Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Can new urbanization alleviate rural-urban health inequality in China? A moderating effect analysis of financial resources misallocation

Lingyun Liu
Nanjing University
Ying Liu
1309454873@qq.com

Nanjing Xiaozhuang University
Zhongwei Yang
Nanjing Xiaozhuang University
Kai Dong
Nanjing Xiaozhuang University

Article

Keywords: new urbanization, rural-urban health inequality, financial resources misallocation, regional heterogeneity

Posted Date: May 22nd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9501125/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Can new urbanization alleviate rural-urban health inequality in China? A moderating effect analysis of financial resources misallocation

Abstract: Long-term urbanization led to resource imbalances and inadequacies, thus prompting the Chinese government to introduce a new urbanization policy. The question is whether the implementation of new-urbanization can facilitate more equitable health outcomes. Based on Chinese provincial panel data, this paper employs Principal Component Analysis (PCA), Gini coefficient analysis, Two-way fixed effects models, and Instrumental variable methods to examine the effects of new urbanization on rural-urban health inequality. The key results are: (1) The eastern region exhibits the highest average level of new urbanization, which continues to grow. The central region ranks second, while the western region experiences the lowest average level of new urbanization, with a declining trend in China. (2) New urbanization contributes to reducing rural-urban health inequality, both in terms of subjective self-rated health and objective chronic disease. (3) Considering regional differences, new urbanization construction has a mitigating effect on rural-urban health inequality in the western region but not in the eastern and central regions. (4) Improving financial resources misallocation enhances the mitigating impact of new urbanization on rural-urban health inequality. Finally, these conclusions illustrate that China should consider regional diversity and resource allocation when further advancing new urbanization to ensure equitable health outcomes.

Keywords: new urbanization; rural-urban health inequality; financial resources misallocation; regional heterogeneity

1. Introduction

In the context of China's transition to a new economic paradigm, the tension between citizens' aspirations for improved well-being and the uneven and insufficient development has emerged as a central societal challenge. Notably, health disparities resulting from variations in rural-urban status garner significant concern. Research consistently demonstrates a positive correlation between urbanization and healthcare resources. Rural groups with lower economic standing face heightened health risks. Additionally, intergenerational transmission perpetuates and even widens rural-urban health inequality by amplifying the impact across generations (Halliday et al., 2020). Over the past decade (2010–2020), the average annual disposable income of Chinese residents surged from RMB 16,510 to RMB 32,189. Simultaneously, the Gini coefficient, a measure of income inequality, declined from 0.481 to 0.468. Despite this progress, substantial disparities persist between the rich and the poor segments of society (Gradína and Wu, 2020). "China's 13th Five-Year Plan for Health and Wellness" underscores the importance of strengthening health status and promoting health equity among vulnerable groups, including the poor and disabled. However, studies reveal that health inequality within Chinese households surpasses income inequality. This situation is not only detrimental to the improvement of national human capital and labor productivity, but ultimately has an adverse impact on economic growth. Accordingly, narrowing the health gap between rural-urban groups becomes a critical imperative.

Urbanization and industrialization have led to the enhancement of healthcare and medical technology, but they have also contributed to declining air quality, environmental degradation, and compromised water quality. Researches point out that the stressors related to overpopulation, environmental pollution, poverty, and violence, alcoholism and tobacco use, network addiction and sleep disorders, anxiety and fear, noise and pollution, and visual aggression are the main factors that

adversely affect physical and mental health as a result of urbanization. Given that these adverse effects disproportionately affect lower socioeconomic groups, urbanization is likely to exacerbate health disparities between rural-urban strata (Bjerregaard et al., 2024).

In 2014, China initiates a comprehensive project to pilot a new type of urbanization. New urbanization aims to strengthen the national coordination of public services and social security, accelerate the reform of social security system in order to achieve urban and rural complementary coordination, economic and social dual development. However, it is little known about whether new urbanization is conducive to reducing rural-urban health inequality, whether this effect varies among regions, and the possible reasons for effect differences. Therefore, it is greatly beneficial to explore the actual impact of new urbanization on rural-urban health inequality and its heterogeneity, which can effectively expand practical experience for developing countries in addressing rural-urban health inequality.

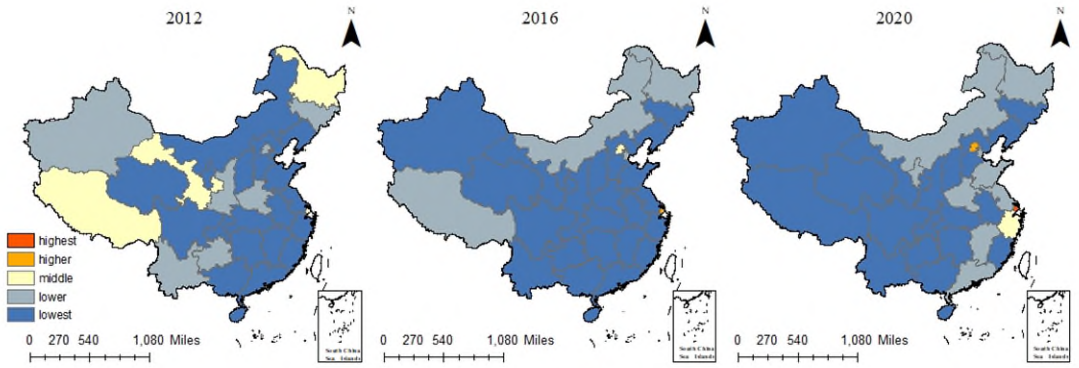


Fig.1. Evolution trend of new urbanization in provinces

The evolutionary trend of new urbanization is shown in Figure 1. There are Significant regional disparities in the development of new urbanization across China. The new urbanization is highest in the eastern regions, mostly in the third tier, with Beijing and Shanghai ranking first as the most developed. The central region ranks second on the whole. Nevertheless, the western region has the

lowest level of new urbanization, mostly in the fourth and fifth echelons. Notably, the level of new urbanization is indicating a downward tendency in the western region could result from population migration and resource allocation toward the central and eastern coastal areas. Consequently, the primary impetus for advancing new urbanization in China lies in the western regions, a finding aligning with Wang et al (2020). Furthermore, it is crucial to aware disparities imbalance of resource distributin caused by the substantial influx of population from the eastern region during the development of new urbanization, so as to preclude the continuous aggravation of rural-urban health inequality.

Simultaneously, the past long period of rapid urbanization (prolonged urbanization) intensifies the concentration of factors and resources within high-income groups and areas (e.g., economically developed cities). which in turn led to imbalanced and inadequate resource distribution, resulting in a financial resources misallocation. Financial resources misallocation will further exacerbate rural-urban health inequality by widening the gap among rural-urban groups' ownership of healthcare resources through unequal subsidies inequality and financial burdens (Rivillas et al., 2020; Mohd Hassan et al., 2022). Consequently, it is necessity to be provided with efficient resource allocation for the in-depth promotion of new urbanization, and the improvement of financial resources misallocation may represent a crucial breakthrough toward the realization of rural-urban health equality. Hence, exploring the role of amending financial resources misallocation is not only conducive to achieving new urbanization development goals and promoting rural-urban health equality, but also helps to provide practical references for resource allocation in addressing health inequality issues in developing countries.

