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Urban–rural disparity in blood pressure among Chinese children: 1985–2010

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Background: Understanding the urban–rural gap in childhood blood pressure (BP) is crucial to alleviate the urban–rural disparity in burden of hypertension in the future. This study investigated trends in urban–rural BP disparity and the influence of body mass index among Chinese children between 1985 and 2010. **Methods:** Data included 1 010 153 children aged 8–17 years enrolled in the Chinese National Survey on Students' Constitution and Health, a successive national cross-sectional survey. High BP was defined according to age-sex- and height-specific 95th percentile. Multi-variable linear and logistic regression models were used to assess the urban–rural BP differentials. **Results:** Although urban children had greater prevalence of overweight and obesity than rural counterparts, rural children revealed higher levels of BP across the consecutive 25-year periods. The urban–rural disparity in prevalence of high systolic BP decreased from 2.3 (95% confidence interval: 2.3, 2.6) % to 0.2 (−0.1, 0.4) % in boys and 3.7 (3.5, 4.0) % to 0.6 (0.3, 0.8) % in girls between 1985 and 2010 after adjusting for confounding factors. Further adjustment of body mass index did not change the urban–rural disparity and its trend. The similar results were also observed for diastolic BP. **Conclusions:** Despite the urban–rural disparity in BP decreased between 1985 and 2010, rural children constantly showed higher BP levels than their urban counterparts. Since these differentials in BP cannot be explained by obesity, study of other potential factors could provide further opportunity to bridge this gap.

Introduction

Hypertension is one of the leading contributors to the global disease burden. Worldwide, 12.8% of global deaths in adults were attributed to high blood pressure (BP) each year,[1] which reached as high as 24.6% in China.[2] Contrast to adult hypertension, high BP in children is likely to have underlying secondary causes, including renal abnormalities, aortic narrowing and hypercortisolism, especially in non-obese younger children (aged < 6 years) with high BP.[3] Primary high BP is more commonly found in late childhood and adolescence and is associated with obesity, dietary behaviour and other lifestyle factors.[4] Since hypertension is a life course problem that can become evident in childhood,[5] the screening and prevention of high BP early in life can result in a life-long reduction of burden in hypertension and its associated cardiovascular diseases and deaths.

In the past 3 decades, the unprecedented socioeconomic development in China has had a significant impact on the health of urban and rural residents.[6] Although health gains have continued, the health inequalities between urban and rural areas are substantial.[6,7] However, the data on risk of cardiovascular disease, including high BP, comparing the Chinese urban and rural areas are sparse, particularly so for children. Previous surveys conducted in children from China and other countries at one point in time observed the inconsistent urban–rural differentials in BP levels.[8–12] However, few large population-based studies have been conducted, let alone the trend in the urban–rural BP disparity. Additionally, since some studies did not adjust BP for height, part of the observed differences in BP between urban and rural children may relate to their differences in height.[11–13] Furthermore, evidence also demonstrated the urban–rural difference in obesity epidemic among Chinese children.[14] Nevertheless, it is unclear whether the urban–rural BP disparity could be attributable to their difference in obesity, which is long recognised as an essential risk factor of hypertension.[15] Since the BP disparity in childhood may persist through adulthood, leading to high health care expenses, increased work absenteeism and disability later in life, a better understanding of the urban–rural gap in childhood BP is critical to alleviating it.

On the basis of national surveys between 1985 and 2010 among more than one million children, we traced secular changes in the urban–rural disparity in BP among Chinese children over the past three decades and further investigated the potential influence of body mass index (BMI) on these trends.

Methods

Study population

Data were obtained from five cycles (1985, 1995, 2000, 2005 and 2010) of Chinese National Survey on Students' Constitution and Health (CNSSCH), a national successive cross-sectional survey designed to investigate health status in Chinese school-aged children. The sampling procedures of CNSSCH have been published previously in detail.[16] In brief, these surveys used the same multistage sampling method to select students from each of the mainland provinces. Each province was classified into urban and rural area groups based on the national household registration system before they were further classified into sex-age-specific subgroups. In each subgroup, equal numbers of participants were selected by stratified cluster sampling from some classes, as clusters are randomly selected from each grade in each selected schools. Thus, an equal size of sample was obtained in each province. To ensure the accuracy of the comparison among surveys conducted in different years, not only were the subjects drawn from the same urban and rural areas but more than 85.0% of the sample schools remained the same in these surveys.

