The standard errors in parentheses in the table are the heteroskedasticity-robust standard errors.

when individual educational attainment is used as a placebo outcome, the estimated coefficient remains statistically insignificant. These findings suggest that the main results are unlikely to be driven by spurious correlations, pre-existing trends, or unrelated outcome dynamics.

5.3.4. *City-specific time trends*

Column (5) of Table 2 presents the estimation results after allowing for city-specific linear time trends. The coefficient on insurance integration remains positive and statistically significant. This indicates that the estimated effect is robust to differential underlying trends across cities and persists even after accounting for gradual, city-level changes in local conditions over time.

5.4. *Mechanism*

We focus on two specific channels that are both theoretically relevant and empirically observable given our data: (1) the reimbursement rate, which captures direct changes in the generosity of insurance benefits; (2) out-of-pocket (OOP) household medical expenditures, reflecting the financial burden on families after reimbursement.

5.4.1. *Reimbursement rate*

The integration policy may influence reimbursement rates by expanding reimbursement coverage or increasing reimbursement amounts, subject to the discretion of local management authorities at the prefecture level. To examine this mechanism, we analyze self-reported medical expenditures and reimbursement amounts, with the results reported in Table 3. The estimates indicate that the integration policy significantly increased the outpatient reimbursement rate, while the effect on the inpatient reimbursement rate is positive but not statistically significant, a pattern that is consistent with existing findings (Ren et al., 2022).

5.4.2. *Out-of-pocket household medical expenditure*

The integration policy may reduce households' out-of-pocket (OOP) medical expenditures, thereby alleviating the financial burden associated with healthcare utilization. Columns (1) and (2) of Table 4 examine the full sample and a subsample consisting only of households with consistently positive medical expenditures (i.e., households whose medical spending never dropped to zero), respectively. Although the estimated effect for the full sample is estimated with lower statistical precision, its magnitude is approximately twice as large as that observed in the subsample with nonzero expenditures. This pattern suggests that, beyond reductions in out-of-pocket spending among households with positive expenditures, the integration policy may also have increased the likelihood that some households incur zero OOP medical spending, thereby providing suggestive evidence of improved financial protection.

5.5. *Heterogeneous effects of urban–rural insurance integration*

5.5.1. *Medical insurance categories*

Columns (1)–(3) in Table 5 report heterogeneous effects of

Table 3
Mechanism analysis of reimbursement rate.

	Reimbursement rate	
	(1) Outpatient	(2) Inpatient
Integration	0.065**	0.043
	(0.03)	(0.04)
Control variables	Yes	Yes
Time FE	Yes	Yes
Prefecture FE	Yes	Yes
N	2136	1968

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The outpatient reimbursement data include only respondents who received medical care within two weeks prior to the survey. The inpatient reimbursement data include only respondents who received inpatient treatment in the year prior to the survey. Because reimbursement outcomes are not observed for the same individuals in every survey wave, individual fixed effects are not feasible. Prefecture fixed effects are therefore employed, reflecting time-invariant city-level characteristics, and time fixed effects are included to account for common shocks across survey years.

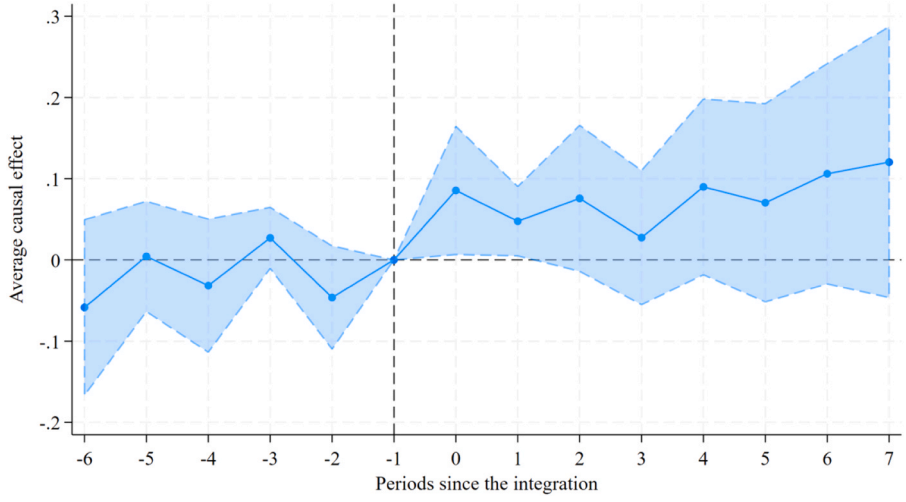

Fig. 1. Dynamic Effects of Urban–Rural Medical Insurance Integration. Note: The blue shaded area in the figure represents the 95% confidence interval. The estimation controls for individual fixed effects, year fixed effects, and all control variables.