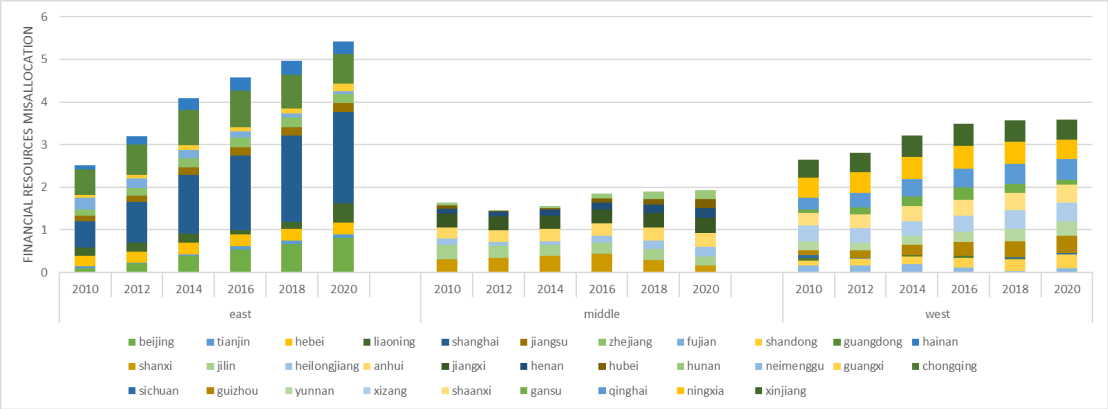


Fig.2. Evolution trend of financial resources misallocation in provinces

It can be found from measurement results that the financial resource allocation in 31 provinces in China exhibit various trends from 2010 to 2020 (Fig. 2). Provinces in the eastern region have the highest financial resources misallocation overall, displaying a significant upward trend, with the average level increasing from 0.22 to 0.49, and the proportion of provinces with a continuous upward trend is as high as 90.9 per cent. For example, Shanghai surges from 0.62 to 2.14, and Jiangsu grows from 0.14 to 0.22, both of which reach a peak in 2020. The provinces in the central region demonstrates a moderate upward trend, with the average level accumulating from 0.20 to 0.24, of which the proportion of provinces with a continuous upward trend reaches 75%. Meanwhile, the provinces in the western region have the lowest financial resources misallocation overall, presenting-a mild upward trend, with the average level rising from 0.22 to 0.30, of which the lowest proportion of upward-trending provinces is about 66.67%. Givin these findings, the improvement of financial resources misallocation in China needs to prioritize the eastern region, which enabling benevolent the positive interaction between the construction of new urbanization and the reduction of rural-urban health inequality."

This paper contributes significantly to the existing literature in following ways. Firstly, existing studies mainly focus on how income inequality, economic growth, government expenditure or

environmental pollution affect income-related health inequality (Liao, 2023). Few studies specifically examine the impact of new urbanization on rural-urban health inequality in developing countries. This paper adds new supplements to this weak line of literatures and provides empirical evidence on the relationship between new urbanization and rural-urban health inequality drawing from Chinese provincial-level data. Secondly, this paper addresses the differences in resource endowments across provinces as a pointcut to further analyze the moderating effect of financial resource endowments on the relationship between new urbanization and income-related health inequality, and verifies the role of financial resources misallocation improvement in mitigating rural-urban health inequality in new urbanization construction. Lastly, unlike previous studies more often use individual self-assessed health status as a health indicator for investigating the causes or influences of health inequality, this paper applies both subjective and objective health indicators to adopts the Gini coefficient method to monitor the degree of rural-urban health inequality in the provincial area, so as to delve the impact of new urbanization on rural-urban health inequality thoroughly.

The remainder of the paper is organized as follows: Section 2 contains literature review. In Section 3 we introduce the economic analysis methods, variables, and data description. Section 4 reports the baseline results, heterogeneous and moderating effect analysis. The robustness checks using instrumental variable method and intercepting subsample method are presented in Section 5. The discussion is in Section 6, and Section 7 provides Conclusions and implications.

2. Literature review

Urbanization is commonly linked to human well-being, yet its effects on human health remain less well-defined. Previous studies focused on the impact of urbanization on the absolute health of

the population. One strand of research argued that urbanization had a positive impact on physical and mental health (Liu et al., 2017). For instance, the mortality rates related to communicable and non-communicable disease have consistently decreased over time during China's urbanization, Factors such as enhanced healthcare, improved urban infrastructure (including piped water supply), and higher resident incomes substantially contribute to the decrease of mortality rates. Conversely, another strand of research highlighted adverse effects of urbanization on physical and mental health (Halbreich, 2023). For example, the study revealed that high-fat diets and reduced physical activity pathways attributed to urbanization hasten the health decline, and the more urbanized areas usually with higher risk of chronic disease (Miao and Wu, 2016). As another example, Morozov (2018) pointed out that in addition to stressors concerning overpopulation, environmental pollution, poverty, violence and lack of social support. Alcohol and tobacco abuse, network addiction and sleep disorders, anxiety and fear, noisy environment and visual aggressiveness were among the main factors of modern urbanization that have a detrimental effect on mental health. Senese (2013) employed the original residents as research subject and concludes that rights violations can impair health through the social determinants of health (e.g. the impact of discrimination on mental health as experienced in Toronto).

Subsequent studies explored health inequality among different groups by dividing population groups mainly in terms of socioeconomic status, geographic terrain location or age-sex differences. The first category of study focused on the impact of urbanization on the health and health disparities of various groups (Miao and Wu 2016; Chen et al. 2017; Chandra 2018; Zhang 2018; Phillipson et al. 2021; Xie et al. 2023; Bjerregaard et al. 2024). Based on data from the China Health and Nutrition Survey (CHNS) during 1991-2011, Miao and Wu (2016) found that the risk of chronic disease was

higher for those living in more urbanized areas, so that the health penalty of urbanization was more severe in high-income populations. Chen et al. (2017) applied the self-assessed health indicators for the first time to illustrate the inverted u-shaped for middle and high-income populations in urbanization-health relationship, i.e., the urbanization was detrimental to the health of the middle and high-income groups when exceeded a specific threshold. Chandra (2018) highlighted the direct and indirect effects of urbanization on the mental health of different groups in India. Concretely, the elevated rates of drug and technology addiction among youth, the heightened rates of self-harm among adolescents and women, the adverse effect of violence and abuse on women's mental health, and the emotional disturbance of older people in urban centers. Phillipson et al. (2021) similarly verified that age discrimination existed in urban environments, which made elderly health deteriorate by exacerbating their living inequality. In China, the urbanization contributed to the improvement of maternal and child health over time from 2005 to 2015 (Xie et al., 2023). Bjerregaard et al. (2024) identified an upswing in health inequality over time, based on health data in Greenland Denmark from 1993 to 2018. Simultaneously, smoking was most widespread among low socioeconomic status group and obesity was most prevalent among high socioeconomic status groups for health damage.