In this study, only subjects of Han ethnicity were included, who accounted for approximately 92% of the total Chinese population.

In addition, Tibet, where Han ethnicity is minority, Hainan and Chongqing, which were set up after 1985, were excluded in this study. Thus, only 28 provinces were included in this study. The participation rates in this study were quite high. For example, the rate was 99.85% in 2010. Of 1 016 572 participants aged 8–17 years, we excluded 6419 participants (0.6%) with missing data or extreme height, weight and BP values (> 5 SDs from the survey year-sex- and age-specific mean). Thus, a total of 1 010 153 participants with complete records on age, sex, height, weight and BPs were included in analyses.

These surveys were conducted according to the guidelines laid down in the Declaration of Helsinki and approved by six ministries of China, including the Ministry of Education, General Administration of Sport, Ministry of Health, State Ethnic Affairs Commission, Ministry of Science and Technology and Ministry of Finance. Formal consents were obtained from parents and students. The project of analysing the survey data was approved by the Medical Research Ethics Committee of the University of Queensland (2011001199).

Measurements

Anthropometric measurements were performed according to the same protocol at all survey sites.[16] Students were asked to wear light clothes only and to stand straight without shoes. Height was measured using a wall-mounted stadiometer to the nearest 0.1 cm, and weight was measured with a scale to the nearest 0.1 kg. Both height and weight were measured twice, and the mean value was recorded. BMI was calculated with the values of weight divided by height squared (kg/m^2). Overweight and obesity were categorised according to the sex-age-specific references suggested by Cole *et al.*[17] Additionally, BMI standard deviation score (*z*-score) was estimated based on the US CDC growth charts.[18]

BP was measured according to the recommendation of the National High Blood Pressure Education Program (NHBPEP) Working Group in Children and Adolescents,[19] using an auscultation mercury sphygmomanometer with an appropriate cuff size for children. The cuff bladder width should cover 50–75% of the circumference of the arm. BP measurements were taken at least 5 min after resting. Systolic BP was defined as the onset of 'tapping' Korotkoff sound, and diastolic BP was defined as the fifth Korotkoff sound. An average of three measurements at a single visit was calculated for each child. The child with BP ≥ age-sex- and height-specific 95th percentile according to the references of NHBPEP Working Group was defined as high BP.[19] BPs were also converted into *z*-scores by using formulas suggested by NHBPEP Working Group.[19] Because diastolic BP in children of different ages was defined by different (fourth or fifth) Korotkoff sounds between 1985 and 1995, only the data between 2000 and 2010 were analysed for diastolic BP.

Throughout all surveys, the measurement instruments were calibrated before use, and all technicians were required to pass the standard measurement test after a rigorous one-week training course. In each survey, all measurements were conducted by the same team of technicians in each province.

Statistical analysis

t-test and Chi-squared test were employed to compare anthropometric and BP variables between urban and rural children depending on the variable. To account for difference in mean age and distribution of residential region among surveys, the urban–rural disparities in height and BMI were assessed after the adjustment of age, province and urban/rural area-by-survey year interaction. For the analyses of the trend in urban–rural disparity in mean systolic BP, we used the multivariable linear models with survey year, urban/rural area and urban/rural area-by-survey year interaction as the categorical predictor and with age, height, province and height-by-survey year interaction as the confounding variables. These confounders, except height, were also used when the multivariable logistic regression model was employed to evaluate the trend in high systolic BP. To investigate the influence of BMI on these trends, BMI and BMI-by-survey year interaction were further adjusted for, and the results were presented graphically by sex-age-specific strata. Analyses were repeated for diastolic BP between 2000 and 2010. As the similar results were observed (Supplementary Tables), we only showed the results for systolic BP. A $P < 0.05$ was considered statistically significant. All analyses were performed with Stata 13 software (College Station, TX).

Results

As listed in table 1, the distributions of sex, age and urban/rural area were quite similar between 1985 and 2010. Both urban boys and girls had taller height, heavier weight and larger BMI levels than their rural counterparts in the same survey year, except levels of BMI in 1985. Although mean BPs in urban boys were higher than in rural boys in most survey years, urban boys showed a lower, if not similar, prevalence of high BP than rural boys. Meanwhile, the BP levels in urban girls were lower than, if not similar with, those in rural girls across the surveys.