Table 4
Mechanism analysis of OOP medical expenditure.

	OOP medical expenditure	
	(1)	(2)
	Full sample	Nonzero medical expenditure
Integration	−0.398**	−0.255***
	(0.19)	(0.11)
Control variables	Yes	Yes
Time FE	Yes	Yes
Individual FE	Yes	Yes
N	13388	7295

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The standard errors in parentheses in the table are the heteroskedasticity-robust standard errors.

urban–rural medical insurance integration across different types of medical insurance. Column (1) presents the effect on enrollment in any medical insurance program (including both public and commercial insurance). Column (2) focuses on government-led public medical insurance, while column (3) examines commercial medical insurance enrollment.

The results show that the integration policy significantly increased overall insurance coverage, with an estimated increase of 5.562% ($p < 0.01$). When disaggregating by insurance type, column (2) indicates a similarly sized and statistically significant increase of 5.58% in public medical insurance participation ($p < 0.01$). In contrast, the coefficient in column (3) is statistically insignificant, suggesting that the policy did not affect commercial insurance enrollment. These findings suggest that the observed improvement in insurance coverage is driven primarily by expanded participation in government-led public medical insurance programs, rather than by changes in commercial insurance markets. This pattern also indicates that the integration policy did not crowd out private insurance coverage.

5.5.2. Marital status

Table 5 also presents the heterogeneous effects of the insurance integration policy based on marital status, with column (4) showing results for married individuals and column (5) for the unmarried group. The results indicate that the integration policy has a statistically significant effect on medical insurance participation among married individuals, with a coefficient of 0.060 ($p < 0.01$). In contrast, for unmarried individuals, the coefficient (0.139) is positive but not statistically significant.

5.5.3. Age

Columns (1)–(3) of Table 6 present the heterogeneous effects of the insurance integration policy across different age groups. The results indicate that the policy impact varies by age. Among individuals aged 30–45, the insurance integration policy significantly increased medical insurance participation by 5.1% ($p < 0.05$). The effect is also statistically significant for those aged 45 and above, with a coefficient of 0.050 ($p < 0.01$), suggesting that older individuals are more likely to benefit from the policy. However, for the youngest age group (15–30 years), the coefficient (0.095) is not statistically significant, indicating that the policy's impact on medical insurance participation is weaker among younger individuals.

Table 5
Heterogeneity regression results of medical insurance type and marital status.

	Medical insurance type			Marriage	
	(1)	(2)	(3)	(4)	(5)
	Any insurance	Public	Commercial	Married	Unmarried
Integration	0.0562***	0.0558***	0.018	0.060***	0.139
	(0.01)	(0.01)	(0.01)	(0.02)	(0.09)
Control variables	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes
N	14454	14454	14290	12796	632

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The standard errors in parentheses in the table are the heteroskedasticity-robust standard errors.

5.5.4. Education level

Columns (4) and (5) of Table 6 report the regression results for individuals with low and high education levels, respectively. The results indicate that the insurance integration policy significantly increased public medical insurance participation among individuals with lower education levels, with a coefficient of 0.049 ($p < 0.01$) in column (4). However, for those with higher education levels (column 5), the effect is not statistically significant.

5.5.5. Hukou

Columns (6) and (7) of Table 6 report the heterogeneous effects of the urban–rural medical insurance integration policy by hukou status. The results show that the integration policy significantly increases medical insurance participation among both rural and urban hukou holders. Specifically, the estimated coefficient is 0.045 for individuals with rural hukou, significant at the 1% level, and 0.071 for those with urban hukou, significant at the 5% level. These findings indicate that the integration policy exerts a positive effect on insurance participation across hukou groups.

6. Discussion

By utilizing a staggered difference-in-differences (DID) approach, we identified a significant increase in universal health insurance coverage following the implementation of the integration policy. The estimated 5.6% increase in coverage highlights the policy's role in reducing institutional fragmentation and promoting equitable access to healthcare. Given China's population size during the study period (approximately 1.38 billion) (Korolenko, 2019), this effect corresponds to a substantial absolute expansion in coverage, potentially benefiting several tens of millions of individuals nationwide. These results align with existing literature (Huang and Wu, 2020), suggesting that harmonizing benefit structures and eliminating disparities between urban and rural medical insurance schemes can effectively enhance coverage rates (Ma et al., 2021). The positive policy effect is likely driven by several factors: higher reimbursement rates, expanded insurance benefits, and improved portability of medical insurance for rural-to-urban migrants (Xie et al., 2019). By addressing these structural challenges, the integration policy has brought China closer to achieving its UHC goals, as outlined by the World Health Organization (WHO) and the Sustainable Development Goals (SDGs).