Another type of research investigated the causes of inequality in health, and identified main factors such as income inequality, economic growth, government spending, knowledge and skills, and environmental pollution (Van Doorslaer et al., 1997; Xu et al., 2006; Van et al., 2009; Olafsdottir, 2007; Bleich et al., 2012; Wang et al., 2017; Wang et al., 2019; Linder et al., 2020; Chen et al., 2022; Liao et al., 2023). Firstly, income inequality and income growth were recognised as critical determinants of health inequality. Time-trend data from the United States showed that the gap

between rich and poor groups is narrowing for health indicators, such as life expectancy, but widening for diabetes prevalence. In contrast, time-trend data from the UK demonstrated that the distance between the richest and poorest groups is diminishing on health indicators, such as the prevalence of high blood pressure, while enlarging for life expectancy (Bleich et al., 2012). In particular, optimized economic structure and increased government spending served to mitigate health inequality in the US states (Xu et al., 2006), while a positive income elasticity of health accounted for a small increase in health inequality in Europe (Van Ourti et al., 2009). Secondly, knowledge capability was also a crucial element. Wang et al. (2019) stated that variations in Chinese language proficiency could explain up to 20% of urban physical and mental health disparities. Chen et al. (2022) further evaluated that unequal access to health-related expertise explains about 18% of health income gradient. In addition to the effects of economy and knowledge-skill factors, recent studies observed that environmental pollution reduces the life quality of the population, and exacerbates income-related health inequality due to a tremendously negative impact on lower socioeconomic groups.

In summary, researches perform plentiful theoretical and empirical analysis around the theme of urbanization and health inequality (Chen et al. 2017; Phillipson et al. 2021; Bjerregaard et al. 2024). Nevertheless, these studies have inconsistent findings about the relationship between urbanization and health inequality, and lack a more in-depth interrogation of health inequality. Contemplating that the new urbanization construction is not only important for China's scientific urban planning and industrial structure optimization, also a pivotal initiative to boost equalized development and even common prosperity (Lin and Li, 2020; Liu et al., 2022). However, the existing studies neglected the influence of new urbanization on health inequality, particularly rural-

urban health inequality. Besides, few studies focus on the heterogeneous effects of urbanization on rural-urban health inequality, and the criteria of influencing factors selection is not standard. Accordingly, the goal of this study is to empirically detect the role of new urbanization on rural-urban health inequality from the perspectives of subjective and objective health, and further takes regiones and their resource endowments differences as a point of penetration to explore the moderating function of financial resources misallocation improvement in the new urbanization affecting rural-urban health inequality.

3. Design of related research methods

3.1. Economic analysis methods

In order to verify the influence of new urbanization on rural-urban health inequality and its heterogeneity, the first is necessary to ascertain the effect of new urbanization on rural-urban health inequality. This paper will focus on the impact of new urbanization on rural-urban health inequality from two health indicator perspectives of subjective self-assessed health and objective chronic disease. The basic form the two-fixed model is constructed as follows:

$$h_{gini} = \alpha_0 + \alpha_1 new_urban + \alpha_2 pgdp + \alpha_3 gender + \alpha_4 illiteracy + \alpha_5 facilities + \alpha_6 spending + \alpha_7 temperature + \alpha_8 pm + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

Where h_{gini} represents the rural-urban health inequality, consisting of both objective and subjective measures of health indicators. new_urban represents new urbanization. $pgdp$, $gender$, $illiteracy$, $facilities$, $spending$, $temperature$, pm are series of control variables affecting new urbanization. μ_i is regional fixed effect and λ_t is year fixed effect. ε_{it} is the random error term.

The second is to detect the moderating effect of financial resource misallocation on the influence of new urbanization on rural-urban health inequality, that is, to concentrate on testing the

facilitating effect of improved financial resource mismatch on the mitigation of economic health inequality in new urbanization. As financial resources misallocation is not only a common resource endowment and allocation problem confronted by all provinces, also intimately intertwined with the availability of healthcare resources. According to the resource misallocation theory (Peters, 2020), financial resources misallocation improvement can stem the Matthew effect and thus have a positive moderating effect on the relationship between new urbanization and rural-urban health inequality. Hence, in order to analyse the moderating effect of financial resource mismatch on new urbanization on rural-urban health inequality, this paper incorporates the interaction term between new urbanization and financial resources misallocation based on the baseline model, and the specific econometric model is as follows:

$$\mathrm{h_{gini}} = \beta_0 + \beta_1 new_urban + \beta_2 \mathrm{abstauk} \times new_urban + \beta_3 \mathrm{pgdp} + \beta_4 \mathrm{gender} + \beta_5 \mathrm{illiteracy} + \beta_6 \mathrm{facilities} + \beta_7 \mathrm{spending} + \beta_8 \mathrm{temperature} + \beta_9 \mathrm{pm} + \lambda_t + \varepsilon_{it} \quad (2)$$

Where $\mathrm{h_{gini}}$, new_urban, pgdp, gender, illiteracy, facilities, spending, temperature, pm are consistent with the above basic model (1). abstauk represents financial resources misallocation. $\mathrm{abstauk} \times new_urban$ denotes the interaction term between new urbanization and financial resource misallocation, whereby the extent of effect of financial resource mismatch on the impact of new urbanization on rural-urban health inequality. When this interaction term is positive, it indicates that a heavier misallocation of financial resources will degrade the alleviating effect of new urbanization on rural-urban health inequality, and negative value implies the opposite implication. μ_i, λ_t and ε_{it} are as same as in the above basic model (1).

3.2. Variables

3.2.1. Dependent variable

The dependent variable in this paper contains two indicators: subjective rural-urban health inequality (h_gini) and objective rural-urban health inequality (c_gini). The former is to measure rural-urban health inequality from a subjective self-rated health (Van et al., 2009; Leopold, 2019), which is exceptionally important among numerous factors affecting health. Currently, the predominantly indicator reflecting self-rated health is self-appraised health status, which comprises five categories: 5 (healthiest), 4 (very healthy), 3 (relatively healthy), 2 (average) and 1 (unhealthy). The latter is to estimate rural-urban health inequality with objective chronic disease, which is characterized by the indicators such as whether the respondent has suffered from a doctor-diagnosed chronic disease in the past six months. Anchored on the above health indicators, this paper calculates the rural-urban health inequality with Gini coefficient method (Wagstaff and Van Doorslaer, 1994).

3.2.2. Core independent variable

The core explanatory variable in this paper is new urbanization (new_urban). In view of the fact that China is in a period of deepening new urbanization, the ratio of urban population to rural population is homogeneous. Referring to Wang et al. (2019), this paper firstly constructs the new urbanization evaluation index system (Table 1), then uses the data of population, environment, space, economy, and integration indexes of 31 provinces to calculate the first four principal component values by applying the PCA, and finally calculates the new urbanization.

Table 1

Evaluation system of new urbanization.

Index I	Index II	Unit
Population index	X_1: Urban population density	Preson/Square kilometre
	X_2: Urbanization rate	%
Environment index	X_3: Harmlessness rate of municipal solid waste	%

	X_4: Per capita green area in urban	Square meter
Space index	X_5: Per capita road area in urban	Square meter
	X_6: Proportion of built-up area	%
Economy index	X_7: Per capita disposable income of urban residents	Yuan
	X_8: Per capita consumption expenditure of urban residents	Yuan
Equity index	X_9: Per capita disposable income ratio of urban and rural residents	%
	X_{10}: Per capita consumption expenditure ratio of urban and rural residents	%

Table 2 shows the eigenvectors and eigenvalues. We can obtain corresponding eigenvectors ($U_1, U_2, \ldots U_{10}$) and 10 non-negative eigenvalues. when we measure the level of new urbanization, we extract four principal components to make the cumulative contribution rate reach 0.8536.

