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Associations of Blood Pressure With Common Factors Among Lety-Behind Farmers in Rural China: A Cross-Sectional Study Using Quantile Regression Analysis

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Abstract: The whole range of blood pressure (BP) has important implications. Yet, published studies focus primarily on hypertension and hypotension, the two extremes of BP continuum. This study aims at exploring quantile-specific associations of BP with common factors.

The study used cross-sectional survey, collected information about gender, age, education, body mass index (BMI), alcohol intake, diet risk behavior, life event index, physical activity, fasting capillary glucose (FCG), and systolic/diastolic blood pressure (SBP/DBP) and pulse pressure (PP) from farmers living in 18 villages from rural Anhui, China, and performed descriptive and multivariate and quantile regression (QR) analysis of associations of SBP, DBP, or PP with the 9 factors surveyed.

A total of 4040 (86.3%) eligible farmers completed the survey. Average hypertension prevalence rate and SBP, DBP, and PP values estimated $43.20 \pm 0.50\%$ and 141.37 ± 21.98, 87.76 ± 12.23, and 53.63 ± 15.72 mm Hg, respectively. Multivariate regression analysis revealed that all the 9 factors were significantly ($P < 0.05$) associated with one or more of SBP, DBP, and PP. QR coefficients of SBP, DBP, or PP with different factors demonstrated divergent patterns and age, BMI, FCG, and life event index showed substantial trends along the quantile axis.

Hypertension prevalence rate was high among the farmers. QR modeling provided more detailed view on associations of SBP, DBP, or PP with different factors and uncovered apparent quantile-related patterns for part of the factors. Both the population group studied and the trends in QR coefficients identified merit specific attention.

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Abbreviations: BMI = body mass index, BP = blood pressure, DBP = diastolic blood pressure, EP = effect potential, FCG = fasting capillary glucose, LBFs = left-behind farmers, PP = pulse pressure, QR = quantile regression, SBP = systolic blood pressure.

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BACKGROUND

The scope of studies on blood pressure (BP) has been expanding. Early research focused primarily on hypertension and hypotension, the 2 extremes of BP, including prevalence, influencing factors and relations with diseases, and health problems.[1] As more and more efforts have been devoted to BP, research interest began to expand to other parts of the BP continuum. In 2003, the seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high BP proposed ''prehypertension,'' and articles addressing this issue started to surge since then.[2] More recently, other aspects of BP have also come into attention. Kannel et al[3] documented a ''J-shaped'' all-cause mortality rate curve in relation to diastolic blood pressure (DBP) in a 38-year-follow-up cohort study of 5209 men and women. Mahoney et al[4] conducted a study of individuals aged >70 years and discovered that those with low systolic blood pressure (SBP) demonstrated worse executive attention than those with normal-to-high SBP, although DBP had no significant effect in their study. Yano and Kario[5] performed a systematic review of studies on nocturnal BP and cardiovascular disease and found that less nocturnal BP decline relative to daytime BP, or a high night–day BP ratio was associated with poor prognosis irrespective of the 24-hour BP levels.

Although all levels of BP (not only the 2 extremes) have health significance, there exists a huge gap in our understanding of the BP continuum. Literature about risk factors of hypertension and hypotension has been mounting; yet there is a paucity of publications on determinants of the middle parts of BP. This study aims primarily at exploring how the whole continuum of DBP, SBP, and pulse pressure (PP) is associated with commonly researched influencing factors of hypertension using quantile regression (QR) analysis. The main advantage for focusing on commonly researched influencing factors of hypertension is that it may help dispute potential misunderstandings about PB since most researchers have formed consensus over how all these factors are related to hypertension; and these commonly believed associations of hypertension can easily be extended to other parts of BP. With regard to QR, it extends the regression model to conditional quantiles of the dependent variables.[6] By modeling a set of percentile, QR provides a complete picture of the covariate effect. In addition, QR makes no distributional assumption about the error term in the model and thus enjoys high flexibility for modeling data with heterogeneous conditional distributions. Although QR is becoming popular in biomedical sciences,[7] published studies providing detailed QR models regarding BP and related factors are limited. A second objective of this study is to describe the status quo of the 3 BP measures among left-behind farmers (LBFs) in China. They represent a newly emerged weak group living in the China's vast rural areas, and researches yielding information about the health status and influencing factors among this group may have profound implications for reshaping the nation's rural health policies and service provision.

