

### Supplementary Materials: Expanded Methods

Socioeconomic factors associated with hypertension prevalence, awareness, treatment and control in China, 2015–2016: spatial cross-sectional regressions modelling procedures, model fit evaluation and model selection.

Spatial analysis facilitates the investigation of geographic patterns in spatial data and instituting a relationship between health-related outcomes and other socio-environmental factors<sup>[28,29]</sup>. In this study, spatial cross-sectional regression models were constructed to deal with potential spatial autocorrelation (spatial dependency) of spatial unit attributes (provincial attributes, including hypertension prevalence, awareness, treatment, control, and socioeconomic variables) that violated the assumption of independent samples in conventional (nonspatial) statistical methods, which might lead to inefficient estimation and bias in inference extrapolation<sup>[30]</sup>.

Considering the disparities of socioeconomic variables that influenced hypertension prevalence, awareness, treatment and control, we included different proxy in separate modelling procedures for 4 hypertension accounting for potential cumulative effects of certain indicators accordingly from alternative data selected from National Bureau of Statistics in 2010<sup>[11,27]</sup>: (i) for hypertension prevalence, metabolic, behavioral, economic development and city construction variables were included; (ii) for hypertension awareness, behavioral, economic development and city construction variables were included; (iii) for hypertension treatment, behavioral, economic development, healthcare resources and social security variables were included; (iv) for hypertension control, metabolic, behavioral, economic development, city construction, healthcare resources and social security variables were all included in the analysis.

Equations of spatial cross-sectional regression models and its different types of spatial effects can be expressed as follows<sup>[33,36,37,38,51]</sup>:

(i) General spatial cross-sectional regression model: incorporating either dependent endogenous variables, independent variables spatially exogenous interactions, and error term spatially interaction.

$$Y = \rho WY + \alpha I_N + X\beta + WX\vartheta + \mu, \mu = \lambda W\mu + \epsilon \quad (1)$$

In equation (1),  $Y$  denotes the dependent variable;  $W$  denotes a non-negative spatial weight matrix to explain spatial relationship between spatial units, and presented by an object of  $n \times n$  dimensional vector;  $\rho$  denotes the (indirect) estimated coefficient that quantify the magnitude of spatially-lagged term  $WY$ ;  $\alpha$  denotes the intercept coefficient;  $I_N$  denotes an object of  $n \times 1$  dimensional column vector ( $i = 1, \dots, N$ );  $X$  denotes the exogenous independent variables presented by an object of  $n \times k$  dimensional vector ( $i = 1, \dots, N$ );  $\beta$  denotes the (direct) estimated coefficient that quantify the magnitude of  $X$  towards  $Y$ , and presented by an object of  $k \times 1$  dimensional column vector;  $\vartheta$  denotes the (indirect) estimated coefficient that quantify the magnitude of spatially-lagged term  $WX$  towards  $Y$ , and presented by an object of  $k \times 1$  dimensional column vector;  $\lambda$  denotes the estimated coefficients of spatially-lagged stochastic disturbance term  $W\mu$ , and  $\epsilon = (\epsilon_1, \dots, \epsilon_N)^T$  denotes stochastic disturbance term, among which,  $\epsilon_i$  is assumed to be an independent identically distributed sample with 0 as mean and  $\sigma^2$  as variance.

(ii) Spatial lag model (SLM, also called spatial autocorrelation regression, SAR): incorporating dependent variables spatially endogenous interactions.

$$Y = \rho WY + \alpha I_N + X\beta + \epsilon \quad (2)$$

(iii) Spatial error model (SEM): incorporating error term spatially interaction.

$$Y = \alpha I_N + X\beta + \mu, \mu = \lambda W\mu + \epsilon \quad (3)$$

(iv) Spatial Durbin model (SDM): incorporating dependent endogenous variables and independent variables spatially exogenous interactions.

$$Y = \rho WY + \alpha I_N + \chi\beta + WX\vartheta + \epsilon \quad (4)$$

(v) Spatial Durbin error model (SDEM): incorporating independent variables spatially exogenous interactions and error term spatially interaction.

$$Y = \alpha I_N + \chi\beta + WX\vartheta + \mu, \mu = \lambda W\mu + \epsilon \quad (5)$$

Spatial cross-sectional regression modelling procedures were as follows<sup>[33,34,38,51]</sup>:

**Step1. Data preparation.** Shapiro-Wilk normality test was used to examine the distribution of hypertension indicators. Multicollinearity analysis was used to ensure that the variance inflation factor (VIF) of all independent variables was less than 10.

**Step2. Moran's I calculation.** Global Moran's I statistics was calculated to detect potential spatial autocorrelation of hypertension indicators.

**Step3. OLS estimation.** The ordinary least square (OLS) regression model was established to select independent variables with the goal of maximum adjusted  $R^2$ , and to ensure that the final model could pass F-test while the selected independent variables could pass  $t$ -test. After that, the Lagrange Multiplier test (LM) and Robust Lagrange Multiplier test (Robust LM) were used to determine whether the effects of spatial lag or spatial error terms existed in the model.