Further adjustment for potential confounding factors slightly changed the urban–rural differentials in height and BMI. A decreased urban–rural disparity in adjusted height was found between 1985 and 2010 (Figure 1A and B). Meanwhile, the adjusted urban–rural disparity in BMI, as well as in the prevalence of overweight and obesity, increased between 1985 and 2005, followed by a moderate decline between 2005 and 2010. (Figure 1C and D and Supplementary Table S1).

Adjustment for height and other confounders and the urban–rural disparities in sex-specific systolic BP between 1985 and 2010 are shown in table 2. Generally, urban and rural children manifested the similar trend in systolic BP, and rural children constantly showed a higher level of BP than their urban counterparts across the consecutive 25-year periods. Furthermore, the urban–rural disparity in mean systolic BP deceased from −1.6 (95% CI: −1.7, −1.5) mm Hg to 0.04 (95% CI: −0.1, 0.2) mm Hg in boys and −2.7 (95% CI: −2.8, −2.6) mm Hg to −0.7 (95% CI: −0.9, −0.6) mm Hg in girls between 1985 and 2010. These declined trends in BP disparity were also observed when BPs were converted into sex-age-and height-specific *z*-scores. The corresponding differences in prevalence of high systolic BP reduced from −2.3 (95% CI: −2.6, −2.1)% to −0.2 (95% CI: −0.4, 0.1)% and −3.7 (95% CI: −4.0, −3.5)% to −0.6 (95% CI: −0.8, −0.3)% in boys and girls, respectively. Similar urban–rural BP disparity, as well as the decreasing trend in BP gap, was also observed for diastolic BP (Supplementary Table S2).

As shown in Figure 2, further controlling BMI did not substantially alter the decreased trends in urban–rural BP disparity over sex and age strata. However, the urban–rural differentials in high systolic BP prevalence enlarged after adjustment for BMI, with the adjusted differences in prevalence ranged from −0.5 (95% CI: −0.9, −0.2)% to −3.6 (95% CI: −4.0, −3.1)% in boys and −0.5 (95% CI: −0.8, −0.3)% to −4.6 (95% CI: −5.0, −4.2)% in girls between 1985 and 2010 depending on age groups. The same pattern of results was also observed for the urban–rural trends in diastolic BP (Supplementary Table S3).

Discussion

To our knowledge, this study is the first to investigate the trend in BP disparity between Chinese urban and rural children. Based on over one million children, higher levels of BP were observed in rural children compared to their urban counterparts. Furthermore, this urban–rural disparity in BP decreased from 1985 to 2010. Additional

Table 1 Anthropometry and BP of Chinese urban and rural children aged 8–17 years by sex and survey year (n = 1 010 153)