METHODOLOGY

Content of the Study

As mentioned earlier, this study collected information about commonly researched influencing factors of hypertension including demographics, alcohol intake, diet behavior, life events, and current physical activity. Smoking behavior was not included since the majority of the study population was females and prevalence of smoking among female farmers in China was very low.[8] The diet behavior inventory contained 18 structured items about common diet habits (see Text, Supplemental Text1, http://links.lww.com/MD/A74, which provides the detailed diet behavior inventory). The life event instrument comprised 20 structured items derived from commonly used instruments in China[9,10] tailored, via qualitative interviews and pilot tests, to the local sociocultural contexts of rural Anhui (see Text, Supplemental Text2, http://links.lww.com/MD/A74, which provides the detailed life event instrument). The physical activity questionnaire included 4 questions asking about daily time currently spent on base (equivalent to lying in bed), light (between lying and seating), moderate (between seating and walking), and heavy (harder than walking) activities, respectively. The demographic questions solicited data about age, gender, and education level. In addition, the study also measured body height and weight, SBP, DBP, and fasting capillary glucose (FCG).

Subject Recruitment and Field Data Collection

Criteria for subject inclusion were LBFs defined as farmers having registered rural residence and actually living at the sampled villages when this survey was conducted; 40 to 70 years old; willing to participate; and able to answer the survey questions. Sampling of site villages proceeded in the following steps: geographically dividing all the counties within Lu'an, one of the largest prefectures in Anhui province, China, into the north, center, and south regions; randomly selecting 1 county from each of the regions; randomly selecting 1 townships from each of the counties selected; and randomly selecting 6 villages from each of the townships selected. The research group from Anhui Medical University performed the randomized selection from the rosters of names of the counties, townships, and villages within the selected areas provided by the local centers for disease control and prevention. Recruitment and survey of the LBFs living in these villages started in early November 2013 and was over by the end of December 2013.

Data about the demographics, diet behaviors, and life events were collected by graduate students from Anhui Medical University using computerized instruments, while body height and weight, SBP/DBP, and FCG were collected by researchers according to relevant standard procedures.[11,12] BP was measured on the right arm using a mercurial sphygmomanometer, with the participant in the seated position and the arm resting. Two BP measurements were obtained at an interval of at least 30 minutes scheduled before and after the questionnaire, respectively. The average of these 2 BP values was used in this analysis. All the interviews and measurements took place at the village clinics. Measures that were taken to ensure data quality included training and examination of filed data collectors; use of computerized logic checks; evening checks, by quality supervisors, of all the questionnaires completed during the day; retest of 5% randomly selected subjects; feedback of errors found via the evening checks and retests; and elimination of disqualified field data collectors.

Value Assignment and Index Calculation

Assigned or calculated values used in this study included gender = 1 for males or 2 for females; education = 0, 1, 2, or 3 for no schooling, primary school, middle school, and higher than middle school education respectively; body mass index (BMI) = body weight (kg)/squared body height (m^2); fasting plasma glucose = values measured after a 8-hour fasting period using glucometer (Changsha San-Nuo Biological Sensing Technology co., LTD, Changsha, China); physical activity $= \sum_{i=1}^{4} w_i x_i$, where x_i = time (in minutes) spent on base, light, moderate, and heavy activities, respectively, and w_i = estimated calorie consumption for base ($w_1 = 3$), light ($w_2 = 4$), moderate ($w_3 = 8$), and heavy ($w_4 = 17$) activities[13]; and alcohol intake = lifetime alcohol intake (in grams).

