Impacts of unifying urban and rural residents’ medical insurance on the hospitalisation expenses of rural patients in eastern China: an interrupted time series analysis

Zhaohui Qin,1,2 Sha Liu,3 Min Zhou,1 Lijiang Chen,2 Wenhao Huang,2 Liang Shen2

ABSTRACT

Objectives This study evaluated the impact of the Urban and Rural Residents’ Basic Medical Insurance scheme on hospitalisation expenses of rural patients in eastern China, which unified separate healthcare systems for urban and rural residents.

Design Monthly hospitalisation data from municipal and county hospitals were collected from the local Medicare Fund Database, covering the period from January 2018 to December 2021. The unification of insurance between urban and rural patients was implemented at different times for county and municipal hospitals. An interrupted time series analysis was used to assess the immediate and gradual effects of the integrated policy on the total medical expenses, out-of-pocket (OOP) expenses and effective reimbursement rate (ERR) among rural patients.

Setting and participants This study included 636 155 rural inpatients over 4 years in Xuzhou City, Jiangsu Province, China.

Results In January 2020, the policy of urban and rural medical insurance was initially integrated in county hospitals, after which the ERR decreased at a monthly rate of 0.23% (p=0.002, 95% CI −0.37 to −0.09%) compared with the preintervention period. After the insurance systems were unified in municipal hospitals in January 2021, OOP expenses decreased by ¥63.54 (p=0.002, 95% CI −102.48 to −24.61) and the ERR increased at a monthly rate of 0.24% (p=0.029, 95% CI 0.03 to 0.045%).

Conclusions Our results suggest that the unification of urban and rural medical insurance systems was an effective intervention to reduce the financial burden of illness for rural inpatients, especially OOP expenses for hospitalisation in municipal hospitals.

INTRODUCTION

In 2005, the World Health Assembly formally introduced the concept of universal health coverage (UHC),1 calling on governments worldwide to ‘provide the necessary health interventions for promotion, prevention, treatment and rehabilitation at an affordable cost for all’. WHO estimates that approximately 100 million people fall into poverty each year because of out-of-pocket (OOP) expenses for health services; UHC would help prevent people from facing economic hardship as a result of such expenses.2 3 In recent years, many countries have made significant progress towards UHC through health system reforms,4 including ongoing efforts to protect citizens from catastrophic health expenditures.5 In China, the government continues to develop a medical security system that aims to maintain and promote the health of all citizens and to address the problem of poverty caused by illness.6

Owing to China’s dual urban–rural structure, differences in urban and rural medical security systems have emerged.7 Before 2003, reforms of the medical security system focused on Basic Medical Insurance for Urban Employees and public medical insurance for urban residents; at the time, nearly 80% of residents in rural areas did not have...
any medical coverage. In 2003, in order to expand the scope and coverage of basic medical insurance in rural areas, the Chinese government initiated the New Cooperative Medical Scheme (NCMS), a unique health insurance system based on mutual help and cooperation that provided low-cost healthcare services to rural residents. In 2007, the government began creating a new medical insurance system, the Urban Residents’ Basic Medical Insurance (URRBMI) system; this extended coverage to those urban residents not covered by the Basic Medical Insurance for Urban Employees. Families were the main funders of URRBMI, with the public treasury providing some subsidies. However, compared with those in urban areas, the extent of coverage, financing levels and reimbursement rates of rural medical insurance remained relatively low, and medical resources in rural areas were relatively scarce.

Disparities in local governments’ health expenditure capacity have also created problems. For example, some rural patients avoided going to hospitals owing to high medical costs and limited access to medical services. Against the background of China’s socioeconomic development and urbanisation, the dual health insurance system split between urban and rural areas hindered labour mobility in the market and increased management costs. Thus, it was not conducive to a fair and sustainable social security system or the achievement of UHC.

In view of this, the Chinese government decided to integrate the two insurance systems, URRBMI and NCMS, establishing a unified Urban and Rural Residents’ Basic Medical Insurance (URRBMI) system to improve the equity of medical services for both urban and rural residents. The State Council issued the ‘Guidance on Integration of the URRBMI’ in 2016; it stipulated that the separate policies’ coverage, financing policies, treatment modalities, medical insurance catalogues and management of designated hospitals should be unified. The URRBMI has been implemented gradually in various regions and has resulted in increased hospitalisation reimbursement for rural patients. China’s National Healthcare Commission reported that the national coverage rate of basic medical insurance reached 96.8% in 2018, an increase of 1.7 percentage points from 2013; further, the medical experience of rural patients has greatly improved. Furthermore, the integration of the medical insurance system was expected to reduce management costs and financial investment. For a summary of the changes in China’s medical insurance-related policies, see online supplemental figure S1.