Area	Survey year	*n*	Age, year[a]	Height, cm[a]	Weight, kg[a]	BMI, kg/m^{2}[a]	BMI *z*-score[a]	Systolic BP, mm Hg[a]	High systolic BP, %[a]	Diastolic BP, mm Hg[a]	High diastolic BP, %[a]
Boys											
Urban	1985	85 287	12.5 (2.9)	149.3 (16.5)**	38.6 (12.5)**	16.8 (2.2)**	−0.9 (0.9)**	106.7 (11.2)**	4.0**	—	—
	1995	41 406	12.6 (2.9)	153.0 (16.2)**	42.9 (13.8)**	17.8 (2.9)**	−0.5 (1.1)**	105.9 (12.5)**	4.1**	—	—
	2000	39 745	12.5 (2.9)	153.9 (16.4)**	45.1 (15.0)**	18.5 (3.3)**	−0.2 (1.6)**	105.7 (11.9)**	3.9**	65.7 (9.5)**	3.4**
	2005	44 415	12.5 (2.9)	154.9 (16.1)**	46.8 (15.3)**	19.0 (3.5)**	−0.02 (1.2)**	105.3 (12.3)**	3.3**	65.1 (9.5)**	2.8**
	2010	41 789	12.5 (2.9)	155.9 (15.9)**	48.2 (15.7)**	19.3 (3.7)**	0.1 (1.2)**	106.9 (12.5)**	4.8	66.1 (9.6)**	3.7**
Rural	1985	85 526	12.5 (2.9)	144.9 (16.4)	36.7 (12.2)	16.9 (2.2)	−0.8 (0.8)	106.9 (11.5)	6.3	—	—
	1995	41 044	12.6 (2.9)	149.0 (16.4)	39.4 (12.9)	17.2 (2.4)	−0.7 (0.9)	105.6 (12.9)	5.4	—	—
	2000	39 964	12.5 (2.9)	150.0 (16.5)	40.5 (13.4)	17.4 (2.7)	−0.6 (1.1)	105.2 (12.1)	4.5	66.0 (9.5)	4.6
	2005	44 531	12.5 (2.9)	151.3 (16.3)	42.0 (13.7)	17.8 (2.9)	−0.4 (1.1)	104.1 (12.5)	3.6	64.6 (9.8)	3.2
	2010	41 775	12.5 (2.9)	152.9 (16.2)	44.2 (14.4)	18.4 (3.2)	−0.2 (1.1)	106.0 (12.5)	5.0	65.8 (9.6)	4.1
Girls											
Urban	1985	85 448	12.5 (2.9)	146.4 (13.0)**	37.3 (10.7)**	17.0 (2.6)**	−0.8 (0.9)**	105.0 (9.7)**	3.7**	—	—
	1995	41 582	12.6 (2.9)**	149.1 (12.4)**	40.1 (11.2)**	17.7 (2.9)**	−0.5 (1.0)**	103.2 (11.0)**	3.2**	—	—
	2000	39 731	12.5 (2.9)	149.7 (12.4)**	41.3 (11.6)**	18.1 (3.1)**	−0.3 (1.0)**	102.6 (10.5)**	3.1**	64.9 (8.8)**	3.7**
	2005	44 241	12.5 (2.9)	150.2 (12.2)**	42.2 (11.7)**	18.3 (3.1)**	−0.2 (1.0)**	101.4 (10.9)	2.3**	63.7 (9.1)**	3.1
	2010	41 735	12.5 (2.9)	151.0 (11.9)**	43.1 (11.7)**	18.5 (3.1)**	−0.2 (1.0)**	102.6 (11.0)*	3.3**	64.8 (9.0)*	3.9
Rural	1985	85 539	12.5 (2.9)	142.5 (13.6)	36.1 (11.2)	17.3 (2.7)	−0.6 (0.8)	106.7 (10.4)	7.3	—	—
	1995	40 002	12.5 (2.9)	145.5 (13.0)	37.9 (11.2)	17.4 (2.8)	−0.6 (0.9)	104.2 (11.6)	5.1	—	—
	2000	40 158	12.5 (2.9)	146.5 (12.9)	38.6 (11.3)	17.5 (2.9)	−0.5 (1.0)	103.2 (10.8)	4.0	65.6 (9.0)	4.7
	2005	44 435	12.5 (2.9)	147.4 (12.6)	39.6 (11.3)	17.8 (2.9)	−0.4 (1.0)	101.4 (11.2)	2.7	64.0 (9.3)	3.3
	2010	41 800	12.5 (2.9)	148.5 (12.4)	40.9 (11.5)	18.1 (3.0)	−0.3 (1.0)	102.7 (11.2)	3.8	64.9 (9.0)	4.1

a: Values are mean (standard deviation) or percentage.
*P < 0.05.
**P < 0.01 for the difference between urban and rural children with the same sex and survey year.