**Step4. Evaluation of spatial regression models.** If the LM test passed, the SLM or SEM will be used to quantify the spatial effects of associated factors. Then SDM was introduced to further describe the direct effect, indirect effect, and total effect of the socioeconomic variables on hypertension indicators. The Likelihood Ratio (LR) test was applied to examine whether SDM should be simplified to SAR or SEM.

**Step5. Evaluation of different SDM.** The best model fitted for hypertension indicators was identified. Theoretically, a smaller Akaike Information Criterion (AIC) indicated a better model performance. Besides, Wald test, LM test, Robust LM test and LR test were approaches to examine the significance of spatial lags, a sequence of Wald test > LR test > LM test of same model indicated the plausibility interpretation of spatial lags configuration in modelling construction for dependent variables, independent variables and error term<sup>[33,34,38]</sup>. Accordingly, we selected SDEM as main model for analysis as shown in equation (5). We defined  $\gamma$  as hypertension prevalence, awareness, treatment and control and  $\chi$  as socioeconomic variables in each province of the country. We defined  $W$  as a first order queen contiguity weight matrix. In this way,  $\beta$  represented the estimated coefficient that quantify the direct magnitude of socioeconomic variables towards hypertension indicators in local province ( $Y$ );  $\vartheta$  represented estimated coefficient that quantify the indirect effects of socioeconomic variables from adjacent provinces ( $WX$ ) towards hypertension indicators in local province ( $Y$ ).

Consequently, the prevalence ( $W = 0.97, P = 0.443$ ), awareness ( $W = 0.96, P = 0.333$ ), treatment ( $W = 0.95, P = 0.106$ ) and control ( $W = 0.97, P = 0.563$ ) of hypertension at provincial level was normally distributed. Multicollinearity was not observed in selected socioeconomic variables (Supplemental Materials: Online Table S3). Significant global autocorrelation was detected for hypertension prevalence ( $P < 0.001$ ), awareness ( $P = 0.022$ ), treatment ( $P = 0.001$ ); although indicator for hypertension control ( $P = 0.089$ ) was not significantly tested spatial autocorrelated, we regarded it as spatial data in the consideration of its spatial attributes. Subsequently, according to modelling selection criterion, including AIC, Wald test, LM test, Robust LM test and LR test, the construction of SLM in hypertension awareness and treatment estimation was irrational in describing spatial relationship of spatial units, which should be excluded in model selection. Furthermore, although AIC indicated that SDM outperformed SDEM slightly in hypertension awareness, treatment and control estimation, we failed to provide robust theoretical evidence the existence of spatial lags for all 4 hypertension indicators. Additionally, we were mostly interested in controlling for spatial clustering of the specific independent variables and error term rather than the endogenous variables, we therefore avoided global spillover models which subjectively restrict the magnitude of spillover effects like SDM, and meanwhile we did not consider spatial models that used spatially lagged dependent variables (e.g. spatial Durbin, spatial autoregressive model) which may be more difficult to interpret. As a result, we selected SDEM to determine, quantify and interpret the relationship between socioeconomic variables and hypertension indicators in the main analysis<sup>[32,35]</sup>. Theoretically, SDEM returned estimates for direct, indirect, and total impacts for each explanatory variable. The direct and indirect impacts or (coefficients) for each of the socioeconomic factors and their relationship to

hypertension indicators were important for this research. Essentially, the direct impacts represented local effects and the indirect impacts represented neighbor effects. The indirect/neighbor impacts were derived from the relationship of neighboring socioeconomic factors values to local hypertension indicators values. The total impacts estimation did not include a measure of significance and was the sum of the direct and indirect impacts for each coefficient. In this study, we were interested in identifying local and neighborhood level factors rather than assessing the total impacts of a factor on hypertension indicators. Therefore, we decided to not report the total impacts.