Chinese scholars have conducted numerous studies on the integration of urban and rural health insurance. Most of the current research has compared factors before and after the implementation of URRBMI and evaluated the policy’s implementation status and effects. Some studies found that the policy was effective in reducing catastrophic medical expenditures and health service costs and promoted health service utilisation among impoverished and vulnerable populations. However, other studies implied that rural inequity has persisted after integration, and gaps remain between the aims and actual results of the URRBMI owning to differences in financing and reimbursement levels between rural and urban residents in the initial stages of the integration.

In addition to providing inconsistent results, most of these studies are cross-sectional and descriptive; few have conducted a longitudinal analysis of policy implementation. A longitudinal analysis is necessary, given that the implementation of the system was a gradual process of continuous adjustment and adaptation, which eventually led to a uniform and standardised system.

Addressing these gaps in the literature, this study aims to provide insights into the dynamic process whereby financing and reimbursement standards in local health insurance systems were adjusted after the URRBMI was implemented; it explores whether the unified URRBMI reduced the financial burden of illness on rural residents and improved urban–rural healthcare inequity. Accordingly, we evaluated the impact of the unification of financing and reimbursement standards in rural and urban areas on rural patients’ hospitalisation expenses. Our results can provide evidence and reference points for other regions and countries seeking to implement a uniform, standardised medical insurance system in urban and rural areas.

METHODS

Setting

Jiangsu Province, located at the centre of China’s eastern coast, has one of the best economies in the country. The province has a total area of 107,200 km² and a resident population of 85,054,000 people in 2021 (approximately 6% of the national population). Xuzhou, located in the north of Jiangsu Province, is a typical eastern Chinese city; and is one of the three most populous cities in the province; its gross domestic product per capita was ¥89,400 in 2021, slightly below the average for eastern China. The city is divided into 10 jurisdictions, five of which are municipalities that have undergone rapid urbanisation, while the other five are developing with predominantly rural residents (online supplemental figure S2).

Xuzhou’s local government initiated the integration of medical insurance for urban and rural residents at the end of 2017. In 2018, it discontinued URBMI and NCMS and implemented the URRBMI. Subsequently, Xuzhou City continuously adjusted the financing standards and reimbursement rates of URRBMI in urban and rural areas; all standards were unified by January 2021.

We collected and compiled specific local URRBMI policies from 2018 to 2021. Table 1 shows that financing and hospitalisation reimbursement standards in rural areas have gradually increased since 2018. The urban-rural differences in medical insurance reimbursement rates for hospitalisation in secondary hospitals decreased from 10 percentage points to zero between January 2018 and January 2020; between 2018 and 2021, the urban-rural
differences in medical insurance reimbursement rates for hospitalisation in tertiary hospitals decreased from 20 percentage points to zero, and the difference in financing standards also gradually reduced to zero. As mentioned above, the URRBMI eventually achieved uniform standards for hospitalisation in urban and rural areas, including funding standards, deductibles, capping and reimbursement rates, in January 2021.

Data sources and outcome variables
Hospitalisation information was collected from rural residents (ie, individuals with rural household registration) who participated in the URRBMI programme in Xuzhou from January 2018 to December 2021. Data were obtained from the medical insurance data information system of the Xuzhou Medical Insurance Bureau, which is managed by the local government and is not publicly available to protect patient’s privacy. The Medicare Fund Database contains detailed medical treatment and insurance information for all urban and rural residents in the jurisdiction. The URRBMI system was implemented in two phases to achieve the unification of inpatient reimbursement rates between county and municipal hospitals in January 2020 and January 2021, respectively. In this study, multistage cluster sampling was performed to obtain a representative sample. To reflect the way urban and rural residents medical insurance was integrated in Xuzhou, the sample was divided into county and municipal levels, and then two municipalities and counties were selected from each of the two levels by random sampling. In the selected municipalities and counties, typical sampling was used to select four public hospitals, including two city-level hospitals (Affiliated Hospital of Xuzhou Medical University and Xuzhou Central Hospital) and two county-level hospitals (People’s Hospital of Xinyi County and People’s Hospital of Pei County). The sampled hospitals represent different hospital grades, all of which are authoritative and recognised in their respective regions, covering the majority of patients in the five municipalities and five counties of Xuzhou, and thus can be considered representative (online supplemental figure S3).