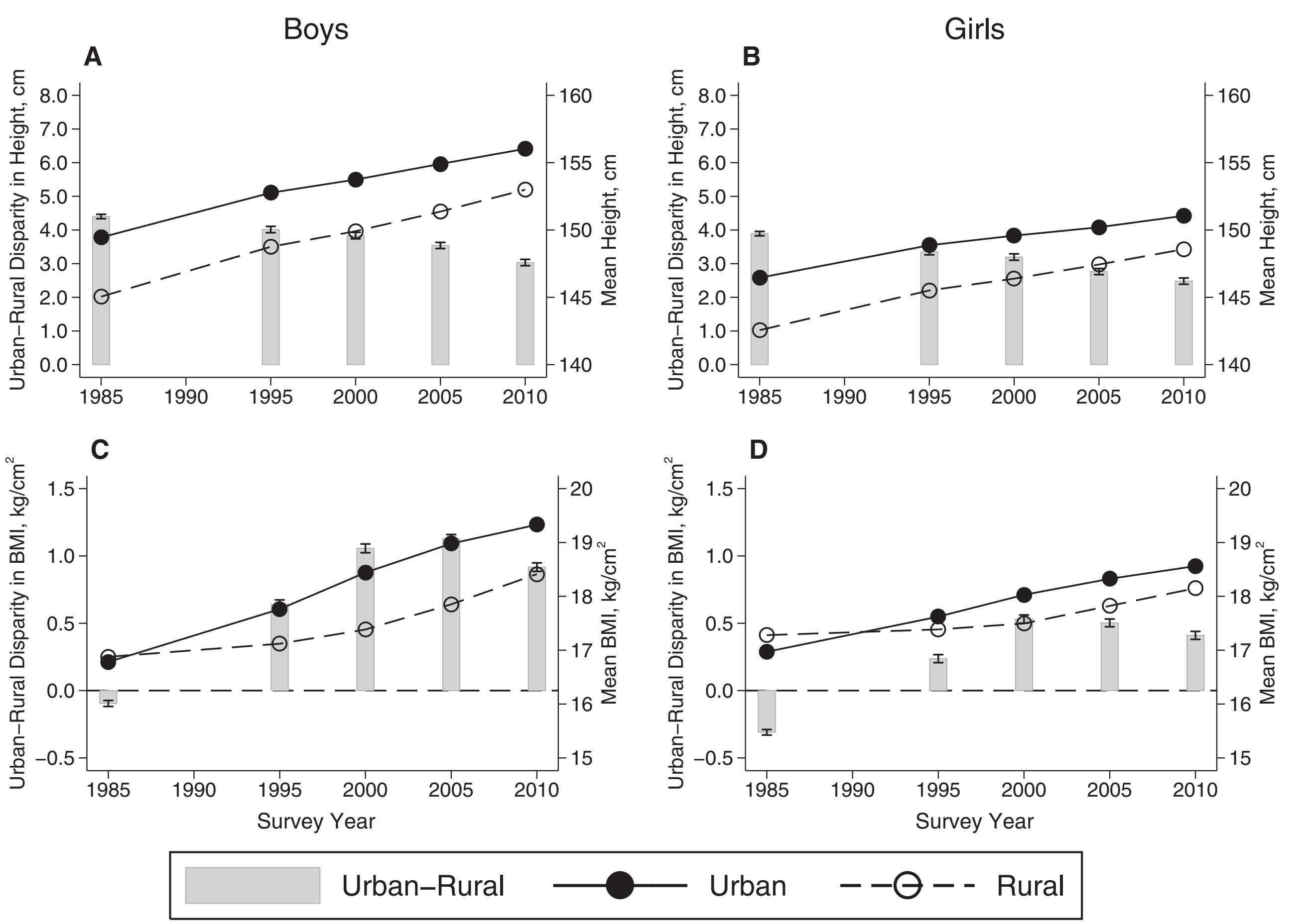

Figure 1 Urban–rural disparities in height (A and B) and BMI (C and D) in Chinese boys and girls aged 8–17 years between 1985 and 2010. The grey bars and error bars represented the adjusted mean urban–rural differences and their 95% confidence intervals, respectively, after adjusting for province, age and urban/rural area-by-survey year interaction; Solid lines and dash lines represented the adjusted mean for urban and rural children, respectively, after adjusting for province and age

Table 2 Urban–rural disparities in systolic BP, systolic BP *z*-score and prevalence of high systolic BP among Chinese children aged 8–17 years by sex and survey year ($n = 10\,10\,153$)