Table 2

Eigenvectors and eigenvalues.

	U_1	U_2	U_3	U_4	U_5	U_6	U_7	U_8	U_9	U_{10}
X_1	-0.3680	0.1615	0.3107	-0.3428	-0.0213	0.3790	-0.4221	0.5449	-0.0606	0.0250
X_2	0.1107	0.6657	0.1263	-0.0240	-0.0369	-0.2442	0.1036	-0.0403	-0.6604	0.1356
X_3	-0.3840	0.1254	-0.2928	0.3382	-0.1966	-0.2804	0.3827	0.5855	0.1044	-0.1378
X_4	-0.3348	-0.0949	0.1808	-0.3301	0.6090	-0.5971	0.0289	-0.0363	0.0861	-0.0106
X_5	-0.2288	-0.2758	0.4138	0.1629	-0.6062	-0.4269	-0.2948	-0.1714	-0.0803	0.0333
X_6	-0.1108	-0.2315	0.6204	0.2539	0.1610	0.3128	0.5743	0.0117	-0.1664	0.0552
X_7	0.1439	0.5578	0.3989	0.0225	-0.0999	-0.0525	0.0804	-0.1044	0.6763	-0.1442
X_8	-0.4626	0.1136	-0.1258	-0.1962	-0.1229	0.2107	0.1307	-0.4335	-0.1394	-0.6592
X_9	-0.4563	0.1314	-0.1919	-0.1616	-0.1582	0.1457	0.1976	-0.3071	0.1752	0.7078
X_{10}	0.2914	-0.1867	0.0301	-0.7087	-0.3807	-0.1105	0.4291	0.1856	0.0034	-0.0335
Eigenvalue	4.0100	1.9890	1.7318	0.8054	0.5852	0.3575	0.2862	0.1715	0.0459	0.0169
Proportion	0.4010	0.1989	0.1731	0.0806	0.0585	0.0358	0.0286	0.0172	0.0046	0.0017
Cumulative	0.4010	0.5999	0.7730	0.8536	0.9121	0.9479	0.9765	0.9937	0.9983	1.0000

3.2.3. Moderating variable

The moderating variable is financial resources misallocation. For the measurement of financial

resources misallocation, this paper draws on the study of Hsieh and Klenow (2009), which calculates the relative distortion coefficient of capital by constructing the input-output production function, and then calculates the capital misallocation index as a proxy variable for financial resources misallocation.

3.2.4. Control variables

In order to address the problem of possible bias due to omitted variables, the econometric model also incorporates a series of control variables. (1) GDP per capita (pgdp): the Gross regional product/ the resident population at the end of the year. (2) Gender ratio (gender): the number of males /the number of females aged 15 and above. (3) Illiteracy rate (illiteracy): the number of illiterate people /total population aged 15 and above. (4) health facilities per capita (health_facilities): the number of health facilities/year-end resident population. (5) public health expenditure per capita (health_spending): local financial health expenditure/year-end resident population. (6) Temperature (temperature): the provincial average annual temperature. (7) respirable particulate matter 2.5 (pm): the provincial average annual particle concentration.

3.3. Data description

At the end of 2014, the list of China's comprehensive new urbanization pilots was officially announced one after another, this paper selects the samples in even-numbered years from 2010 to 2020. The data sources are as follows: (1) the raw data of the rural-urban health inequality indicator are from the China Family Panel Studies (CFPS) database; (2) the raw data of the new urbanization are from China's Provincial Statistical Yearbook; (3) the raw data of the financial resources misallocation indicator are from the official website of the National Bureau of Statistics; (4) the raw data of pgdp, gender, illiteracy, health_facilities, and health_spending are obtained from China's

Provincial Statistical Yearbook. In addition, the temperature data are obtained from the platform of China's Tibetan Plateau Science Data Centre, and the pm2.5 data are obtained from the National Oceanic and Atmospheric Administration (NOAA). Finally, this paper uses the interpolation method to fill in the records with obvious anomalies and individual missing values.

After excluding individual provinces with serious missing data and those that have been adjusted by administrative divisions, this paper selects 31 provinces across the country as the research sample. In order to reveal the reality of different regions in detail, this paper will adopt the provincial grouping of East, Central and West in the research process.

Descriptive statistics for the main variables are shown in Table 3.

Table 3

Descriptive statistics.

VarName	Obs	Mean	SD	Min	Max	skewness	kurtosis
h_gini	186	0.229	0.140	0.081	1.626	0.000	0.000
c_gini	186	0.090	0.117	0.029	1.376	0.000	0.000
new_urban	186	8.536	7.880	0.080	42.370	0.000	0.000
abstauk	186	0.292	0.293	0.002	2.136	0.000	0.000
pgdp	186	5.088	2.730	1.299	16.420	0.000	0.000
gender	186	1.028	0.041	0.941	1.180	0.000	0.002
illiteracy	186	0.061	0.062	0.012	0.411	0.000	0.000
health_facilities	186	75.479	32.513	20.196	211.429	0.000	0.000
health_spending	186	0.097	0.054	0.026	0.394	0.000	0.000
temperature	186	11.865	6.557	-4.022	24.622	0.004	0.667
pm	186	37.309	15.049	4.418	85.512	0.104	0.517

4. Results

4.1. Baseline results

Table 4 reports the results of testing the impact of new urbanization on health inequalities when rural-urban health inequalities are measured from both subjective self-rated health and objective chronic disease perspectives.

Columns (1)-(3) show the results of regressions estimated with random effects, fixed effects and two-way fixed effects, respectively. When rural-urban health inequality represented by a subjective self-rated health measure and controlling for a range of relevant factors, the two-way fixed effects regression results show that the effect of new urbanization on rural-urban health inequality is significantly negative at the 5% level, with a coefficient of -0.0072. Consequently, the regression results initially manifest that with the increasing of new urbanization, subjective rural-urban health inequality is mitigated.

Columns (4)-(6) suggest the results of regressions estimated with random effects, fixed effects and two-way fixed effects, respectively. Conditional on using an objective chronic disease measure of rural-urban health inequality, and controlling for a range of relevant factors, the two-way fixed effects regression results show that the effect of new urbanization on rural-urban health inequality is significantly negative at the 10% level, with a coefficient of -0.0050. Accordingly, the regression results also tentatively disclosure that as the new urbanization continues to rise, objective rural-urban health inequality is also dwindling.

Table 4

Benchmark regression results.