Also, we find some heterogeneity of policy effects through heterogeneity analysis. First, in terms of insurance type, the urban-rural medical insurance integration policy increases participation in public health insurance schemes without significantly crowding out enrollment in commercial insurance (Choi et al., 2018). One possible explanation is that, in the Chinese context, commercial medical insurance primarily serves a supplementary role rather than acting as a substitute for public insurance. Commercial policies typically cover services and expenditures that fall outside the basic benefit package of public insurance, such as high-cost treatments, special medical services, or additional reimbursement beyond statutory limits (Barr, 2020). In addition, the availability and role of commercial insurance vary substantially across regions. In rural areas, limited product availability and lower effective demand imply that commercial insurance plays only a marginal role, while in urban areas it is typically purchased as a complement to public coverage, particularly among higher-income households (Chen et al., 2017). These features likely weaken the substitutability between public and commercial insurance and may help explain the absence of a significant crowding-out effect.

Table 6
Heterogeneity regression results of age, education level, and hukou.

	Age			Education level		Hukou	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	15–30	30–45	45 +	Low	High	Rural	Urban
Integration	0.095	0.051**	0.050***	0.049***	0.055	0.045***	0.071**
	(0.06)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1355	4646	7008	9554	4088	10847	2857

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The standard errors in parentheses in the table are the heteroskedasticity-robust standard errors. Consistent with the institutional cutoff of compulsory education in China, high education level is defined as individuals with post-secondary education or above (including university and vocational/technical college), while low education level refers to individuals with educational attainment below the high school level.

Second, our findings suggest that the policy impact is stronger among individuals with lower educational attainment, who may have a greater reliance on government-sponsored insurance programs and fewer alternative healthcare financing options (Li et al., 2012; Meng et al., 2015). In contrast, individuals with higher education levels may already have better access to employer-provided insurance or private healthcare options, reducing their responsiveness to the integration policy. Moreover, the effect of the urban-rural medical insurance integration policy varies across age groups, with stronger impacts observed among older individuals. The insignificant effect among younger individuals may be attributed to their generally better health status and lower perceived need for medical insurance, reducing their responsiveness to policy changes (Conway, 2020). In contrast, middle-aged and older individuals are more likely to recognize the benefits of insurance coverage (Dormont et al., 2006), as they experience greater healthcare needs and financial risks associated with medical expenses. In addition, our findings suggest that married individuals exhibit a stronger response to the integration policy, which may be associated with greater family-related financial responsibilities, heightened health security concerns, or spousal influence on insurance decisions and should be interpreted as suggestive rather than definitive evidence, given differences in subgroup sample sizes (Koball et al., 2010; Umberson and Karas Montez, 2010).

The heterogeneity analysis by hukou status shows that the urban–rural medical insurance integration policy significantly increased medical insurance participation among both rural and urban hukou holders (Meng et al., 2015), suggesting that the reform generated positive effects across different hukou groups by unifying the institutional framework, enhancing the level of risk pooling, and improving benefit generosity (Zhu et al., 2017). At the same time, our results also show that the increase in insurance participation is relatively larger among urban hukou holders. This may be because, compared with rural areas, urban areas generally have more extensive policy dissemination and more effective information transmission, which makes enrollment registration, information updating, and transitions across insurance schemes more convenient for urban residents (Qiu et al., 2011).

It is important to note that certain groups, such as individuals with lower educational attainment and older adults, generally exhibited lower baseline insurance coverage and faced greater institutional and informational barriers prior to the integration reform (Yip et al., 2012). Because our empirical strategy incorporates individual fixed effects that absorb time-invariant differences across individuals and subgroups, the heterogeneous effects identified in this study should be interpreted as differential responses to the policy rather than mechanical outcomes driven by pre-existing coverage gaps. The larger effects among these groups are consistent with the interpretation that the integration policy may have been particularly effective in alleviating institutional barriers that had previously limited their insurance participation (Meng et al., 2015).

Beyond insurance coverage, fragmented health insurance systems may also generate broader system-level consequences, including barriers to patient mobility, higher administrative costs, and disparities in clinical quality (Li et al., 2019). While this study focuses on insurance coverage as a core indicator of progress toward universal health insurance, the integration of urban and rural schemes may also generate spillover effects at the health system level, influencing healthcare utilization patterns, administrative efficiency, and the long-term fiscal sustainability of insurance funds (Yan, 2025). Existing studies suggest that insurance integration can increase service utilization and improve access, but may simultaneously place pressure on fund balances if benefit expansion is not accompanied by adequate financing and effective cost-containment mechanisms (Cai et al., 2023). Accordingly, the observed gains in coverage should be interpreted as part of a broader process of health system integration, in which coverage expansion represents only one dimension, and complementary reforms in provider payment systems, benefit design, and fiscal arrangements play a critical role in ensuring long-term sustainability.