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Characteristics	Blood pressure (mmHg, 95% CI)							Classification of hypertension (%; 95% CI)		
	SBP	DBP	Optimal	Normal	High normal	Stage 1 hypertension	Stage 2 hypertension	Stage 3 hypertension		
Couple status										
Living with another person	129.65 (129.01, 130.29)	78.12 (77.84, 78.39)	31.23 (29.71, 32.75)	34.27 (33.70, 34.84)	17.8 (17.20, 18.41)	13.09 (12.41, 13.76)	3.02 (2.82, 3.22)	0.59 (0.52, 0.66)		
Living alone	125.53 (124.30, 126.77)	74.59 (74.11, 75.06)	40.49 (38.06, 42.91)	33.81 (32.09, 35.54)	14.11 (12.57, 15.66)	8.6 (7.48, 9.73)	2.45 (2.00, 2.90)	0.54 (0.40, 0.68)		
P for difference	< 0.001	< 0.001	< 0.001	0.612	< 0.001	< 0.001	0.021	0.516		
Education										
Illiterate	141.32 (140.05, 142.60)	78.35 (77.81, 78.89)	16.39 (14.46, 18.32)	30.88 (29.94, 31.81)	22.08 (20.85, 23.30)	22.21 (21.04, 23.39)	6.89 (6.10, 7.67)	1.56 (1.18, 1.93)		
Primary school	133.63 (133.04, 134.23)	78.83 (78.54, 79.12)	24.59 (23.22, 25.96)	34.53 (33.69, 35.38)	20 (19.37, 20.63)	16.16 (15.37, 16.95)	3.9 (3.59, 4.22)	0.81 (0.70, 0.92)		
Junior high school	127.57 (126.96, 128.18)	77.98 (77.66, 78.31)	33.75 (32.18, 35.33)	35.05 (34.19, 35.92)	16.94 (16.10, 17.78)	11.33 (10.64, 12.02)	2.44 (2.23, 2.65)	0.49 (0.39, 0.58)		
Senior high school	125.29 (124.15, 126.44)	76.89 (76.42, 77.35)	38.48 (35.84, 41.13)	34.49 (33.33, 35.66)	15.37 (13.73, 17.01)	9.39 (8.13, 10.66)	1.98 (1.66, 2.29)	0.29 (0.20, 0.37)		
College graduate or above	120.66 (119.92, 121.40)	74.66 (74.27, 75.05)	48.01 (45.96, 50.07)	33.38 (32.12, 34.65)	12.08 (10.89, 13.28)	5.44 (4.71, 6.16)	0.94 (0.61, 1.27)	0.14 (0.06, 0.22)		
P for trend	< 0.001	< 0.001	< 0.001	0.183	< 0.001	< 0.001	< 0.001	< 0.001		
Employment										
Peasant	132.84 (132.34, 133.35)	78.87 (78.53, 79.21)	25.06 (23.76, 26.36)	35.46 (34.66, 36.25)	19.71 (19.11, 20.31)	15.19 (14.63, 15.75)	3.85 (3.57, 4.14)	0.73 (0.63, 0.83)		
Employed	124.42 (123.39, 125.44)	76.87 (76.43, 77.30)	39.72 (37.29, 42.16)	34.81 (33.93, 35.70)	14.83 (13.74, 15.93)	8.66 (7.70, 9.63)	1.64 (1.44, 1.85)	0.33 (0.25, 0.41)		
Housewife/husband	131.36 (130.43, 132.29)	76.93 (76.48, 77.37)	33.13 (31.40, 34.87)	29.95 (28.68, 31.23)	17.42 (16.43, 18.42)	14.42 (13.50, 15.34)	4.14 (3.59, 4.68)	0.93 (0.72, 1.15)		
Unemployment/student	123.85 (122.90, 124.80)	75 (74.50, 75.50)	44.07 (41.34, 46.80)	32.99 (30.55, 35.44)	12.8 (11.27, 14.33)	7.81 (6.65, 8.96)	1.86 (1.33, 2.39)	0.47 (0.22, 0.71)		
Retired	139.38 (138.55, 140.20)	78.96 (78.60, 79.32)	14.72 (13.24, 16.19)	31.99 (30.85, 33.14)	24.03 (22.72, 25.35)	23.19 (21.69, 24.70)	5.15 (4.59, 5.71)	0.91 (0.72, 1.10)		
P for difference	< 0.001	< 0.001	< 0.001	< 0.001	0.031	0.175	0.958	0.511		