We extracted medical insurance information about all rural inpatients insured by the URRBMI in the four selected public hospitals in Xuzhou between January 2018 and December 2021. The key items used for the analysis included medical institution, total medical expenses, OOP expenses and medical insurance reimbursement expenses. An exhaustive list of all variables of interest is shown in online supplemental table S1.

Table 1 Financing and hospitalisation reimbursement standards in urban and rural areas from 2018 to 2021

<table>
<thead>
<tr>
<th></th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
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<tbody>
<tr>
<td></td>
<td>Urban</td>
<td>Rural</td>
<td>Urban</td>
<td>Rural</td>
</tr>
<tr>
<td>Financing standard (¥)</td>
<td>720</td>
<td>690</td>
<td>790</td>
<td>770</td>
</tr>
<tr>
<td>Individual contribution (¥)</td>
<td>210</td>
<td>180</td>
<td>240</td>
<td>220</td>
</tr>
<tr>
<td>Government subsidies (¥)</td>
<td>510</td>
<td>510</td>
<td>550</td>
<td>550</td>
</tr>
<tr>
<td>Deductible (¥)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Primary hospitals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>¥10 000–¥50 000</td>
<td>90</td>
<td>90</td>
<td>93</td>
<td>93</td>
</tr>
<tr>
<td>Over ¥50 000</td>
<td>95</td>
<td>95</td>
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<td>95</td>
</tr>
<tr>
<td>Secondary hospitals*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>¥10 000–¥50 000</td>
<td>85</td>
<td>85</td>
<td>88</td>
<td>88</td>
</tr>
<tr>
<td>Over ¥50 000</td>
<td>90</td>
<td>80</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Tertiary hospitals†</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>¥10 000–¥50 000</td>
<td>85</td>
<td>65</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>Over ¥50 000</td>
<td>85</td>
<td>65</td>
<td>85</td>
<td>70</td>
</tr>
</tbody>
</table>

*County hospitals are referred to as secondary hospitals. Although some county-level hospitals have been upgraded to tertiary hospitals, charging standards in hospitals have not been upgraded accordingly. Therefore, medical insurance is still paid at the original level.
†All municipal hospitals are tertiary hospitals.
To ensure the homogeneity of the study subjects, we screened for general inpatients over 18 years old who were insured by the URRBMI; we also screened medical insurance payments to only include those that were of the fee-for-service type. Students, retired workers and those who were hospitalised for childbirth were excluded because these groups have exclusive medical insurance reimbursement rates.\(^2\) Meanwhile, samples that were missing key fields or contained logical errors were eliminated. Finally, the valid data consisted of a total of 636,155 records including 389,905 and 246,850 rural inpatients in municipal and county hospitals, respectively (online supplemental figure S4).

**Statistical analysis**

An interrupted time series analysis (ITSA) was used to analyse the impact of the unification of medical insurance standards for urban and rural residents on the hospitalisation expenses of rural residents. ITSA is a quasiexperimental research design that is commonly used to evaluate intervention effects.\(^2\)\(^,\)\(^3\) It measures the instantaneous and trend impacts of interventions by observing data at multiple time points before and after policy implementation. This study used a monthly unit to analyse the change trend (slope) and change level of the indicator data before and after the unification of insurance standards in urban and rural areas under the URRBMI. Segmented regression is a model frequently used in ITSA; it is specifically represented as follows\(^2\).

\[
Y_t = \beta_0 + \beta_1 \times \text{time} + \beta_2 \times \text{intervention} + \beta_3 \times \text{time after intervention} + \varepsilon
\]

where \(Y_t\) is the monthly outcome variable in the period from January 2018 to December 2021, \(\text{time}\) is a continuous variable indicating the specific month, \(\text{intervention}\) is an indicator variable taking a value of 1 after policy implementation and 0 otherwise, and \(\text{time after intervention}\) is a continuous variable representing the number of months since the intervention, and takes a value of 0 if it was before the intervention. Furthermore, the regression coefficient \(\beta_0\) represents the baseline level or intercept at \(t=0\), \(\beta_1\) represents the trend or slope of change before the policy of unified insurance standard, \(\beta_2\) represents the instantaneous change after the policy implementation, and \(\beta_1 + \beta_2\) represents the trend or slope of change after the policy implementation. Thus, \(\beta_1 + \beta_2\) denotes the actual trend of the outcome and thus represents the net effect of policy intervention. \(\varepsilon\) is a random error term at moment \(t\), which is not explained in the model.