Sex	Survey year	Urban	Rural	Urban–rural
Systolic BP, mm Hg[a]				
Boys	1985	107.2 (107.1, 107.2)	108.8 (108.7, 108.8)	−1.6 (−1.7, −1.5)**
	1995	105.2 (105.1, 105.3)	106.1 (106.0, 106.2)	−0.9 (−1.1, −0.8)**
	2000	104.8 (104.7, 104.9)	105.4 (105.3, 105.5)	−0.6 (−0.7, −0.4)**
	2005	104.1 (104.0, 104.1)	104.0 (103.9, 104.1)	0.1 (−0.04, 0.2)
	2010	105.4 (105.3, 105.5)	105.4 (105.3, 105.5)	0.04 (−0.1, 0.2)
Girls	1985	105.2 (105.2, 105.3)	108.0 (107.9, 108.0)	−2.7 (−2.8, −2.6)**
	1995	102.7 (102.6, 102.8)	104.6 (104.5, 104.7)	−1.9 (−2.1, −1.8)**
	2000	102.0 (101.9, 102.1)	103.3 (103.2, 103.4)	−1.3 (−1.5, −1.2)**
	2005	100.6 (100.5, 100.7)	101.4 (101.3, 101.4)	−0.8 (−0.9, −0.7)**
	2010	101.7 (101.6, 101.8)	102.4 (102.3, 102.5)	−0.7 (−0.9, −0.6)**
Systolic BP *z*-score[b]				
Boys	1985	0.13 (0.12, 0.14)	0.29 (0.29, 0.30)	−0.16 (−0.17, −0.15)**
	1995	−0.06 (−0.07, −0.06)	0.04 (0.03, 0.05)	−0.10 (−0.12, −0.09)**
	2000	−0.11 (−0.12, −0.10)	−0.04 (−0.05, −0.03)	−0.07 (−0.08, −0.06)**
	2005	−0.18 (−0.19, −0.18)	−0.18 (−0.19, −0.17)	−0.01 (−0.02, 0.01)
	2010	−0.06 (−0.07, −0.05)	−0.05 (−0.06, −0.04)	−0.01 (−0.02, 0.002)
Girls	1985	0.08 (0.07, 0.08)	0.34 (0.34, 0.35)	−0.27 (−0.28, −0.26)**
	1995	−0.17 (−0.18, −0.16)	0.02 (0.01, 0.03)	−0.19 (−0.20, −0.18)**
	2000	−0.24 (−0.25, −0.23)	−0.11 (−0.12, −0.10)	−0.14 (−0.15, −0.12)**
	2005	−0.38 (−0.39, −0.37)	−0.30 (−0.31, −0.29)	−0.08 (−0.10, −0.07)**
	2010	−0.28 (−0.29, −0.27)	−0.20 (−0.21, −0.19)	−0.08 (−0.09, −0.06)**
High systolic BP, %[b]				
Boys	1985	4.0 (3.8, 4.1)	6.3 (6.1, 6.4)	−2.3 (−2.6, −2.1)**
	1995	4.1 (3.9, 4.3)	5.4 (5.2, 5.6)	−1.4 (−1.7, −1.1)**
	2000	3.9 (3.7, 4.1)	4.5 (4.3, 4.7)	−0.6 (−0.9, −0.4)**
	2005	3.3 (3.1, 3.5)	3.6 (3.5, 3.8)	−0.4 (−0.6, −0.1)**
	2010	4.8 (4.6, 5.0)	5.0 (4.8, 5.2)	−0.2 (−0.4, 0.1)
Girls	1985	3.7 (3.5, 3.8)	7.3 (7.1, 7.5)	−3.7 (−4.0, −3.5)**
	1995	3.2 (3.0, 3.4)	5.1 (4.9, 5.3)	−1.9 (−2.2, −1.6)**
	2000	3.1 (3.0, 3.3)	4.0 (3.8, 4.2)	−0.9 (−1.2, −0.6)**
	2005	2.3 (2.2, 2.4)	2.7 (2.6, 2.9)	−0.4 (−0.6, −0.2)**
	2010	3.2 (3.1, 3.4)	3.8 (3.6, 4.0)	−0.6 (−0.8, −0.3)**

Note: Values are means (95% confidence intervals).
a: Adjusted for province, age, height and height-by-survey year interaction.
b: Adjusted for province and age.
**$P < 0.01$ for the difference between urban and rural children.

adjustment of BMI did not change this declined trend in BP disparity between Chinese urban and rural children.

Several cross-sectional studies have assessed the urban–rural disparity in childhood BP. Some studies showed that urban children had higher BP levels than their rural peers,[8] others have found urban children had either similar[9,10] or lower BP levels.[11] These discordant results occurred in not only different countries[8–10] but also different sexes in the same country,[20] which indicated that the urban–rural differential in BP might vary between countries. Conflicted results were reported by studies conducted in Chinese children as well.[11,12,21] However, some of those studies did not take height into consideration.[11,12] Because childhood BP relates strongly to height independently of age and sex,[19] the lack of controlling for height complicated the interpretation of those results.[22] In our study, the differences in BP between urban and rural boys between 1995 and 2010 reversed after controlling for height.