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Characteristics	Classification of hypertension (%; 95% CI)									
	Blood pressure (mmHg, 95% CI)		SBP	DBP	Optimal	Normal	High normal	Stage 1 hypertension	Stage 2 hypertension	Stage 3 hypertension
Annual household income										
Q1 (< 16,000 yuan)	133.89 (133.05, 134.73)	78.38 (77.99, 78.77)	25.71 (23.95, 27.48)	32.9 (32.00, 33.81)	19.6 (18.71, 20.49)	16.51 (15.67, 17.34)	4.29 (3.91, 4.66)	0.99 (0.83, 1.14)		
Q2 (16,000–29,999 yuan)	131.07 (130.45, 131.69)	78.43 (78.09, 78.78)	29.04 (27.37, 30.70)	34.39 (33.24, 35.54)	18.21 (17.19, 19.24)	14.28 (13.43, 15.14)	3.32 (2.97, 3.67)	0.76 (0.58, 0.93)		
Q3 (30,000–59,999 yuan)	128.95 (128.50, 129.40)	77.88 (77.60, 78.16)	31.68 (30.20, 33.15)	35.06 (34.06, 36.06)	17.61 (16.92, 18.29)	12.23 (11.63, 12.82)	2.93 (2.68, 3.19)	0.5 (0.41, 0.59)		
Q4 (> 60,000 yuan)	125.56 (124.24, 126.87)	76.66 (76.14, 77.18)	38.34 (35.38, 41.30)	34.43 (33.36, 35.50)	15.63 (14.05, 17.21)	9.38 (8.08, 10.67)	1.86 (1.56, 2.17)	0.37 (0.28, 0.45)		
Don't know/not sure/refused	128.79 (127.90, 129.69)	77.18 (76.76, 77.59)	33.96 (31.82, 36.09)	33.49 (32.28, 34.71)	16.37 (15.33, 17.41)	12.45 (11.50, 13.40)	3.15 (2.79, 3.51)	0.58 (0.47, 0.69)		
P for trend <sup>a</sup>	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Body weight status (BMI categories, kg/m <sup>3</sup> )										
Underweight, BMI < 18.5	117.67 (116.10, 119.24)	71.24 (70.53, 71.95)	61.78 (58.39, 65.17)	23.41 (21.16, 25.66)	7.59 (6.12, 9.06)	5.63 (4.59, 6.68)	1.41 (1.06, 1.75)	0.18 (0.10, 0.26)		
Normal weight, BMI: 18.5–24.9	125.89 (125.20, 126.58)	75.53 (75.26, 75.81)	39.39 (37.66, 41.12)	33.8 (33.08, 34.52)	14.64 (13.80, 15.48)	9.58 (8.92, 10.25)	2.14 (1.96, 2.32)	0.44 (0.37, 0.51)		
Overweight, BMI: 25–29.9	134.44 (133.88, 135.00)	81 (80.72, 81.27)	19.92 (18.83, 21.00)	36.61 (35.74, 37.47)	22.37 (21.70, 23.03)	16.38 (15.58, 17.18)	3.96 (3.65, 4.27)	0.77 (0.68, 0.87)		
Obesity, BMI ≥ 30	139.63 (138.61, 140.64)	84.28 (83.83, 84.73)	11.33 (9.56, 13.09)	34.13 (32.18, 36.09)	23.31 (21.88, 24.74)	23.72 (22.20, 25.24)	6.27 (5.55, 6.99)	1.24 (0.86, 1.63)		
P for trend	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Smoking status										
Never	127.7 (126.96, 128.45)	76.52 (76.23, 76.81)	36.53 (34.84, 38.21)	32.68 (31.95, 33.41)	15.97 (15.28, 16.66)	11.52 (10.82, 12.23)	2.75 (2.53, 2.96)	0.55 (0.49, 0.62)		
Former	137.05 (136.13, 137.97)	81.25 (80.85, 81.65)	16.33 (14.74, 17.93)	35.36 (33.29, 37.44)	23.82 (22.65, 24.99)	19.09 (17.70, 20.48)	4.62 (3.88, 5.37)	0.77 (0.56, 0.98)		
Current	130.65 (129.88, 131.43)	79.43 (79.02, 79.83)	26.35 (24.40, 28.30)	37.71 (36.78, 38.63)	19.05 (18.02, 20.08)	13.22 (12.32, 14.11)	3.05 (2.77, 3.33)	0.62 (0.51, 0.74)		
P for trend	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.019	0.299		

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Characteristics	Blood pressure (mmHg, 95% CI)							Classification of hypertension (%; 95% CI)			
	SBP	DBP	Optimal	Normal	High normal	Stage 1 hypertension	Stage 2 hypertension	Stage 3 hypertension			
Drinking status											
Non-current	128.92 (128.36, 129.47)	76.66 (76.40, 76.93)	34.59 (33.13, 36.05)	32.88 (32.07, 33.70)	16.43 (15.89, 16.96)	12.48 (11.94, 13.02)	3.01 (2.80, 3.21)	0.61 (0.54, 0.69)			
Low to moderate	127.35 (126.13, 128.56)	77.85 (77.32, 78.38)	32.98 (30.25, 35.71)	36.48 (35.42, 37.55)	17.27 (15.81, 18.73)	10.57 (9.27, 11.86)	2.35 (2.03, 2.67)	0.36 (0.27, 0.44)			
Excessive	136.42 (135.57, 137.27)	83.19 (82.68, 83.69)	17.04 (15.17, 18.91)	34.32 (33.00, 35.64)	23.67 (22.47, 24.87)	19.08 (17.60, 20.56)	4.71 (4.04, 5.38)	1.19 (0.89, 1.48)			
P for difference	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.029	0.104			
Excessive drinking											
No	128.41 (127.68, 129.14)	77.05 (76.75, 77.34)	34.07 (32.39, 35.76)	34.04 (33.42, 34.67)	16.7 (16.03, 17.36)	11.86 (11.15, 12.58)	2.79 (2.61, 2.98)	0.53 (0.47, 0.59)			
Yes	136.42 (135.57, 137.27)	83.19 (82.68, 83.69)	17.04 (15.17, 18.91)	34.32 (33.00, 35.64)	23.67 (22.47, 24.87)	19.08 (17.60, 20.56)	4.71 (4.04, 5.38)	1.19 (0.89, 1.48)			
P for difference	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001			
Physical inactivity											
No	128.96 (128.26, 129.66)	77.6 (77.30, 77.90)	32.68 (31.09, 34.27)	34.22 (33.61, 34.83)	17.34 (16.60, 18.08)	12.31 (11.60, 13.02)	2.89 (2.69, 3.09)	0.57 (0.50, 0.63)			
Yes	129.17 (128.19, 130.15)	77.43 (77.06, 77.81)	32.69 (30.45, 34.93)	34.11 (32.90, 35.33)	16.78 (15.79, 17.77)	12.69 (11.66, 13.72)	3.08 (2.72, 3.45)	0.64 (0.52, 0.76)			
P for difference	0.548	0.328	0.987	0.872	0.264	0.31	0.261	0.198			

**Note.** <sup>a</sup>Category “Don’t know /not sure/refused” was excluded in the trend test. SBP: systolic blood pressure; DBP: diastolic blood pressure.