We fitted multiple linear regression model equations using segmented linear regression methods, and autocorrelation was often present in the time series data. We used the Durbin-Watson test to assess autocorrelation (a value of approximately 2 indicated no autocorrelation). If the variables were autocorrelated, we used the generalised least squares method (Prais-Winsten method) to correct for first-order serial correlation errors.\(^2\)\(^,\)\(^3\) All data were analysed using Stata V.17.0 software. \(P<0.05\) was considered statistically significant. In addition, the Dickey-Fuller test was used to evaluate the robustness of the data. The \(p\) values of the Dickey-Fuller test in this study were all less than 0.05, indicating that there was no unit root in the data and the time series was stationary.

**Patient and public involvement**

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**RESULTS**

We conducted a comparative analysis between municipal and county hospitals to assess the long-term impacts of the URRBMI on rural residents’ medical expenses. As medical institutions at different tiers, municipal and county hospitals differ significantly in terms of their medical insurance reimbursement rates and the characteristics of their patients. Following the local implementation of the URRBMI, urban and rural inpatient reimbursement rates for secondary and tertiary medical institutions were unified in January 2020 and January 2021 respectively. Therefore, we conducted an ITSA for rural inpatient medical expenses at different times to test the effect of policy intervention.

**Changes in the hospitalisation expenses of rural patients in county hospitals**

**Figure 1** presents the trends in the average total medical expenses, OOP expenses, and effective reimbursement rate (ERR) of rural inpatients in county hospitals. The vertical line denotes January 2020, when urban and rural inpatient reimbursement rates were unified in county hospitals. **Table 2** also shows the impact of policy implementation on the total medical expenses, OOP expenses and ERR among rural patients in county hospitals.

Before the implementation of the unified policy, total medical expenses showed an increasing trend, with a statistically significant \(\beta_1\) of 61.15 (\(p<0.001\), 95% CI 31.34 to 90.96). Meanwhile, OOP expenses showed a decrease of ¥9.42 that was also statistically significant (\(p<0.05\), 95% CI -18.34 to -0.50). Total and OOP medical expenses increased after unification, but the difference was not statistically significant. Compared with the preintervention period, the ERR trend declined at a monthly rate of 0.23% after policy implementation (\(p=0.002\), 95% CI -0.37% to -0.09%). Thus, since 2018, the policy intervention resulted in a 0.19% increase in the ERR for rural inpatients at county hospitals. The Durbin-Watson tests indicated no autocorrelation.

**Changes in the hospitalisation expenses of rural patients in municipal hospitals**

**Figure 2** shows the trends in the average total medical expenses, OOP expenses and ERR of rural inpatients in municipal hospitals. The vertical line denotes January 2021, when the URRBMI standards were unified in municipal hospitals. **Table 3** also shows the impact of
policy implementation on the total medical expenses, OOP expenses and ERR among rural patients in municipal hospitals.

The trend in the average total medical expenses of rural inpatients in municipal hospitals was almost flat, with no significant difference before and after policy implementation. Before policy implementation, there was a decreasing trend in OOP expenses; $\beta_1$ was $-24.39$ and was statistically significant ($p=0.015$, 95% CI $-43.70$ to $-5.07$). After the policy was implemented, the OOP expenses trend showed a decrease of ¥63.54 per month, which was statistically significant ($p=0.002$, 95% CI $-107.35$ to $-19.72$).