The study also used diet risk index and life event index derived according to $\sum_{i=1}^{n} w_i x_i$. Here, i = ith item included in the life event or diet behavior instruments; x_i = value assigned to the ith item according to the number used, in the instruments, for labeling the responses; w_i = the weight of the ith item generated from a logistic regression model using "hypertension" as the dependent variable (valued as "0" if the subject's SBP/DBP measured <140/90 mm Hg or 1, otherwise) and age, gender, education, and all the x_i as the covariates. The Cronbach's alpha of the diet risk index and life event index was estimated 0.660 and 0.795, respectively.

In addition, the study calculated the effect potential (EP) of each of the factors introduced in multivariate regression models. EP = R ($F_{max} - F_{min}$), where, R stands for the regression coefficient of a dependent variable with an independent variable under concern, and F_{max} and F_{min} represent the maximum and minimum value of the independent variable, respectively, for example, if the age of the LBFs ranged 40 to 70 and the regression coefficients between age and SBP was 0.5; thus, while keeping all the other factors constant, age contributes 20 mm Hg to SBP for a 40-year-old individual and 35 mm Hg for a 70 years old. This translates into an "effect-potential" of age on SBP as 15 (=35 − 20) mm Hg.

Data Process and Analysis

Data analysis used SPSS 16.0 (SPSS Inc, Chicago, IL) and StataSE (StataCorp, College Station, TX) and comprised 5 steps: descriptive summaries intended to examine distributions and patterns of all the variables studied and check for normality of the distributions; transformations and standardization, if necessary, to induce approximate normality; analysis, using 2-sided χ^2 or t test, of null hypothesis, of the power of differences ($P < 0.05$) in the means of SBP, DBP, PP, BMI, life event index, and diet risk index between different gender, age, and medication groups; estimation, using multivariate linear regression model, of regression coefficients of SBP, DBP, and PP with the 9 factors, and related 95% confidence intervals; and calculation of quantile-specific coefficients of SBP, DBP, and PP with the 9 factors. Questionnaires with missing data were excluded from all the analysis.

Human Subject Protection

The study protocol had been reviewed and approved by the Biomedical Ethics Committee of Anhui Medical University. The farmers and village doctors participated voluntarily, and written informed consent was sought from all participants.

RESULTS

Descriptive Characteristics of Participants and BP

As shown in Table 1, a total of 4040 LBFs aged 40 to 70 years completed the survey, accounting for 86.3% of all the LBFs who met the inclusion criteria. Female LBFs overcounted males by 80.36%. The LBFs had lower than middle school education on average (1.72 ± 0.81) with female and the eldest LBFs being the least educated. Their SBP, DBP, and PP were 141.37 ± 21.98, 87.76 ± 12.23, and 53.63 ± 15.72 mm Hg, respectively. Male and older LBFs presented statistically higher SBP, DBP, PP, physical activity index, and alcohol intake than female and younger ones ($P = 0.001$–0.006), while female and younger LBFs showed greater measurements in BMI and life event index ($P < 0.001$). Thirty-two percent of the LBFs had been diagnosed with hypertension before the survey and 71.88% of them were on antihypertensive therapy. The percentage of LBFs with previously diagnosed hypertension showed gender and age difference ($P = 0.001$–0.034), while the proportion of LBFs on antihypertensive treatment was only different between age groups ($P < 0.001$). FCG turned out to be the only exception measured without any statistically significant differences between gender and age groups ($P = 0.051$–0.904).