**Supplementary Table S2.** Collinearity diagnostics and variance inflation factor (VIF) of subnational level socioeconomic variables in China, 2010 (5-year lag)

Variables	Being hypertensive	Awareness among hypertensive participants	Treatment among hypertensive participants who were aware of their condition	Controlled hypertensive participants who received antihypertensive treatment
Obesity prevalence (%)	1.67	–	–	–
Current smoker prevalence (%)	1.47	1.38	1.94	1.94
Excessive drinker prevalence (%)	1.43	1.32	1.46	1.46
Physical inactivity prevalence (%)	1.13	1.13	1.66	1.66
GDP (10,000 yuan per person)	4.09	3.89	5.31	5.31
Average years of education attainment	5.44	4.07	8.10	8.10
Per capita public green areas (m <sup>2</sup> per person)	1.09	1.09	1.34	1.34
Number of medical technical personnel in healthcare institutions per 10,000 person	–	–	6.89	6.89
Beds of internal medicine per 10,000 person	–	–	2.59	2.59
Old dependency ratio (%)	–	–	1.63	1.63
OLS collinearity diagnostics (VIF)	2.69	2.65	3.20	1.64

**Supplementary Table S3-1.** Socioeconomic factors of the odds of being hypertensive among all participants in CCDNS 2015–2016

Socioeconomic variables	Estimate (95% CI)				
	OLS	SLM	SEM	SDM	SDEM
Obesity prevalence (%)	0.83 (0.30, 1.36)***	0.71 (0.24, 1.18)***	0.87 (0.48, 1.26)***	0.19 (–0.50, 0.88)	–0.27 (–0.90, 0.36)
Current smoker prevalence (%)	0.38 (0.02, 0.74)*	0.36 (0.06, 0.66)**	0.42 (0.10, 0.73)***	0.36 (0.09, 0.63)***	0.37 (0.13, 0.60)***
Excessive drinker prevalence (%)	0.52 (0.05, 1.00)**	0.42 (0.01, 0.84)**	0.50 (0.12, 0.89)**	0.19 (–0.16, 0.54)	0.22 (–0.16, 0.60)
Physical inactivity prevalence (%)	0.58 (0.21, 0.95)***	0.53 (0.22, 0.84)***	0.64 (0.35, 0.92)***	0.60 (0.28, 0.93)***	0.64 (0.31, 0.97)***
GDP (10,000 yuan per person)	–0.31 (–1.85, 1.22)	–0.09 (–1.38, 1.19)	–0.53 (–1.83, 0.78)	0.54 (–0.66, 1.74)	0.92 (–0.23, 2.06)
Average years of education attainment	1.01 (–1.80, 3.81)	0.46 (–1.92, 2.84)	1.35 (–1.02, 3.72)	0.57 (–1.63, 2.76)	0.91 (–1.33, 3.16)
Per capita public green areas (m <sup>2</sup> per person)	–0.12 (–0.67, 0.43)	–0.25 (–0.71, 0.22)	–0.04 (–0.50, 0.42)	–0.40 (–0.87, 0.07)*	–0.39 (–0.84, 0.05)*
W×Obesity prevalence (%)	–	–	–	1.59 (0.45, 2.73)***	2.03 (1.11, 2.94)***
W×Current smoker prevalence (%)	–	–	–	0.72 (0.03, 1.42)**	0.60 (–0.01, 1.20)*
W×Excessive drinker prevalence (%)	–	–	–	0.23 (–0.66, 1.12)	0.003 (–0.95, 0.95)
W×Physical inactivity prevalence (%)	–	–	–	1.05 (0.34, 1.75)***	0.96 (0.34, 1.59)***
W×GDP (10,000 yuan per person)	–	–	–	–2.62 (–5.20, –0.05)**	–2.95 (–5.46, –0.45)**
W×Average years of education attainment	–	–	–	1.4 (–3.72, 6.52)	–0.47 (–5.70, 4.75)
W×Per capita public green areas (m <sup>2</sup> per person)	–	–	–	0.17 (–1.30, 1.65)	0.28 (–1.30, 1.86)
Constant	–8.79 (–29.22, 11.63)	–9.17 (–26.47, 8.13)	–14.08 (–29.25, 1.09)*	–46.54 (–74.27, –18.81)***	–38.82 (–59.52, –18.12)***