### Table 2

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>P value</th>
<th>95% CI</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total medical expenses (¥)</td>
<td>1.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_1$: baseline slope</td>
<td>61.15</td>
<td>14.79</td>
<td>4.13</td>
<td>&lt;0.001</td>
<td>(31.34, 90.96)</td>
<td></td>
</tr>
<tr>
<td>$\beta_2$: level change after policy</td>
<td>240.05</td>
<td>388.76</td>
<td>0.62</td>
<td>0.540</td>
<td>(−543.44, 1023.55)</td>
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</tr>
<tr>
<td>$\beta_3$: slope change after policy</td>
<td>12.01</td>
<td>30.03</td>
<td>0.40</td>
<td>0.691</td>
<td>(−48.52, 72.53)</td>
<td></td>
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<tr>
<td>$\beta_0$: baseline level</td>
<td>7310.74</td>
<td>212.98</td>
<td>34.32</td>
<td>&lt;0.001</td>
<td>(6881.49, 7739.99)</td>
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</tr>
<tr>
<td>OOP expenses (¥)</td>
<td>1.71*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_1$: baseline slope</td>
<td>−9.42</td>
<td>4.43</td>
<td>−2.13</td>
<td>0.039</td>
<td>(−18.34, −0.50)</td>
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<tr>
<td>$\beta_2$: level change after policy</td>
<td>215.49</td>
<td>117.41</td>
<td>1.84</td>
<td>0.073</td>
<td>(−21.13, 452.11)</td>
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<tr>
<td>$\beta_3$: slope change after policy</td>
<td>14.29</td>
<td>8.52</td>
<td>1.68</td>
<td>0.101</td>
<td>(−2.88, 31.46)</td>
<td></td>
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<tr>
<td>$\beta_0$: baseline level</td>
<td>3171.10</td>
<td>68.93</td>
<td>46.01</td>
<td>&lt;0.001</td>
<td>(3032.19, 3310.02)</td>
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<tr>
<td>Effective reimbursement rate (%)</td>
<td>1.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_1$: baseline slope</td>
<td>0.42</td>
<td>0.06</td>
<td>7.35</td>
<td>&lt;0.001</td>
<td>(0.30, 0.54)</td>
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<tr>
<td>$\beta_2$: level change after policy</td>
<td>−1.80</td>
<td>0.69</td>
<td>−2.59</td>
<td>0.013</td>
<td>(−3.20, −0.40)</td>
<td></td>
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<tr>
<td>$\beta_3$: slope change after policy</td>
<td>−0.23</td>
<td>0.07</td>
<td>−3.29</td>
<td>0.002</td>
<td>(−0.37, −0.09)</td>
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<tr>
<td>$\beta_0$: baseline level</td>
<td>56.76</td>
<td>0.86</td>
<td>65.88</td>
<td>&lt;0.001</td>
<td>(55.03, 58.50)</td>
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</table>

*Adjusted Durbin-Watson (DW) test value.

ITSA, interrupted time series analysis; OOP, out-of-pocket.
−102.48 to −24.61). The ERR for patients increased by 0.24% (p=0.029, 95% CI 0.03% to 0.045%) compared with the preintervention period. Thus, since 2018, the policy intervention resulted in a 0.42% increase in the ERR for municipal hospital inpatients. The Durbin-Watson tests indicated no autocorrelation.

**DISCUSSION**

In this section, we provide an overview of the changes in the medical expenses and ERR of rural inpatients in Xuzhou after the implementation of the policy, which unified financing and reimbursement standards for urban

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**Figure 2** Trends in the monthly (A) total medical expenses, (B) out-of-pocket (OOP) expenses and (C) effective reimbursement rate of rural patients in municipal hospitals, January 2018 to December 2021.

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**Table 3** ITSA results of the policy effect on total medical expenses, out-of-pocket expenses and effective reimbursement rate in municipal hospitals