	(1)	(2)	(3)	(4)	(5)	(6)
	Self-rated health			Chronic disease		
	RE	FE	Two-FE	RE	FE	Two-FE
new_urban	-0.0021	-0.0053**	-0.0072**	0.0003	-0.0018	-0.0050*

	(-1.3320)	(-2.5098)	(-2.4401)	(0.2075)	(-0.9921)	(-1.9741)
pgdp	0.0041	0.0575***	0.0703***	0.0048	0.0140	0.0396**
	(0.6059)	(3.8587)	(3.1562)	(0.7512)	(1.1008)	(2.0891)
gender	0.2585	0.0894	0.0582	0.0378	-0.1252	-0.0837
	(0.9526)	(0.2912)	(0.1840)	(0.1621)	(-0.4774)	(-0.3109)
illiteracy	0.3094	-1.2933	-0.7589	0.3035	-0.2342	-0.5189
	(1.2082)	(-1.2590)	(-0.6489)	(1.2185)	(-0.2669)	(-0.5210)
health_facilities	-0.0009	-0.0024	-0.0029	-0.0005	-0.0046**	-0.0045**
	(-1.5396)	(-1.1517)	(-1.3383)	(-0.8313)	(-2.5717)	(-2.4475)
health_spending	-0.6891**	-2.9560***	-2.8775***	-0.8880***	-1.5967***	-1.7100***
	(-2.2021)	(-6.1750)	(-5.1609)	(-3.1966)	(-3.9048)	(-3.6012)
temperature	-0.0065***	0.0461**	0.0761**	-0.0048**	0.0137	0.0135
	(-2.7828)	(1.9804)	(2.4624)	(-2.0865)	(0.6900)	(0.5117)
pm	-0.0026***	-0.0009	-0.0013	-0.0024***	-0.0032**	-0.0033
	(-2.9626)	(-0.4634)	(-0.5241)	(-2.8706)	(-1.9887)	(-1.5220)
Constant	0.2495	-0.0773	-0.4024	0.2764	0.6404*	0.6000
	(0.8485)	(-0.1806)	(-0.8074)	(1.0856)	(1.7509)	(1.4137)
Prov FE	-	Y	Y	-	Y	Y
Year FE	-	N	Y	-	N	Y
R-squared	-	0.2145	0.2364	-	0.1971	0.2243
N	186	186	186	186	186	186

Notes: *, **, *** present the significance level of 10%, 5% and 1% respectively.

4.2. Heterogeneity analysis

In order to further test the effects in different regions of China, this paper divides three economic zones in the east, central and west based on the distribution of natural resources and the level of economic and social development. Table 5 reports the regional heterogeneity of the impact of new urbanization on rural-urban health inequality.

Columns (1)-(3) show the results of two-fixed effects estimation for the eastern, central and western regions. When subjective self-rated health is used to measure rural-urban health inequality

and controlling for a range of relevant factors, the regression results demonstrate that the impact of new urbanization on rural-urban health inequality in the eastern region is significantly positive at the 1% level, with a coefficient of 0.0075, indicating that the construction of new urbanization in the developed regions will not only fail to improve but even deteriorate health inequality, a result contrary to the benchmark regression. The influence of new urbanization on subjective rural-urban health inequality in the central region is positive but insignificant, with an impact coefficient of 0.0004, indicating that the construction of new urbanization in more developed regions has no effect on rural-urban health inequality, a result that is still inconsistent with the benchmark regression. The effect of new urbanization on rural-urban health inequality in the western region is significantly negative at the 1% level, with an impact coefficient of -0.0218, suggesting that the construction of new urbanization in underdeveloped regions will have a significant improvement on rural-urban health inequality. This result is similar to the benchmark regression.

Columns (4)-(6) present the results of two-fixed effects estimation for the eastern, central and western regions. When objective chronic disease is used to measure rural-urban health inequality and controlling for a range of relevant factors, the regression results show that the influence of new urbanization on objective rural-urban health inequality in the Eastern region is significantly positive at the 5% level, with a coefficient of 0.0045, implying that the construction of new urbanization not only fail to improve but even exacerbate rural-urban health inequality in developed regions, a result that is opposite to the benchmark regression. The effect of the new urbanization on rural-urban health inequality in the central region is positive but not significant, with a coefficient of 0.0005, indicating that the new urbanization has no effect on rural-urban health inequality in the more developed regions, a result that is also inconsistent with the benchmark regression. The effect of

new urbanization on rural-urban health inequality in the western region is significantly negative at the 1% level, with a coefficient of -0.0161, suggesting that the construction of new urbanization has a significant mitigating effect on rural-urban health inequality in underdeveloped regions. This result is similar to the benchmark regression.

Table 5

Heterogeneous effects of new urbanization by region.

	(1)	(2)	(3)	(4)	(5)	(6)
	Self-rated health			Chronic disease		
	(East)	(Mid)	(West)	(East)	(Mid)	(West)
new_urban	0.0075***	0.0004	-0.0218***	0.0045**	0.0005	-0.0161***
	(2.9907)	(0.6199)	(-3.4762)	(2.2010)	(0.6928)	(-3.4253)
pgdp	-0.0040	-0.0062	0.1869*	0.0084	0.0078	-0.0052
	(-0.3261)	(-1.3411)	(1.9553)	(0.8278)	(1.4514)	(-0.0729)
gender	0.1385	-0.0413	-0.7002	0.0305	0.1336	-1.0369
	(0.9673)	(-0.5088)	(-0.7993)	(0.2573)	(1.4220)	(-1.5788)
illiteracy	3.3434***	-0.0691	-1.1046	1.8486**	0.1373	-0.6060
	(3.0728)	(-0.2809)	(-0.5134)	(2.0511)	(0.4822)	(-0.3757)
health_facilities	0.0011	0.0004	-0.0064	0.0011	0.0003	-0.0086**
	(0.4774)	(1.2188)	(-1.3201)	(0.5782)	(0.9699)	(-2.3592)
health_spending	-1.7869***	-0.0165	-4.1064***	-1.5475***	0.2554	-1.3732
	(-4.9436)	(-0.1151)	(-3.3157)	(-5.1684)	(1.5413)	(-1.4790)
temperature	0.0505***	0.0023	0.0813	0.0317**	0.0067	-0.1059
	(3.2385)	(0.3951)	(0.9356)	(2.4521)	(1.0012)	(-1.6255)
pm	-0.0002	0.0005	0.0024	-0.0005	0.0005	-0.0117
	(-0.1673)	(0.8733)	(0.2563)	(-0.5113)	(0.7350)	(-1.6306)
Constant	-0.9041***	0.1014	1.1488	-0.5367*	-0.2323**	3.7980***
	(-2.7098)	(1.0451)	(0.9714)	(-1.9421)	(-2.0703)	(4.2840)
Prov FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
R-squared	0.7518	0.9801	0.3834	0.6375	0.6899	0.5433

N	66	48	72	66	48	72

4.3 Moderating effect analysis

Table 6 reports the econometric results of incorporating the interaction term of new urbanization and financial resources misallocation (new_urban and abstauk) using one-way fixed effects model and two-way fixed effects model respectively. The results show that in the case of rural-urban health inequality measured by subjective self-rated health, the coefficients of the interaction term are insignificant regardless of which fixed effects regression is used. Unevenly, as rural-urban health inequality is measured by objective chronic disease, the effects of the interaction term are significant. In columns (3) and (4), the coefficients of interaction term are 0.0043 and 0.0041 respectively, which are significantly positive at the 5% statistical level. These illustrate that the improvement of financial resources misallocation enhances the mitigating effect of new urbanization on objective rural-urban health inequality, namely, the deeper improvement in financial resources misallocation, the punchier effect of new urbanization on objective rural-urban health inequality, and this ameliorating effect is robust.