Multivariate Relations of BP With Common Factors

Table 2 presents the main results of multivariate linear regression analysis. For total LBFs, all the 9 factors listed in the table were significantly linked to one or more of the 3 BP measures. Gender was negatively associated with SBP ($P = 0.001$) and DBP ($P = 0.000$), that is, female LBFs presented about 3.24 or 2.94 mm Hg lower SBP/DBP than did males, while all the remaining factors positively linked with the 3 BP measures. Age, BMI, FCG, diet risk index, and life event index revealed statistically significant coefficients with all the BP measures ($P = 0.000$–0.048), while education, only DBP. The EP greatly differed across factors. The top 3 potential contributors to SBP were age (21.3), BMI (40.75), and FCG (21.38); to DBP, BMI (26.84), FCG (7.61), and diet risk index (4.9); and to PP, age (18.6), BMI (13.18), and FCG (10.53). The most of the associations of BP measures with the 9 factors for LBFs not on antihypertensive therapy were similar to that for total LBFs. For LBFs on antihypertensive therapy, only 3 of the 9 factors were associated with BP with statistical significance ($P = 0.001$–0.902). Physical activity was significantly linked with SBP ($P = 0.039$) but not DBP ($P = 0.194$) and PP ($P = 0.126$). This contradicted the associations of the same factor with BP measures for LBFs not on antihypertensive therapy.

QR Models of BP With Common Factors

Tables 3 to 5 and Figures 1 to 6 provide QR statistics between the 3 BP measures and the 9 influencing factors. For total LBFs, gender was inversely related with SBP and DBP

TABLE 1. Descriptive Statistics of BP and Common Factors

BP and Related Factors ($\bar{X} \pm$ SD)/(% ± SD)	Gender: Male (n = 1441)	Gender: Female (n = 2599)	Age: 40∼ (n = 1221)	Age: 50∼ (n = 1187)	Age: 60∼ (n = 1632)	Total (n = 4040)
Education	2.03 ± 0.87	1.54 ± 0.71**	1.94 ± 0.76	1.80 ± 0.92	1.48 ± 0.68††	1.72 ± 0.81
SBP, mm Hg	144.58 ± 21.30	139.63 ± 22.15**	132.85 ± 18.19	142.65 ± 21.96	146.84 ± 22.51††	141.37 ± 21.98
DBP, mm Hg	90.07 ± 12.63	86.51 ± 11.82**	86.64 ± 11.92	89.31 ± 11.98	87.48 ± 12.50††	87.76 ± 12.23
PP, mm Hg	54.58 ± 15.48	53.12 ± 15.83**	46.28 ± 11.29	53.34 ± 15.38	59.36 ± 16.42††	53.63 ± 15.72
Prevalence of hypertension, %	48.9 ± 0.5	40.1 ± 0.49**	26.20 ± 0.44	44.7 ± 0.50	55.00 ± 0.50††	43.20 ± 0.50
Previously diagnosed hypertension, %	34.1 ± 0.47	30.8 ± 0.46**	15.6 ± 0.36	31.7 ± 0.47	43.9 ± 0.50††	32.0 ± 0.47
Antihypertensive user, %	23.7 ± 0.43	22.7 ± 0.42	8.7 ± 0.28	23.7 ± 0.43	32.9 ± 0.47††	23.0 ± 0.42
Body height, cm	164.90 ± 6.09	154.50 ± 5.73**	159.07 ± 7.34	158.27 ± 7.56	157.36 ± 7.91††	158.14 ± 7.67
Body weight, kg	65.39 ± 9.92	58.35 ± 9.20**	62.30 ± 10.04	61.64 ± 10.07	59.08 ± 9.75††	60.81 ± 10.04
BMI	24.70 ± 3.07	25.21 ± 3.37**	25.31 ± 3.20	25.32 ± 3.30	24.60 ± 3.28††	25.03 ± 3.28
Prevalence of overweight, %	43.2 ± 0.71	43.5 ± 0.75	46.0 ± 0.72	42.8 ± 0.75	41.7 ± 0.74	43.3 ± 0.74
Prevalence of obesity, %	13.1 ± 0.71	18.8 ± 0.75	17.9 ± 0.72	18.9 ± 0.75	14.5 ± 0.74	16.8 ± 0.74
Fasting capillary glucose, mmol/L	5.82 ± 0.90	5.82 ± 0.90	5.76 ± 0.98	5.83 ± 0.84	5.85 ± 0.89	5.82 ± 0.90
Physical activity	0.21 ± 1.07	−0.12 ± 0.94**	0.01 ± 1.04	0.08 ± 0.97	−0.06 ± 0.98††	0.00 ± 1.00
Diet risk index[a]	0.10 ± 0.98	−0.06 ± 1.01	−0.03 ± 1.03	−0.01 ± 0.99	0.04 ± 0.99	0.00 ± 1.00
Alcohol intake	0.69 ± 1.28	−0.36 ± 0.54**	−0.20 ± 0.76	0.03 ± 1.04	0.13 ± 1.10††	0.00 ± 1.00
Life events index[a]	−0.05 ± 1.01	0.03 ± 1.00	0.12 ± 0.94	0.06 ± 1.02	−0.13 ± 1.02††	0.00 ± 1.00