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Socioeconomic variables	Estimate (95% CI)				
	OLS	SLM	SEM	SDM	SDEM
Observations	31	31	31	31	31
R <sup>2</sup>	0.63				
Adjusted R <sup>2</sup>	0.51				
Log Likelihood		-78.54	-79.02	-70.02	-67.99
sigma <sup>2</sup>		9.11	9.34	5.24	4
Akaike Inf. Crit.	176.78	177.09	178.03	174.03	169.98
Residual Std. Error	3.64 (df = 23)				
F Statistic	5.54*** (df = 7; 23)				
Wald Test (df = 1)		2.33	1.76	1.7	14.41***
LR Test (df = 1)		1.7	0.75	1.34	5.40**
LM Test		0.25	0.62	0.01**	0.02*

**Note.** \*  $P < 0.1$ ; \*\*  $P < 0.05$ ; \*\*\*  $P < 0.01$ . OLS: ordinary least square; SLM: spatial lag model; SEM: spatial error model; SDM: spatial Durbin model; SDEM: spatial Durbin error model; CI: confidence interval; LM: Lagrange Multiplier; LR: Lagrange multiplier.

**Supplementary Table S3-2.** Socioeconomic factors of the odds of being aware of hypertension condition among hypertensive participants

Socioeconomic variables	Estimate (95% CI)				
	OLS	SLM	SEM	SDM	SDEM
Current smoker prevalence (%)	-0.01 (-0.54, 0.53)	¥ -0.02 (-0.47, 0.43)	0.005 (-0.44, 0.45)	0.21 (-0.19, 0.61)	0.24 (-0.17, 0.65)
Excessive drinker prevalence (%)	-0.5 (-1.19, 0.20)	¥ -0.43 (-1.03, 0.17)	-0.49 (-1.01, 0.02)*	-0.50 (-1.04, 0.05)*	-0.47 (-1.02, 0.07)*
Physical inactivity prevalence (%)	0.17 (-0.40, 0.74)	0.28 (-0.21, 0.77)	0.35 (-0.06, 0.75)*	0.23 (-0.24, 0.69)	0.18 (-0.27, 0.64)
GDP (10,000 yuan per person)	3.42 (1.14, 5.70)***	3.71 (1.76, 5.65)***	3.89 (2.09, 5.70)***	3.13 (1.32, 4.94)***	2.93 (1.12, 4.74)***
Average years of education attainment	-0.07 (-3.76, 3.63)	0.18 (-3.02, 3.39)	-0.79 (-3.65, 2.06)	0.4 (-2.53, 3.34)	0.86 (-2.03, 3.76)
Per capita public green areas (m <sup>2</sup> per person)	0.47 (-0.37, 1.31)	0.47 (-0.24, 1.19)	0.22 (-0.45, 0.89)	-0.18 (-0.91, 0.56)	-0.22 (-0.95, 0.51)
W×Current smoker prevalence (%)	-	-	-	0.04 (-0.97, 1.04)	-0.04 (-1.09, 1.01)
W×Excessive drinker prevalence (%)	-	-	-	-0.54 (-1.80, 0.72)	-0.65 (-1.89, 0.60)
W×Physical inactivity prevalence (%)	-	-	-	1.58 (0.54, 2.62)***	1.73 (0.66, 2.79)***
W×GDP (10,000 yuan per person)	-	-	-	2.35 (-1.91, 6.61)	0.8 (-2.97, 4.56)
W×Average years of education attainment	-	-	-	3.62 (-2.87, 10.12)	5.34 (-1.07, 11.75)
W×Per capita public green areas (m <sup>2</sup> per person)	-	-	-	-4.07 (-6.53, -1.61)***	-4.82 (-7.13, -2.52)***
Constant	18.83 (-10.89, 48.54)	22.09 (-3.47, 47.65)*	22.11 (2.37, 41.85)**	4.03 (-39.51, 47.57)	-8.89 (-52.64, 34.85)
Observations	31	31	31	31	31
R <sup>2</sup>	0.62				
Adjusted R <sup>2</sup>	0.53				

Continued

Socioeconomic variables	Estimate (95% CI)				
	OLS	SLM	SEM	SDM	SDEM
Log Likelihood		-92.21	-91.79	-84.96	-85.24
sigma <sup>2</sup>		22.13	20.41	13.83	14.23
Akaike Inf. Crit.	202.22	202.42	201.58	199.92	200.48
Residual Std. Error	5.54 (df = 24)				
F Statistic	6.59*** (df = 6; 24)				
Wald Test (df = 1)		1.62	4.85**	1.22	0.45
LR Test (df = 1)		1.79	2.64	0.83	0.26
LM Test		0.17	0.25	0.45	0.04

**Note.** \*  $P < 0.1$ ; \*\*  $P < 0.05$ ; \*\*\*  $P < 0.01$ . OLS: ordinary least square; SLM: spatial lag model; SEM: spatial error model; SDM: spatial Durbin model; SDEM: spatial Durbin error model; CI: confidence interval; LM: Lagrange Multiplier; LR: Lagrange multiplier.