In essence, owing to the ‘preference for the rich over the poor’ in financial resource, the misallocation of financial resource makes it easier for high-income groups sand regions to access financial resources sand enjoy wealthier health-care resource given their favorable cash flow and creditworthiness, while the opposite is undisputed for lower-income groups and regions. Consequently, eliminating the misallocation of financial resource will alleviate objective rural-urban health inequality by equalizing health resources across rural-urban populations.

Table 6

Moderating effect of financial resources misallocation.

	(1)	(2)	(3)	(4)
	Self-rated health	Self-rated health	Chronic disease	Chronic disease
new_urban	-0.0071***	-0.0084***	-0.0045**	-0.0069**
	(-2.7973)	(-2.6765)	(-2.1099)	(-2.6059)
abstauknew_urban	0.0028	0.0026	0.0043**	0.0041**
	(1.2680)	(1.1151)	(2.3039)	(2.1236)
pgdp	0.0508***	0.0602**	0.0037	0.0234
	(3.2165)	(2.5022)	(0.2785)	(1.1541)
gender	0.1723	0.1447	0.0020	0.0551
	(0.5501)	(0.4449)	(0.0074)	(0.2011)
illiteracy	-1.4423	-0.8095	-0.4626	-0.6001
	(-1.3977)	(-0.6923)	(-0.5313)	(-0.6095)
health_facilities	-0.0025	-0.0031	-0.0048***	-0.0048***
	(-1.2091)	(-1.4174)	(-2.7086)	(-2.6260)
health_spending	-3.0039***	-2.9727***	-1.6703***	-1.8627***
	(-6.2685)	(-5.2746)	(-4.1312)	(-3.9252)
temperature	0.0500**	0.0769**	0.0197	0.0147
	(2.1342)	(2.4887)	(0.9973)	(0.5652)
pm	-0.0017	-0.0017	-0.0044***	-0.0039*
	(-0.8373)	(-0.6891)	(-2.6364)	(-1.8478)
Constant	-0.1176	-0.4219	0.5787	0.5687
	(-0.2744)	(-0.8468)	(1.6007)	(1.3555)
Prov FE	Y	Y	Y	Y
Year FE	N	Y	N	Y
R-squared	0.2230	0.2431	0.2253	0.2483
N	186	186	186	186

5. Robustness check

To guarantee the reliability of the above conclusions, this paper dose a series of robustness tests such as instrumental variable method and intercepted sub-sample method. First, this paper adopts the average urbanization rate of provincial cities as an instrumental variable for new urbanization. Second, this paper uses the post-capital exclusion sample and the post-epidemic exclusion sample,

respectively. The outcomes show that the robustness tests are all consistent with the regression results in Tables 4 and 6, which further demonstrate that new urbanization mitigates rural-urban health inequality in China, while the improvement in the financial resources misallocation contributes to the alleviating effect of new urbanization on objective rural-urban health inequality.

5.1. Instrumental variable method

The endogeneity problem in this paper stems mainly from the impact of rural-urban health inequality on the construction of new urbanization, but the mean of urbanization rate within provincial cities has little correlation with individual health disparities. Based on these considerations, this paper uses the mean urbanization rate of provincial cities as an instrumental variable (IV) for new provincial urbanization. After controlling for model endogeneity, the results in column 2 of Table 7 exhibit that the regression coefficient for the effect of new urbanization on subjective rural-urban health inequality is significantly negative at the 10% level, and the regression coefficient for the interaction term of new urbanization and financial resources misallocation on subjective rural-urban health inequality not significant. The results in column 4 of Table 7 depict that the regression coefficients of the effect of new urbanization on objective rural-urban health inequality are significantly negative at the 5% level, and the regression coefficients of the interaction term of new urbanization and financial resources misallocation on objective rural-urban health inequality are significantly positive at the 5% level. Hereby, the robustness of the regression results in Table 4 and 6 are verified.

Table 7

Instrumental variable results.

	(1)	(2)	(3)	(4)

	Self-rated health	Self-rated health	Chronic disease	Chronic disease
new_urban	-0.012*	-0.015*	-0.007*	-0.020**
	(0.007)	(0.009)	(0.004)	(0.010)
abstauk×new_urban		0.004		0.010**
		(0.003)		(0.005)
Controls	Y	Y	Y	Y
Prov FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
R-squared	0.204	0.198	-	-
N	186	186	186	186

Notes: i. In IV estimation, a negative R2 is not statistically significant and is left out of the report. ii: The results are IV estimation: second stage.

5.2. Intercepted subsample method

To eliminate estimation bias due to full sample selection and epidemics, this paper considers separate regressions for the sample excluding the capital (Ex_c) and the epidemics (Ex_e). The results in Table 8 identify that for both the post-capital sample and the post-epidemic sample, the regression coefficients for the effect of new urbanization on subjective and objective rural-urban health inequality are significantly negative, and the regression coefficients for the effect of the interaction term of new urbanization and financial resources misallocation on objective rural-urban health inequality is significantly positive. These manifest that the regression results in Tables 4 and 6 are still robust across the different groups.

Table 8

Intercepted subsample results.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Self-rated health				Chronic disease			
Ex_c	Ex_e	Ex_c	Ex_e	Ex_c	Ex_e	Ex_c	Ex_e

new_urban	-0.007**	-0.007**	-0.009**	-0.009***	-0.005*	-0.005*	-0.007**	-0.007**
	(-2.063)	(-2.399)	(-2.297)	(-2.654)	(-1.714)	(-1.920)	(-2.266)	(-2.592)
abstauk×			0.003	0.003			0.005*	0.004**
new_urban			(1.060)	(1.153)			(1.916)	(2.178)
Constant	-0.518	-0.428	-0.533	-0.463	0.688	0.628	0.665	0.572
	(-0.900)	(-0.830)	(-0.925)	(-0.899)	(1.347)	(1.433)	(1.318)	(1.320)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Prov FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
R-squared	0.287	0.236	0.294	0.243	0.220	0.225	0.245	0.252
N	186	186	186	186	186	186	186	186

6. Discussion

The above analysis explores the role of new urbanization in the issue of health inequalities. Existing studies focus on the risk of association between urbanization and health inequality (Wang et al., 2017; Liao et al., 2023; Bjerregaard et al., 2024). Concurrently, environmental pollution exacerbates income-related health inequality, with a greater exposure on lower socioeconomic groups. As a result of facing environmental pollution, the rich are more concerned about their health status than the poor to increase beneficial healthy behaviors, such as purchasing air purifiers, getting more sleep, smoking less or having a more balanced diet (Wang et al., 2017; Liao, 2023). Mindful of the fact that relevant studies neither explore the impact of new urbanization on health inequality nor conduct further analyses for different types of rural-urban health inequality, the conclusions validate the negative effects of urbanization on health inequalities are incongruent with our article.

There are certain limitations in this study. Firstly, considering health encompasses that consists of both physical and mental dimensions, if this article could collect provincial medical data on the mental dimension, such as the prevalence of mental disorders or the length and cost of hospitalization per capita, this paper would have drawn more elaborate and well-directed

conclusions about mitigating rural-urban health inequality. Secondly, in addition to resource endowments, environmental endowments can potentially modulate the role of new urbanization in income-related health inequalities, and groups in the same region are prone to converging healthy behaviors. For example, when cities build public infrastructure such as healthy parks and health bulletin boards, residents are probably to adopt healthy behaviors. When smoking is banned in urban public areas, people may unusually engage in unhealthy behaviors (McGeary et al., 2020). Thirdly, in addition to the differences in rural-urban status, this research do not consider the differential impacts of new urbanization on the health status of residents in different age zones, different genders, different occupations, etc., thus affecting the health disparities among different groups. Therefore, this research can design models based on micro-individual samples to further enrich the research about the effects of new urbanization on rural-urban health inequality.