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>P value</th>
<th>95% CI</th>
<th>DW</th>
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<tbody>
<tr>
<td>Total medical expenses (¥)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.99*</td>
</tr>
<tr>
<td>β1: baseline slope</td>
<td>26.17</td>
<td>21.34</td>
<td>1.23</td>
<td>0.227</td>
<td>(−16.84, 69.18)</td>
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<tr>
<td>β2: level change after policy</td>
<td>−97.46</td>
<td>570.85</td>
<td>−0.17</td>
<td>0.897</td>
<td>(−1247.94, 1053.02)</td>
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<tr>
<td>β3: slope change after policy</td>
<td>−41.57</td>
<td>44.51</td>
<td>−0.93</td>
<td>0.355</td>
<td>(−131.27, 48.13)</td>
<td></td>
</tr>
<tr>
<td>β0: baseline level</td>
<td>18 736.57</td>
<td>429.98</td>
<td>43.58</td>
<td>&lt;0.001</td>
<td>(17 870.01, 19 603.14)</td>
<td></td>
</tr>
<tr>
<td>OOP expenses (¥)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.01*</td>
</tr>
<tr>
<td>β1: baseline slope</td>
<td>−24.39</td>
<td>9.59</td>
<td>−2.54</td>
<td>0.015</td>
<td>(−43.70, −5.07)</td>
<td></td>
</tr>
<tr>
<td>β2: level change after policy</td>
<td>452.37</td>
<td>263.47</td>
<td>1.72</td>
<td>0.093</td>
<td>(−78.62, 983.36)</td>
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</tr>
<tr>
<td>β3: slope change after policy</td>
<td>−63.54</td>
<td>19.32</td>
<td>−3.29</td>
<td>0.002</td>
<td>(−102.48, −24.61)</td>
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<tr>
<td>β0: baseline level</td>
<td>8322.65</td>
<td>184.53</td>
<td>45.10</td>
<td>&lt;0.001</td>
<td>(7950.75, 8694.55)</td>
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<tr>
<td>Effective reimbursement rate (%)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>2.1</td>
</tr>
<tr>
<td>β1: baseline slope</td>
<td>0.18</td>
<td>0.03</td>
<td>5.22</td>
<td>&lt;0.001</td>
<td>(0.11, 0.25)</td>
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<tr>
<td>β2: level change after policy</td>
<td>−2.56</td>
<td>1.04</td>
<td>−2.46</td>
<td>0.018</td>
<td>(−4.66, −0.46)</td>
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<tr>
<td>β3: slope change after policy</td>
<td>0.24</td>
<td>0.11</td>
<td>2.26</td>
<td>0.029</td>
<td>(0.03, 0.45)</td>
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<tr>
<td>β0: baseline level</td>
<td>55.64</td>
<td>0.75</td>
<td>74.22</td>
<td>&lt;0.001</td>
<td>(54.13, 57.15)</td>
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*Adjusted Durbin-Watson (DW) test value.

ITSA, interrupted time series analysis; OOP, out-of-pocket.
and rural patients between 2018 and 2021. Through ITSA, we estimated a statistically significant increase in the ERR and a decrease in the OOP expenses of rural patients hospitalised in municipal hospitals. This finding suggests that the URRBMI played a positive role in reducing the financial burden of hospitalisation for rural patients, highlighting the importance of unifying urban and rural healthcare standards. Despite the high population coverage of healthcare insurance, insurance often does not cover non-medical costs associated with healthcare and OOP expenses like deductibles and copayments can accumulate quickly, allowing high deductibles and catastrophic expenses to remain a financial burden.

The local government began implementing the URRBMI in 2018, which integrated the former NCMS in rural areas and URBMI in urban areas. However, differences in medical insurance benefits between rural and urban areas persisted after the URRBMI was implemented.26 27 Subsequently, the government has continued to adjust financing standards and hospitalisation reimbursement ratios for urban and rural residents. Specifically, reimbursement rates for urban and rural secondary hospitals were uniformly adjusted to 80% in January 2020. One interesting finding was that although patients' OOP expenses fell in the short term, there was no significant change after the implementation of the policy, and total medical expenses gradually increased in the long-term trend. This could be explained by the fact that the increased reimbursement rate for rural patients has resulted in a huge increase in patient intake at county hospitals at the expense of OOP medical charges, resulting in unreasonable medical visits and a waste of medical resources to some extent. Furthermore, the capacity of county hospitals to provide medical services has increased owing to the hierarchical medical system promoted by the Chinese government.28 This policy has guided rural residents to seek medical care in the county, which may have contributed to the rise in medical expenses.29 Thus, the inherent link between total medical expenses, OOP and the ERR is concerning and may reflect potential policy risks.