After adjusting for height and other confounders, we found rural children generally showed higher BP than their urban counterparts across the consecutive 25-year periods. Although we did not track the birth weight, sodium intake, health behaviour and other covariates in this study, some studies reported Chinese rural infants had a higher incidence rate of low birth weight than infants in urban areas,[23] which is considered to be a risk factor for child hypertension.[24] Other surveys observed rural residents consumed more sodium and animal oil and less milk products and protein, than residents in cities.[25–27] In addition, reports showed rural children are more likely to be exposed to household second-hand smoke environment than their urban peers.[28] Furthermore, rural residents tend to have more barriers to health services, have lower levels of health knowledge and are poorer than their urban counterparts, which could result in an unhealthy lifestyle, such as an increased sodium intake.[29] Although children in rural areas tend to have more physical activities,[30] which is related to lower BP,[31] these other factors may contribute to higher BP in rural children.[24,32,33]

Though the disparity in BP between urban and rural children persisted between 1985 and 2010, our study found children in rural areas seemed to experience a greater reduction of high BP burden. A larger decrease in BP was observed in rural children compared with that in their urban counterparts, particularly between 1985 and 2005, which resulted in a substantial close in the urban–rural BP gap. Albeit the exact underlying mechanism is unclear, the improved health knowledge of parents among rural areas may contribute to the decreasing trend in BP disparity.[34] For instance, several educational interventions were conducted to improve the child feeding practices in rural areas, which demonstrated an effective improvement in caregiver's knowledge, food selection and feeding behaviours.[35,36] Additionally, modified maternal nutrition, increased access of hospital care services and increased birth weight in rural areas may also attribute to the amelioration of BP profile in children.[6,24,37] Future studies designed to investigate this decreasing urban–rural differential in BP may provide the opportunity to reduce this gap in hypertension burden.

Evidences have well documented the close relationship between elevated BMI and hypertension,[15] and studies also reported Chinese