BMI = body mass index, BP = blood pressure, DBP = diastolic blood pressure, PP = pulse pressure, SBP = systolic blood pressure, SD = standard deviation. "†" and "††" denotes $P < 0.05$ and $P < 0.01$, respectively, for the power test of null difference between age groups. "*" and "**" denotes $P < 0.05$ and $P < 0.01$, respectively, for the power test of null difference between gender groups. [a]Index generated from multivariate regression coefficients.

TABLE 2. Multivariate Regression Statistics Between Blood Pressure and Common Factors

Influencing Factor	Systolic Blood Pressure				Diastolic Blood Pressure				Pulse Pressure			
	B	95%CI	*P*	EP	B	95%CI	*P*	EP	B	95%CI	*P*	EP
Total subjects ($R = 0.40, 0.35, 0.40$)												
Gender	−2.89	−4.62, −1.16	0.001	2.89	−2.94	−4.00, −1.88	0.000	2.94	−0.31	−1.49, 1.23	0.849	0.31
Age	0.71	0.62, 0.80	0.000	21.3	0.07	0.02, 0.12	0.003	2.1	0.62	0.56, 0.69	0.000	18.6
Education	0.76	−0.22, 1.73	0.129	3.04	0.95	0.40, 1.51	0.001	3.8	−0.10	−0.80, 0.60	0.785	0.4
BMI	1.67	1.44, 1.89	0.000	40.75	1.10	0.97, 1.23	0.000	26.84	0.54	0.38, 0.70	0.000	13.18
Fasting capillary glucose, mmol/L	1.32	0.52, 2.12	0.001	21.38	0.47	0.02, 0.93	0.042	7.61	0.65	0.07, 1.23	0.027	10.53
Physical activity	0.68	−0.06, 1.42	0.073	2.12	0.12	−0.30, 0.55	0.567	0.37	0.54	0.05, 1.07	0.048	1.68
Diet risk index	1.11	0.38, 1.83	0.003	8.37	0.68	0.27, 1.10	0.001	4.90	0.95	0.42, 1.48	0.000	7.14
Alcohol intake	0.54	−0.23, 1.30	0.169	2.94	0.49	0.02, 0.97	0.041	2.39	0.05	−0.55, 0.65	0.878	0.23
Life events index	1.52	0.81, 2.22	0.000	4.92	0.95	0.54, 1.35	0.000	2.94	1.31	0.76, 1.86	0.000	4.24
Constant	55.76	46.00, 65.53	0.000		56.63	51.09, 62.17	0.000		1.71	−5.45, 8.89	0.639	
Subjects on antihypertensive therapy ($R = 0.17, 0.32, 0.32$)												
Gender	−1.87	−5.67, 1.93	0.334	1.87	−2.80	−5.11, −0.50	0.017	2.8	−0.23	−3.54,3.07	0.890	0.23
Age	0.27	0.05, 0.48	0.014	11.61	−0.35	−0.47, −0.23	0.000	15.05	0.62	0.45, 0.79	0.000	26.66
Education	−0.65	−2.79, 1.50	0.553	1.95	0.39	−0.81, 1.60	0.520	1.17	0.95	−2.67, 0.76	0.274	2.85