Since January 2021, the same URRBMI standards have been applied to rural and urban areas; the reimbursement rate in tertiary hospitals was uniformly adjusted to 70%, and the financing standard was set to ¥910. After this point, we found a decrease in OOP expenses and a significant increase in the ERR for rural inpatients in municipal hospitals. This represented a compromise created by increasing the reimbursement rate for rural residents and decreasing that for urban residents, maintaining a balance between the overall income and expenditure of the medical insurance system.30 In China, critical illness insurance is settled at the end of each year, which is an additional reimbursement for patients with higher payouts in China. Hence, the annual ERR fluctuates from a low level at the beginning of the year to a high level at the end of the year; this explains the decrease in the ERR immediately after the intervention.

Comparison of rural inpatient medical expenses in municipal and county hospitals reveals several differences between the two. Given the distribution characteristics of China's health resources, municipal hospitals have placed greater emphasis on medical and health service resources. To guide patients to seek medical treatment, the range of the ERR for municipal hospitals was set at approximately 5% lower than that for county hospitals. Subsequently, it was found that an increasing number of rural patients sought out-of-county medical treatment, which posed a great burden on the medical insurance fund.31 32 Since the integration of urban and rural residents’ medical insurance in 2018, the policy reimbursement rate for rural residents' hospitalisation has been increasing, but the total amount paid by the Chinese government’s medical insurance fund has not increased significantly. This has pushed medical institutions to effectively control the cost of medical services in order to counterbalance the economic pressure from rising medical expenses. Compared with that of county hospitals, the total expenses of municipal hospitals continued to fluctuate in a smooth manner, demonstrating the beneficial effects of cost control.33 In summary, the URRBMI has already played a positive role in directing the effective supply of medical services and reducing the cost of health services, which has been implemented more effectively in municipal than county hospitals.34

Our results are largely consistent with those of previous studies. For example, one American study found that five state Medicaid programmes reimbursed primary care services at less than 50% of the Medicare rate, and 35 states reimbursed at less than 75%35; in our study, the ERR for rural inpatients after urban and rural health insurance unification was approximately 65%–70% at county hospitals and 60%–65% at municipal hospitals. Meanwhile, a study by Niu et al showed that the ERR was only 59% in Jiujiang City, Jiangxi Province, even after urban and rural medical insurance were integrated.36 As a result, compared with other regions, the ERR for rural residents in Xuzhou is relatively high. Empirical evidence has shown that the URRBMI equalises the financing and reimbursement levels between urban and rural residents and provides greater reimbursements for the poor than for the rich.14 37 More broadly, Li et al claimed that the integration of fragmented health insurance schemes could increase reimbursement rates, improving the affordability of healthcare.38 The integration implemented by the URRBMI significantly increased the probability and extent of benefits for residents, and the choice for rural enrollees (ie, the level and range of hospitals) was expanded.17

Since the deployment of the URRBMI, different plans have been implemented in various regions. Some regions adopted the 'financing by stages' and 'one system and multiple files' strategy, allowing residents to choose between various grades, to adapt to the consumption capacity of urban and rural residents, characterised by their different economic levels.39 Most cities in eastern
China have adopted different medical insurance standards in urban and rural areas, and these policies aimed to reduce the cost of expanding the healthcare system and increase economic efficiency. Despite its positive effects, the integrated medical insurance system fails to fundamentally address the inequity between urban and rural health insurance. In some pilot areas, the insurance fund still operates and is managed independently instead of being integrated into a uniform risk pool. Some studies found that the fragmentation of funding pools could result in unequal access to basic healthcare. Thus, the government should take appropriate measures to deepen the reform and integration of urban and rural health insurance systems. First, fund pooling should be increased to better cope with China’s rapidly ageing population and epidemiological transitions, as well as to protect the insured, mainly the vulnerable population, from illness-related poverty. Second, the operation and management mechanism of urban and rural medical insurance funds need to be further integrated through the regulation of funding and reimbursement rates to hedge financial pressure and ensure the stability and sustainability of medical insurance funds.

**Strengths and limitations**

This study had several strengths and limitations. First, due to the limited time span of the data, the hospitalisation expenses of rural residents before 2018 were not observed. Although the Chinese government advocated the integration of urban and rural medical insurance in 2016, local governments only started to officially implement it in 2018. We chose 2018 as the starting point of the study while controlling for the effects of some other factors, because the NCMS was the insurance system for rural residents before 2018, and these patient data were in a different medical insurance information system. Second, as the implementation pattern of the URRBMI differed significantly among provinces, no province was suitable to use as a control group. Our findings can thus only provide a reference for regions with similar economies. Finally, this study reflected the impact of the URRBMI on the financial burden of illness among rural residents by using their hospitalisation expenses and ERR; however, there was a strong consistency between the two, implying the presence of inherent confounding factors. In addition, declining healthcare costs do not necessarily represent improved equity, and more emphasis should be placed on equal financing and benefits when making further reforms. Thus, similar studies on other insurance payments and populations are necessary to further explore the effects of integrating urban and rural medical insurance.