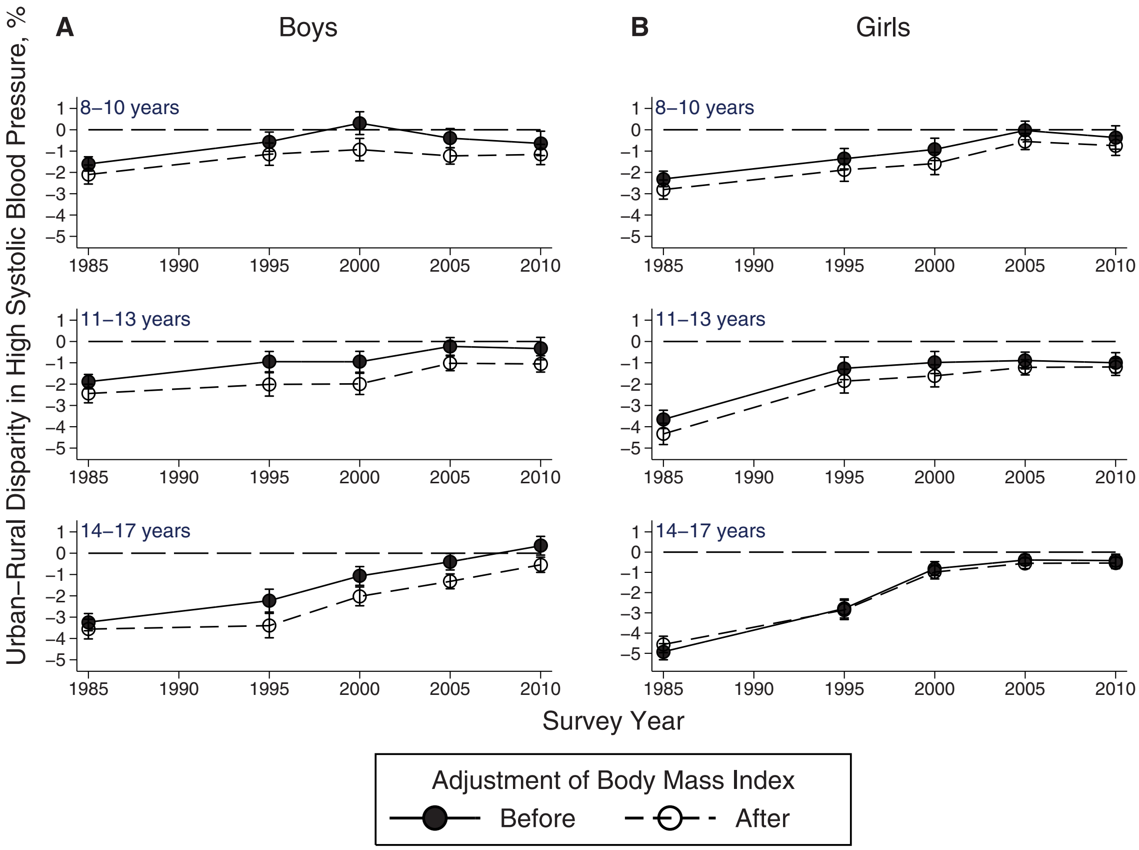

Figure 2 Urban–rural disparities in prevalence of high systolic BP before and after adjusting for BMI in Chinese boys (A) and girls (B) between 1985 and 2010. Solid lines and their error bars represented the means and 95% confidence intervals, respectively, of urban–rural disparities in prevalence of high systolic BP after adjusting for province and age. Dash lines and their error bars represented the means and 95% confidence intervals, respectively, of urban–rural disparities in high systolic BP after additionally adjusting for BMI and BMI-by-survey year interaction

urban children were suffering a more serious obesity epidemic than rural children.[16] Thus, the expanded urban–rural difference in BP after controlling for BMI observed in our study is reasonable. However, our results suggested the observed urban–rural disparity in BP was narrowed partially as the result of higher level of BMI in urban areas. The greater BMI among city children partly veiled the important influence of other hypertensive factors, including unhealthy dietary behaviour, low health educational levels and parental smoking, in rural children.

It is important to recognize that high BP in Chinese urban and rural children is attributed to multiple risk factors with different magnitudes. Compared to urban children who were undergoing an obesity epidemic, rural children were more likely to be exposed to other hypertension risk factors. Further research is needed to identify the key risk factors of hypertension in urban and rural children separately for developing interventions targeting specific subpopulations. For instance, current evidence shows a strong association between dietary salt intake and BP levels,[4] and clinical controlled trials have also demonstrated that even a modest reduce in salt intake could cause immediate falls in BP in both children and adults.[32] However, the sodium intake of Chinese residents in 2009 (4.7 g/day) was double the upper limit of the recommendation of World Health Organization.[38,39] Even higher sodium consumption levels have been observed among rural residents.[25–27] Therefore, the interventions, including government initiatives, health education and promotion of low sodium salt among food processing companies and restaurants, should give priority to the rural areas. Indeed, such campaign is ongoing named the China Rural Health Initiative Sodium Reduction Study with results to come.[40]

A limitation of our study is that BP records were based on three measurements in a single visit, which may overestimate the BP levels.[19] However, identical methods of BP measurement were performed in our study, and this is unlikely to change our findings. Second, this study was based on data that does not include environmental variables at the individual level. Additionally, because only Han students were analysed, the results may not be generalizable to other countries and ethnic groups. However, these limitations cannot minimize the implications that this is the first study evaluating the trend in BP disparity between Chinese urban and rural children and provides vital cue to bridge this gap.

Conclusion

In conclusion, Chinese rural children showed higher BP than their urban counterparts. Although this urban–rural disparity was decreasing between 1985 and 2010, the gap still existed. The policies and interventions that focus on hypertension should pay greater attention to rural children. Since this BP disparity cannot be explained by BMI, study on other potential modifiable determinants may provide further opportunities to bridge this gap.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest: None declared.

Key points

- Although Chinese rural children had a lower prevalence of obesity, they showed a higher blood pressure (BP) level than their urban counterparts between 1985 and 2010.
- Despite the urban–rural disparity in levels of childhood, BP was decreasing between 1985 and 2010, the differential still existed.
- Body mass index cannot explain the observed urban–rural disparity in BP, study of other potential factors is desired to bridge this gap.

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