BMI	0.57	0.10, 1.04	0.018	12.94	0.55	0.28, 0.81	0.000	12.48	0.02	−0.35, 0.40	0.902	0.45
Fasting capillary glucose, mmol/L	0.65	−0.96, 2.26	0.425	7.48	0.24	−0.65, 1.14	0.593	2.76	0.22	−1.06, 1.50	0.736	2.53
Physical activity	1.75	0.09, 3.41	0.039	5.52	0.62	−0.32, 1.55	0.194	1.96	1.03	−0.29, 2.35	0.126	3.25
Diet risk index	1.52	−0.07, 3.11	0.060	10.43	0.53	−0.36, 1.41	0.241	3.67	1.60	0.29, 2.92	0.017	11.61
Alcohol intake	−0.60	−2.09, 0.89	0.427	4.39	−0.06	−0.98, 0.86	0.893	0.29	0.90	−2.21, 0.41	0.176	4.20
Life events index	0.16	−1.39, 1.72	0.836	0.52	0.77	−0.07, 1.61	0.073	2.51	0.70	−0.64, 2.03	0.305	2.27
Constant	125.46	102.44, 148.49	0.000		102.50	89.54, 115.45	0.000		25.59	6.98, 44.20	0.007	
Subjects not on antihypertensive therapy ($R = 0.38, 0.34, 0.38$)												
Gender	−3.27	−5.09, −1.44	0.000	3.27	−2.93	−4.08, −1.78	0.000	2.93	−0.19	−1.60, 1.22	0.791	0.19
Age	0.60	0.50, 0.69	0.000	28.80	0.07	0.02, 0.13	0.010	3.36	0.51	0.44, 0.57	0.000	24.48
Education	0.98	−0.05, 2.01	0.063	3.92	1.05	0.45, 1.65	0.001	4.20	0.03	−0.70, 0.75	0.946	0.12
BMI	1.52	1.28, 1.77	0.000	37.06	1.06	0.91, 1.20	0.000	25.85	0.44	0.27, 0.62	0.000	10.73
Fasting capillary glucose, mmol/L	1.26	0.38, 2.13	0.005	20.41	0.39	−0.12, 0.90	0.136	6.32	0.64	0.02, 1.26	0.045	10.37
Physical activity	0.66	−0.13, 1.44	0.100	2.08	1.09	−0.37, 0.55	0.703	3.44	0.56	0.01, 1.12	0.045	1.77
Diet risk index	0.65	−0.12, 1.42	0.099	4.90	0.51	0.06, 0.96	0.026	3.54	0.77	0.22, 1.32	0.007	5.69
Alcohol intake	0.64	−0.21, 1.48	0.139	4.69	0.53	−0.01, 1.07	0.052	2.58	0.27	−0.38, 0.92	0.413	1.26
Life events index	1.63	0.89, 2.38	0.000	5.28	0.82	0.38, 1.27	0.000	2.67	1.34	0.77, 1.91	0.000	4.35
Constant	63.15	52.51, 73.80	0.000		56.83	50.62, 63.04	0.000		8.87	1.20, 16.54	0.024	

B = multivariate regression coefficient, BMI = body mass index, CI = confidence interval, EP = effect potential.

TABLE 3. Quantile regression coefficients and 95% confidence intervals between blood pressure and common factors for total subjects