**CONCLUSION**

This study indicates that the unification of system standards in the URRBMI has increased individual contributions and hospitalisation reimbursement rates for rural inpatients. This has motivated medical institutions to control the cost of medical services and ensure a balance between income and expenditure of health insurance funds, and has narrowed the urban–rural gap to promote equity in health service utilisation. Unification has effectively reduced the financial burden of illness for rural inpatients, particularly by reducing their OOP expenses related to hospitalisation in municipal hospitals. Overall, the Chinese government has improved its macro-level control of basic medical insurance for urban and rural residents, which may have a positive influence on promoting the sustainable development of medical insurance funds. The findings of this study may provide a reference for other regions and countries that intend to reduce citizens’ medical expenses.

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**Contributors**

ZQ and SL served as the principal investigators who were involved in the study design and conception, manuscript preparation and editing. ZQ obtained funding. SL wrote the original draft. MZ performed critical revisions of the manuscript. LC, WH and LS performed data cleaning and provided helpful technical support to the study design. All authors have read and approved the final manuscript. ZQ is responsible for the overall content as the guarantor.

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**Competing interests**

None declared.

**Patient and public involvement**

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication**

Not applicable.

**Ethics approval**

This study involves human participants and was approved by the Institutional Ethics Committee of Xuzhou Medical University, Xuzhou, China (ethical approval number: XZMU-JK-2021057). Participants gave informed consent to participate in the study before taking part.

**Provenance and peer review**

Not commissioned; externally peer reviewed.

**Data availability statement**

Data are available upon reasonable request. Data may be obtained from a third party and are not publicly available. The data that support the findings of this study are available from the corresponding author upon reasonable request and with permission from Xuzhou Medical Insurance Bureau.

**Supplemental material**

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Supplemental Figure S1. Timeline of the health insurance policy evolution in Xuzhou and the Nation
Supplemental Figure S2. Location of sample city
multi-stage cluster sampling (Xuzhou city)

five municipalities in Xuzhou

Yunlong district, Quanshan district

Affiliated Hospital of Xuzhou Medical University, Xuzhou Central Hospital

Random sampling

five counties in Xuzhou

Xinyi county, Pei county

People's Hospital of Xinyi County, People's Hospital of Pei County

Typical sampling

rural inpatients insured by URRBMI in the four public hospitals between 2018 and 2021
Supplemental Figure S4. Study design and flow chart of inclusion/exclusion criteria of study participants

All samples admitted from Xuzhou Medicare Fund Database between 2018 and 2021 (n=775212)

Individuals with exclusive medical insurance reimbursement rates (n= 87198)

Individuals insured by URRBMI with Fee-For-Service payment (n= 688014)

Patients less than 18 years of age (n=51761)

Missing value in key items (n=98)

Samples were eligible for analysis (n= 636155)

Municipal hospitals (n= 389305)

County hospitals (n= 246850)
### Supplemental Table S1. List of variables of interest in the Medicare database

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable Name</th>
<th>Attribution</th>
</tr>
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<td>Dependent</td>
<td>total medical expenses</td>
<td>continuous variable</td>
</tr>
<tr>
<td></td>
<td>out-of-pocket expense</td>
<td>continuous variable</td>
</tr>
<tr>
<td></td>
<td>reimbursement expenses</td>
<td>continuous variable</td>
</tr>
<tr>
<td>Independent</td>
<td>medical insurance category</td>
<td>categorical variable</td>
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<td>medical institution</td>
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<tr>
<td></td>
<td>medical insurance checkout time</td>
<td>continuous variable</td>
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<tr>
<td>Covariates</td>
<td>age</td>
<td>continuous variable</td>
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<tr>
<td></td>
<td>gender</td>
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<td>medical insurance payments</td>
<td>categorical variable</td>
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<td></td>
<td>admission diagnosis</td>
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