**Supplementary Table S3-3.** Socioeconomic factors of the odds of receiving antihypertensive treatment among hypertensive participants who were aware of their condition

Socioeconomic variables	Estimate (95% CI)				
	OLS	SLM	SEM	SDM	SDEM
Current smoker prevalence (%)	0.23 (-0.35, 0.81)	0.24 (-0.25, 0.73)	0.73 (0.36, 1.10)***	0.87 (0.59, 1.14)***	0.79 (0.47, 1.10)***
Excessive drinker prevalence (%)	-0.63 (-1.32, 0.05)*	-0.70 (-1.30, -0.10)**	-0.56 (-0.88, -0.24)***	-0.73 (-1.08, -0.37)***	-0.79 (-1.41, -0.16)**
Physical inactivity prevalence (%)	0.62* (0.01, 1.23)	0.58 (0.07, 1.10)**	1.09 (0.78, 1.41)***	0.87 (0.61, 1.13)***	0.73 (0.39, 1.07)***
GDP (10,000 yuan per person)	1.94 (-0.56, 4.44)	1.92 (-0.19, 4.02)*	4.43 (2.96, 5.90)***	3.36 (2.09, 4.63)***	2.67 (1.21, 4.14)***
Average years of education attainment	2.95 (-1.64, 7.54)	2.43 (-1.82, 6.68)	1.06 (-0.77, 2.89)	-1.32 (-3.91, 1.27)	-2.75 (-6.67, 1.18)
Number of medical technical personnel in healthcare institutions per 10,000 person	-0.08 (-0.29, 0.14)	-0.07 (-0.25, 0.10)	-0.14 (-0.27, -0.02)**	-0.05 (-0.16, 0.06)	0.05 (-0.13, 0.22)
Beds of internal medicine per 10,000 person	0.002 (-1.42, 1.43)	0.12 (-1.15, 1.38)	0.12 (-0.46, 0.69)	0.33 (-0.67, 1.34)	0.5 (-1.09, 2.10)
Old dependency ratio (sample survey) (%)	0.01 (-1.13, 1.15)	0.08 (-0.88, 1.05)	-0.84 (-1.36, -0.32)***	-0.28 (-0.85, 0.28)	0.26 (-0.44, 0.96)
W×Current smoker prevalence (%)	-	-	-	1.72 (0.95, 2.49)***	1.46 (0.40, 2.52)***
W×Excessive drinker prevalence (%)	-	-	-	-0.81 (-1.79, 0.18)	0.07 (-1.45, 1.59)
W×Physical inactivity prevalence (%)	-	-	-	2.55 (1.82, 3.27)***	1.63 (0.68, 2.59)***
W×GDP (10,000 yuan per person)	-	-	-	7.16 (4.54, 9.79)***	2.97 (-0.05, 5.98)*
W×Average years of education attainment	-	-	-	-0.17 (-5.06, 4.71)	0.25 (-7.05, 7.55)
W×Number of medical technical personnel in healthcare institutions per 10,000 person	-	-	-	0.02 (-0.23, 0.27)	0.03 (-0.32, 0.39)
W×Beds of internal medicine per 10,000 person	-	-	-	-0.83 (-2.30, 0.64)	-1.61 (-3.63, 0.40)
W×Old dependency ratio (%)	-	-	-	-2.80 (-4.11, -1.48)***	-3.58 (-5.35, -1.81)***

Continued

Socioeconomic variables	Estimate (95% CI)				
	OLS	SLM	SEM	SDM	SDEM
Constant	38.65 (10.84, 66.46)**	33.89 (2.54, 65.24)**	34.17 (22.68, 45.66)***	66.58 (37.03, 96.13)***	19.57 (-3.16, 42.30)*
Observations	31	31	31	31	31
R <sup>2</sup>	0.66				
Adjusted R <sup>2</sup>	0.54				
Log Likelihood		-89.76	-83.57	-70.96	-71.97
sigma <sup>2</sup>		19.12	7.69	3.98	4.24
Akaike Inf. Crit.	199.75	201.52	189.15	179.92	181.94
Residual Std. Error	5.22 (df = 22)				
F Statistic	5.38*** (df = 8; 22)				
Wald Test (df = 1)		0.28	175.98***	77.42***	60.88***
LR Test (df = 1)		0.22	12.60***	15.87***	13.85***
LM Test		0.67	0.25	0.02*	0.01**

**Note.** \**P* < 0.1; \*\**P* < 0.05; \*\*\**P* < 0.01. OLS: ordinary least square; SLM: spatial lag model; SEM: spatial error model; SDM: spatial Durbin model; SDEM: spatial Durbin error model; CI: confidence interval; LM: Lagrange Multiplier; LR: Lagrange multiplier.