Related Factors	Quantile 10	Quantile 20	Quantile 30	Quantile 40	Quantile 50	Quantile 60	Quantile 70	Quantile 80	Quantile 90
Systolic blood pressure									
Gender	−4.00 [−6.81, −1.19]	−3.58 [−5.87, −1.28]	−2.99 [−5.18, −0.81]	−3.01 [−4.70, −1.33]	−3.12 [−5.48, −0.76]	−3.53 [−5.57, −1.50]	−2.94 [−5.33, −0.56]	−3.28 [−7.37, 0.81]	−0.89 [−5.27, 3.49]
Age	0.45 [0.36, 0.55]	0.51 [0.38, 0.64]	0.54 [0.44, 0.64]	0.57 [0.47, 0.66]	0.67 [0.56, 0.78]	0.79 [0.68, 0.90]	0.82 [0.72, 0.91]	0.88 [0.73, 1.02]	1.13 [0.95, 1.30]
Education	1.26[0.41,2.11]	0.67[−0.07,1.42]	0.79 [0.18,1.41]	0.33[−0.64,1.30]	0.95[0.11,1.80]	1.18[0.29,2.07]	1.35[0.35,2.35]	0.06[−1.64,1.75]	1.83[−0.59,4.25]
BMI	1.58[1.31,1.85]	1.74[1.37,2.10]	1.75 [1.46,2.04]	1.75[1.41,2.09]	1.68[1.41,1.95]	1.74[1.48,2.00]	1.64[1.31,1.97]	1.63[1.18,2.08]	1.71[1.25,2.17]
Fasting capillary glucose	1.15[0.23,2.07]	0.61[0.11,1.11]	0.19 [−0.56,0.95]	0.55[−0.38,1.48]	1.18[−0.16,2.52]	1.70[0.73,2.68]	2.16[1.25,3.06]	2.16[0.53,3.80]	3.87[1.73,6.01]
Physical activity	0.55[−0.47,1.57]	0.51[−0.28,1.29]	0.19 [−0.53,0.92]	0.28[−0.40,0.96]	0.14[−0.67,0.95]	0.54[−0.27,1.35]	0.65[−0.21,1.51]	0.71[−0.26,1.67]	1.25[−0.16,2.67]
Diet risk index	0.52[−0.62,1.66]	0.78[−0.22,1.79]	0.92 [0.00,1.84]	1.24[0.47,2.00]	1.19[0.21,2.17]	1.43[0.29,2.58]	1.30[0.54,2.07]	1.64[0.55,2.73]	1.20[−0.64,3.05]
Alcohol intake	0.81[0.09,1.53]	0.72[−0.28,1.72]	0.72 [0.05,1.39]	0.55[−0.23,1.33]	0.66[−0.44,1.76]	0.57[−0.41,1.56]	0.61[−0.74,1.97]	0.81[−0.45,2.07]	−0.45[−1.83,0.93]
Life events index	1.47[0.61,2.33]	1.47[0.70,2.23]	1.81 [1.17,2.46]	2.08[1.23,2.93]	2.44[1.43,3.45]	2.24[1.30,3.17]	1.99[0.86,3.11]	1.41[0.04,2.78]	−0.06[−2.04,1.91]
Diastolic blood pressure									
Gender	−2.62[−4.39, −0.86]	−1.81[−2.92, −0.69]	−1.98[−3.51,−0.46]	−2.38[−3.84, −0.91]	−2.57[−4.06, −1.07]	−3.06[−4.39, −1.74]	−3.32[−4.50, −2.13]	−3.29[−4.53, −2.04]	−3.31[−5.06, −1.57]
Age	0.02[−0.07,0.11]	0.04[−0.04,0.12]	0.04 [−0.03,0.11]	0.06[−0.01,0.12]	0.09[0.01,0.17]	0.11[0.04,0.17]	0.12[0.03,0.21]	0.12[0.03,0.20]	0.17[0.07,0.26]
Education	0.79[−0.33,1.90]	0.83[0.27,1.39]	0.75 [0.18,1.31]	0.99[0.42,1.56]	0.92[0.34,1.49]	1.04[0.39,1.69]	1.08[0.36,1.79]	1.24[0.39,2.09]	1.33[0.10,2.56]