Future research could enrich the literature in this area in several ways. Firstly, future researches could focus on the relationship between new urbanization and rural-urban health inequality in psychological dimensions such as mental disorders. This would provide a more comprehensive understanding of the positive effects of new urbanization on rural-urban health inequality and reveal possible solutions for reducing health disparities among different income groups in developing countries. Secondly, the investigation could approach the issue from an environmental endowment perspective to explore the actual impact of new urbanization on rural-urban health inequality across different environmental endowments. This could facilitate the exploration of how healthy behaviors in the identical environment can lead to group mimicry effects. Thirdly, the study could further use micro-individual sample design models to capture the effects of new urbanization on the health of different groups.

7. Conclusions and implications

A number of studies examine the sources of income-related health inequalities, such as income inequality, economic growth, government spending or environmental pollution, while others investigate whether urbanization is associated with income-related health inequalities, particularly in China. Although Robert (1999) constructs a theoretical framework of the relevance of urban living to health, proposing that urbanization enhances the importance of income status in protecting health, it does not furnish empirical evidence on rural-urban health inequality in the developing world. Furthermore, few studies explain the possible ways in which new urbanization can mitigate rural-urban health inequality. This paper investigates the role of new urbanization in income-related health inequality based on subjective health appraisal and objective chronic disease, utilizing Principal Component Analysis (PCA) and Gini Coefficient methods, Two-way fixed effects models and Instrumental variable methods to fill this gap. Simultaneously, this paper concerns the effect of heterogeneity in provincial resource endowments and further explores the moderating effect of improved financial resources misallocation on new urbanization construction to dilute health inequality which related to financial status.

Based on Chinese provincial panel data, this paper analyses the impact of new urbanization on rural-urban health inequality from the perspective of rural-urban status. The following conclusions can be drawn from the descriptive statistics and empirical results.

(1) From 2010 to 2020, there are considerable differences in the level and trend of new urbanization in China's provinces. Overall, the eastern region has the highest level and shows an upward trend, followed by the central region, whereas the western region has the lowest level and declines year by year.

(2) From the test of the benchmark regression, the construction of new urbanization has a narrowing effect on average rural-urban health inequality in China, implying that it has a mitigating effect on both subjective self-assessed health and objective chronic disease. The results remain robust after excluding the capital sample or the epidemic sample.

(3) From the test of regional heterogeneity, the mitigating effect of new urbanization on rural-urban health inequality holds in the western region of China, while it does not hold in the eastern and central regions. The probable explanation is that the western region has the lowest level of new urbanization and a declining trend, the new urbanization is still at a basic stage and should be actively strengthened. In contrast, the level of new urbanization in the eastern and central regions may have already exceeded their corresponding thresholds, and the rapid population growth does not match the inherent resources size and structure, making it more difficult to achieve equalisation of healthcare resources across large, medium and small cities, small towns, and new rural communities. Thus further pathway research can be conducted from the perspective of regional resource or environmental endowments.

(4) From the test of the moderating effect, the improvement of financial resources misallocation contributes to the mitigation of objective rural-urban health inequality in China's new urbanization construction. This means that, in addition to the consideration of new urbanization, resource endowment does also affect the mitigating effect on rural health inequality. When the degree of improvement in financial resources misallocation is higher, it more beneficial for rural groups to access medical resources and take health measures, thus reducing objective rural-urban health inequality.

The following policy recommendations can be put forward based on conclusions above.

(1) At present, China's new urbanization process is in an intensive stage of advancement, it is imperative to research on the refinement of new urbanization construction to alleviate subjective and objective rural-urban health inequality. For example, based on the proposed connotations of new urbanization, the Chinese government could continue to work on the following two areas: encouraging and subsiding the adoption of healthy lifestyles by low-income groups and cities, and regional integration of healthcare resources.

(2) In response to the results of the regional heterogeneity test, the appropriateness of policies for different regions should be strengthened, taking into full consideration the characteristics of new urbanization in different regions. For instance, while the new urbanization in eastern region is comparatively high, the healthcare resources owned by rural-urban groups may be more unequal; therefore, the eastern region should focus on striking a good balance of new urbanization construction, and settle the inequality of healthcare resources so as to alleviate the rural-urban health inequality.

(3) As the level of new urbanization increases, the improvement of financial resources misallocation will facilitate its role in mitigating rural-urban health inequality, so China should optimize the resource endowments allocation and ameliorate financial resources misallocation while promoting new urbanization. The Chinese government can formulate supportive policies to enable low-income groups to obtain discount loans and low-income regions to establish special industrial chains, thereby enhancing the efficiency of financial resource allocation to improve financial resources misallocation, which is conducive to the positive interaction between the construction of new urbanization and the alleviation of rural-urban health inequality.

References

Bjerregaard, P., Svartá, D. L., Ottendahl, C. B., & Larsen, C. V. L. (2024). Increasing health inequality among Inuit in Greenland from 1993 to 2018: Different patterns for household assets, urbanization and a sociocultural index as indicators of social position. *SSM-Population Health*, 25, 101635. https://doi.org/10.1016/j.ssmph.2024.101635

Bleich, S. N., Jarlenski, M. P., Bell, C. N., & LaVeist, T. A. (2012). Health inequalities: trends, progress, and policy. *Annual Review of Public Health*, 33(1), 7-40. https://doi.org/10.1146/annurev-publhealth-031811-124658

Chandra, P. S., Shiva, L., & Nanjundaswamy, M. H. (2018). The impact of urbanization on mental health in India. *Current Opinion in Psychiatry*, 31(3), 276-281. https://doi.org/10.1097/YCO.0000000000000408

Chen, H., Liu, Y., Li, Z., & Xue, D. (2017). Urbanization, economic development and health: evidence from China's labor-force dynamic survey. *International Journal for Equity in Health*, 16, 1-8. https://doi.org/10.1186/s12939-017-0705-9

Chen, J., Chen, S., Landry, P. F., & Davis, D. S. (2014). How dynamics of urbanization affect physical and mental health in urban China. *The China Quarterly*, 220, 988-1011. https://doi.org/10.1017/S0305741014001465

Chen, Y., Persson, P., & Polyakova, M. (2022). The roots of health inequality and the value of intrafamily expertise. *American Economic Journal: Applied Economics*, 14(3), 185-223. https://doi.org/10.1257/app.20200405

Gradín, C., & Wu, B. (2020). Income and consumption inequality in China: A comparative approach with India. *China Economic Review*, 62, Article 101463. https://doi.org/10.1016/j.chieco.2020.101463

Halliday, T. J., Mazumder, B., & Wong, A. (2020). The intergenerational transmission of health in the United States: A latent variables analysis. *Health Economics*, 29(3), 367–381. https://doi.org/10.1002/hec.3988

Halbreich, U. (2023). Impact of urbanization on mental health and well being. *Current Opinion in Psychiatry*, 36(3), 200-205. https://doi.org/10.1097/YCO.0000000000000864