**Supplementary Table S3-4.** Socioeconomic factors of the odds of controlling BP among hypertensive participants who received antihypertensive treatment

Socioeconomic variables	Estimate (95% CI)				
	OLS	SLM	SEM	SDM	SDEM
Obesity prevalence (%)	-1.56 (-2.75, -0.37)**	-1.72 (-2.68, -0.76)***	-1.77 (-2.52, -1.02)***	0.19 (-0.56, 0.94)	-0.15 (-1.00, 0.69)
Current smoker prevalence (%)	-0.08 (-0.79, 0.63)	-0.08 (-0.65, 0.49)	0.16 (-0.41, 0.74)	0.52 (0.18, 0.86)***	0.39 (0.04, 0.74)**
Excessive drinker prevalence (%)	-0.5 (-1.39, 0.39)	-0.48 (-1.18, 0.23)	-0.36 (-0.96, 0.24)	-0.17 (-0.63, 0.29)	-0.15 (-0.76, 0.46)
Physical inactivity prevalence (%)	0.56 (-0.26, 1.39)	0.62 (-0.03, 1.27)*	0.69 (0.10, 1.28)**	0.55 (0.17, 0.93)***	0.71 (0.29, 1.13)***
GDP (10,000 yuan per person)	0.61 (-2.41, 3.63)	1 (-1.44, 3.43)	1.69 (-0.91, 4.29)	0.33 (-2.40, 3.06)	0.01 (-2.57, 2.60)
Average years of education attainment	0.29 (-5.84, 6.42)	0.61 (-4.31, 5.53)	-1.05 (-4.95, 2.84)	-1.19 (-4.64, 2.25)	-0.04 (-4.45, 4.37)
Per capita public green areas (m <sup>2</sup> per person)	0.8 (-0.26, 1.86)	0.75 (-0.09, 1.58)*	0.56 (-0.27, 1.39)	0.31 (-0.45, 1.08)	0.54 (-0.22, 1.30)
Number of medical technical personnel in healthcare institutions per 10,000 persons	0.14 (-0.14, 0.43)	0.13 (-0.09, 0.36)	0.16 (-0.08, 0.40)	0.07 (-0.18, 0.32)	0.002 (-0.29, 0.29)
Beds of internal medicine per 10,000 person	0.87 (-1.28, 3.02)	0.76 (-0.96, 2.48)	0.99 (-0.36, 2.34)	1.96 (0.69, 3.24)***	2.66 (1.08, 4.23)***

Continued

Socioeconomic variables	Estimate (95% CI)				
	OLS	SLM	SEM	SDM	SDEM
Old dependency ratio (sample survey) (%)	-0.57 (-1.97, 0.84)	-0.62 (-1.73, 0.50)	-0.47 (-1.41, 0.47)	-1.56 (-2.18, -0.94)***	-1.69 (-2.42, -0.96)***
W×Obesity prevalence (%)	-	-	-	-4.65 (-6.78, -2.51)***	-2.84 (-5.09, -0.60)**
W×Current smoker prevalence (%)	-	-	-	1.31 (0.41, 2.21)***	1.24 (0.13, 2.35)**
W×Excessive drinker prevalence (%)	-	-	-	-1.20 (-2.46, 0.07)*	-0.69 (-2.42, 1.03)
W×Physical inactivity prevalence (%)	-	-	-	1.41 (0.40, 2.42)***	0.76 (-0.56, 2.09)
W×GDP (10,000 yuan per person)	-	-	-	8.51 (3.67, 13.35)***	6.35 (1.36, 11.34)**
W×Average years of education attainment	-	-	-	-1.64 (-9.11, 5.82)	-0.4 (-9.19, 8.39)
W×Per capita public green areas (m <sup>2</sup> per person)	-	-	-	-2.83 (-5.20, -0.46)**	-3.75 (-6.74, -0.76)**
W×Number of medical technical personnel in healthcare institutions per 10,000 person	-	-	-	0.27 (-0.17, 0.72)	0.28 (-0.21, 0.78)
W×Beds of internal medicine per 10,000 person	-	-	-	1.41 (-0.89, 3.71)	-0.78 (-3.35, 1.79)
W×Old dependency ratio (%)	-	-	-	1.57 (-0.01, 3.15)*	1.72 (-0.18, 3.62)*
Constant	14.45 (-23.23, 52.13)	19.15 (-13.14, 51.43)	12.47 (-12.98, 37.91)	-18.59 (-80.26, 43.07)	-27.94 (-84.87, 28.99)
Observations	31	31	31	31	31
R <sup>2</sup>	0.54				
Adjusted R <sup>2</sup>	0.31				
Log Likelihood		-93.7	-92.47	-70.17	-71.04
sigma <sup>2</sup>		24.42	20.5	4.9	4.34
Akaike Inf. Crit.	212.23	213.41	210.94	186.34	188.08
Residual Std. Error	6.27 (df = 20)				
F Statistic	2.37** (df = 10; 20)				
Wald Test (df = 1)		0.93	8.37***	9.39***	34.85***
LR Test (df = 1)		0.82	3.29*	6.34**	4.60**
LM Test		0.41	0.26	0.46	0.29

**Note.** \*  $P < 0.1$ ; \*\*  $P < 0.05$ ; \*\*\*  $P < 0.01$ . OLS: ordinary least square; SLM: spatial lag model; SEM: spatial error model; SDM: spatial Durbin model; SDEM: spatial Durbin error model; CI: confidence interval; LM: Lagrange Multiplier; LR: Lagrange multiplier.