More broadly, health insurance fragmentation is not unique to China. Many countries, particularly developing ones, face similar challenges in integrating healthcare systems (Savedoff et al., 2012). By using China, the world's largest developing country, as a case study, this study provides context-specific evidence and highlights analytical mechanisms that may be relevant for countries seeking to address health insurance fragmentation under different institutional and fiscal conditions. At the same time, the applicability of China's experience to other developing countries should be interpreted with caution (Paina and Peters, 2012). China's urban–rural medical insurance integration was implemented within a specific political, fiscal, and administrative context, characterized by strong central coordination, relatively stable fiscal transfers, and a nationwide social insurance infrastructure (Eggleston et al., 2008; Yip et al., 2019). Policymakers in other settings may face distinct structural constraints, such as limited fiscal space, fragmented governance arrangements, weaker administrative capacity, or uneven health service provision. Therefore, rather than offering a uniform policy blueprint, the findings of this study highlight general mechanisms, including reducing institutional fragmentation, expanding risk pooling, and harmonizing benefit structures, which may inform context-specific reform strategies adapted to local institutional and fiscal conditions.

Several limitations of this study should be acknowledged. First, due to the design of the CLDS, the sample is restricted to individuals aged 15–64 over the period 2012–2016, and the data do not allow us to distinguish between different categories of commercial insurance, which limits a more nuanced assessment of potential crowding-out effects. Secondly, due to post-treatment concerns and data constraints related to selective observation of the mechanism variables, the analysis does not formally decompose the total policy effect, but provides mechanism-consistent evidence. Third, because local implementation quality and enforcement intensity are unobserved, the estimated effects capture average policy adoption and may understate the true impact. Finally, the policy coincided with other health and social reforms, and despite extensive robustness checks, overlapping policy effects cannot be fully isolated.

Despite these limitations, this study has several notable strengths. First, we systematically collected the implementation timelines of urban–rural medical insurance integration across more than 300 prefecture-level cities in China and constructed a difference-in-differences model at the city level. In contrast, most existing studies rely on provincial-level data, with relatively few conducting analyses at the prefecture level. This finer spatial resolution enhances the precision of policy evaluation and helps address an important gap in the literature. Second, we conducted a comprehensive heterogeneity analysis across key population characteristics to examine differential policy effects among distinct groups. This approach provides valuable evidence on distributional impacts and offers useful insights for the design of more targeted and equitable health insurance policies.

7. Conclusion

This study empirically documents the significant positive impact of urban–rural medical insurance integration on increasing medical insurance participation rates through a staggered difference-in-differences model at the prefecture level. Heterogeneity analysis indicates that the policy effect is relatively larger among disadvantaged populations, with no observed crowding-out effect on commercial insurance, suggesting the compatibility of a multi-tiered healthcare system. These findings not only provide a basis for refining China's targeted health insurance policies, but also offer context-specific insights that may inform reform efforts in emerging economies striving to achieve universal health coverage.

Author statement

Originality and authorship

We declare that this manuscript is original, has not been published previously, and is not under consideration for publication elsewhere. All authors have read and approved the final version of the manuscript. We confirm that there are no other individuals who meet the criteria for authorship but are not listed, and that the order of authorship has been approved by all authors. The corresponding author is the sole contact for the editorial process and is responsible for communication with the journal, coordination among co-authors, submission of revisions, and final approval of proofs.

CRediT authorship contribution statement

Mingzheng Hu: Writing – review & editing, Writing – original draft, Validation, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Xin Ye:** Methodology. **Shaojie Li:** Methodology, Conceptualization, Writing – review & editing. **Weihao Nie:** Methodology, Conceptualization, Writing – review & editing. **Shuye Yu:** Conceptualization, Methodology, Writing – review & editing. **Yingying Ouyang:** Methodology, Conceptualization, Writing – review & editing. **Jinkang Huo:** Writing – review & editing, Writing – original draft, Validation, Software, Methodology, Formal analysis, Data curation, Conceptualization.

Ethics approval and consent to participate

This study is based on anonymized secondary data from the China Labor-force Dynamic Survey (CLDS), which contains no personally identifiable information. Therefore, no additional ethical approval or informed consent was required.

Consent for publication

All the authors have given their consent for the publication of this paper.

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Declaration of competing interest

The authors declare no conflicts of interest.

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Data availability

Data will be made available on request.

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