Hsieh, C. T., & Klenow, P. J. (2009). Misallocation and manufacturing TFP in China and India. *The Quarterly Journal of Economics*, 124(4), 1403-1448. https://doi.org/10.1162/qjec.2009.124.4.1403

Lin, B. Q., & Li, Z. (2020). Spatial analysis of mainland cities' carbon emissions of and around Guangdong-Hong Kong-Macao Greater Bay area. *Sustainable Cities and Society*, 61, Article 102299. https://doi.org/10.1007/s11356-022-23880-2

Lin, W. (2009). Why has the health inequality among infants in the US declined? Accounting for the shrinking gap. *Health Economics*, 18(7), 823-841. https://doi.org/10.1002/hec.1407

Liao, L., Du, M., & Chen, Z. (2023). Environmental pollution and socioeconomic health inequality: Evidence from China. *Sustainable Cities and Society*, 95, 104579. https://doi.org/10.1016/j.scs.2023.104579

Linder, A., Spika, D., Gerdtham, U. G., Fritzell, S., & Heckley, G. (2020). Education, immigration and rising mental health inequality in Sweden. *Social Science & Medicine*, 264, 113265. https://doi.org/10.1016/j.socscimed.2020.113265

Liu, M., Liu, X., Huang, Y., Ma, Z., & Bi, J. (2017). Epidemic transition of environmental health risk during China's urbanization. *Science Bulletin*, 62(2), 92-98.

https://doi.org/10.1016/j.scib.2016.12.004

Liu, X., Li, Y. C., Chen, X. H., & Liu, J. (2022). Evaluation of low carbon city pilot policy effect on carbon abatement in China: An empirical evidence based on time-varying DID model. *Cities*, 123, Article 103582. https://doi.org/10.1016/j.cities.2022.103582

McDade, T. W., & Adair, L. S. (2001). Defining the "urban" in urbanization and health: a factor analysis approach. *Social Science & Medicine*, 53(1), 55-70. https://doi.org/10.1016/S0277-9536(00)00313-0

McGeary, K. A., Dave, D., Lipton, B., & Roeper, T. (2020). Impact of comprehensive smoking bans on the health of infants and children. *American Journal of Health Economics*, 6(1), 1-38. https://doi.org/10.1086/706622

Miao, J., & Wu, X. (2016). Urbanization, socioeconomic status and health disparity in China. *Health & place*, 42, 87-95. https://doi.org/10.1016/j.healthplace.2016.09.008

Mohd Hassan, N. Z. A., Mohd Nor Sham Kunusagaran, M. S. J., Zaimi, N. A., Aminuddin, F., Ab Rahim, F. I., Jawahir, S., & Abdul Karim, Z. (2022). The inequalities and determinants of Households' Distress Financing on Out-off-Pocket Health expenditure in Malaysia. *BMC Public Health*, 22(1), 449. https://doi.org/10.1186/s12889-022-12834-5

Morozov, P. V. (2018). Mental health and urbanization: a Russian perspective. *Current opinion in psychiatry*, 31(3), 272-275. https://doi.org/10.1097/YCO.0000000000000415

Olafsdottir, S. (2007). Fundamental causes of health disparities: stratification, the welfare state, and health in the United States and Iceland. *Journal of Health and Social Behavior*, 48(3), 239-253.

Peters, M. (2020). Heterogeneous markups, growth, and endogenous misallocation. *Econometrica*, 88(5), 2037-2073. https://doi.org/10.3982/ECTA15565

Phillipson, C., & Grenier, A. (2021). Urbanization and ageing: Ageism, inequality, and the future of "age-friendly" cities. *University of Toronto quarterly*, 90(2), 225-241. https://doi.org/10.3138/utq.90.2.11

Senese, L. C., & Wilson, K. (2013). Aboriginal urbanization and rights in Canada: Examining implications for health. *Social Science & Medicine*, 91, 219-228. https://doi.org/10.1016/j.socscimed.2013.02.016

Rivillas, J. C., Devia-Rodriguez, R., & Ingabire, M. G. (2020). Measuring socioeconomic and health financing inequality in maternal mortality in Colombia: a mixed methods approach. *International Journal for Equity in Health*, 19, 1-12. https://doi.org/10.1186/s12939-020-01219-y

Senese, L. C., & Wilson, K. (2013). Aboriginal urbanization and rights in Canada: Examining implications for health. *Social Science & Medicine*, 91, 219-228. https://doi.org/10.1016/j.socscimed.2013.02.016

Sun, C., Kahn, M. E., & Zheng, S. (2017). Self-protection investment exacerbates air pollution exposure inequality in urban China. *Ecological Economics*, 131, 468-474. https://doi.org/10.1016/j.ecolecon.2016.06.030

Van Doorslaer, E., Wagstaff, A., Bleichrodt, H., Calonge, S., Gerdtham, U. G., Gerfin, M., ... & Winkelhake, O. (1997). Income-related inequalities in health: some international comparisons. *Journal of Health Economics*, 16(1), 93-112. https://doi.org/10.1016/S0167-6296(96)00532-2

Van Ourti, T., Van Doorslaer, E., & Koolman, X. (2009). The effect of income growth and inequality on health inequality: Theory and empirical evidence from the European Panel. *Journal of Health Economics*, 28(3), 525-539. https://doi.org/10.1016/j.jhealeco.2008.12.005

Wang, H., Cheng, Z., & Smyth, R. (2019). Health outcomes, health inequality and Mandarin proficiency in urban China. *China Economic Review*, 56, Article 101305. https://doi.org/10.1016/j.chieco.2019.101305

Wang, Z., Sun, Y., & Wang, B. (2019). How does the new-type urbanization affect CO2 emissions in China? An empirical analysis from the perspective of technological progress. *Energy Economics*, 80, 917-927. https://doi.org/10.1016/j.eneco.2019.02.017

Wu, J., Cheng, D., Xu, Y., Huang, Q., & Feng, Z. (2021). Spatial-temporal change of ecosystem health across China: Urbanization impact perspective. *Journal of Cleaner Production*, 326, 129393. https://doi.org/10.1016/j.jclepro.2021.129393

Xu, K. T. (2006). State-level variations in income-related inequality in health and health achievement in the US. *Social Science & Medicine*, 63(2), 457–464. https://doi.org/10.1016/j.socscimed.2006.01.011

Ye, C., Schröder, P., Yang, D., Chen, M., Cui, C., & Zhuang, L. (2022). Toward healthy and liveable cities: a new framework linking public health to urbanization. *Environmental Research Letters*, 17(6), 064035. https://doi.org/10.1088/1748-9326/ac70eb

Zhang, N. (2018). Trends in urban/rural inequalities in cardiovascular risk bio-markers among Chinese adolescents in two decades of urbanization: 1991–2011. *International Journal for Equity in Health*, 17, 1-11. https://doi.org/10.1186/s12939-018-0813-1

Declarations

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: All data supporting the findings of this study are available within the paper and its Supplementary Information.

Conflicts of Interest: The authors declare no conflict of interest.

Ethical Approval:

This article does not contain any studies with human participants performed by any of the authors.

Informed Consent:

This article does not contain any studies with human participants performed by any of the authors.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- 20102020paneldata.xlsx