BMI	1.02[0.83,1.21]	1.01[0.85,1.17]	1.03 [0.87,1.18]	1.09[0.96,1.22]	1.11[0.97,1.26]	1.14[0.92,1.36]	1.20[1.04,1.36]	1.18[1.04,1.32]	1.15[0.92,1.38]
Fasting capillary glucose	0.49[−0.10,1.09]	0.41[−0.07,0.89]	0.32 [−0.20,0.83]	0.41[−0.01,0.84]	0.29[−0.31,0.88]	0.31[−0.30,0.93]	0.55[−0.20,1.30]	0.73[−0.16,1.62]	0.93[−0.34,2.19]
Physical activity index	−0.09[−0.86, 0.67]	0.37[−0.21,0.95]	0.27[−0.20,0.74]	0.28[−0.23,0.78]	0.10[−0.38,0.58]	0.32[−0.26,0.90]	0.04[−0.50,0.58]	−0.13[−0.81, 0.55]	−0.18[−0.96,0.60]
Diet risk index	−0.41[−1.01,0.20]	−0.04[−0.50,0.42]	0.35 [−0.07,0.76]	0.82[0.43,1.21]	0.92[0.46,1.39]	0.86[0.28,1.45]	0.89[0.32,1.46]	1.15[0.44,1.86]	1.06[0.34,1.78]
Alcohol intake	0.23[−0.52,0.98]	0.33[−0.13,0.79]	0.45 [−0.21,1.12]	0.48[−0.10,1.07]	0.44[−0.17,1.04]	0.42[−0.26,1.10]	0.57[−0.18,1.33]	0.52[−0.10,1.13]	1.08[0.28,1.88]
Life event index	0.84 [0.11, 1.56]	0.80 [0.30, 1.30]	0.77 [0.21, 1.34]	0.97 [0.53, 1.41]	1.17 [0.68, 1.65]	1.16 [0.61, 1.71]	1.37 [0.64, 2.11]	1.15 [0.42, 1.88]	0.80 [−0.13, 1.72]
Pulse pressure									
Gender	0.05 [−1.41, 1.50]	0.48 [−0.82, 1.78]	−0.21 [−1.99, 1.57]	−0.50 [−1.93, 0.92]	−0.24 [−1.80, 1.31]	0.23 [−1.36, 1.82]	−0.22 [−1.86, 1.43]	−1.14 [−3.72, 1.44]	−0.66 [−3.75, 2.43]
Age	0.33 [0.24, 0.41]	0.44 [0.38, 0.50]	0.48 [0.42, 0.54]	0.52 [0.47, 0.58]	0.55 [0.49, 0.60]	0.60 [0.52, 0.67]	0.69 [0.61, 0.78]	0.77 [0.64, 0.89]	0.98 [0.83, 1.13]
Education	−0.28 [−0.93, 0.38]	0.25 [−0.33, 0.82]	0.08 [−0.53, 0.69]	0.10 [−0.57, 0.76]	−0.06 [−0.95, 0.83]	−0.38 [−1.14, 0.37]	−0.46 [−1.37, 0.45]	−0.14 [−1.28, 1.00]	−0.11 [−1.55, 1.32]
BMI	0.55 [0.42, 0.67]	0.54 [0.41, 0.67]	0.41 [0.28, 0.54]	0.38 [0.18, 0.59]	0.46 [0.21, 0.70]	0.57 [0.36, 0.77]	0.67 [0.41, 0.93]	0.61 [0.33, 0.90]	0.74 [0.35, 1.13]
Fasting capillary glucose	0.07 [−0.42, 0.57]	−0.01 [−0.55, 0.53]	0.18 [−0.44, 0.79]	0.50 [−0.27, 1.27]	0.83 [0.24, 1.41]	0.57 [−0.08, 1.22]	0.71 [−0.08, 1.49]	0.70 [−0.14, 1.54]	2.41 [1.12, 3.70]
Physical activity	0.34 [−0.65, 1.33]	0.58 [0.08, 1.09]	0.37 [−0.17, 0.91]	0.41 [−0.17, 0.99]	0.37 [−0.22, 0.97]	0.42 [−0.22, 1.06]	0.65 [−0.06, 1.36]	0.58 [−0.38, 1.54]	0.68 [−0.63, 2.00]
Diet risk index	0.31 [−0.40, 1.01]	0.82 [0.15, 1.50]	0.80 [0.20, 1.41]	0.78 [0.37, 1.19]	0.93 [0.42, 1.43]	1.17 [0.51, 1.84]	0.76 [0.00, 1.51]	0.94 [−0.15, 2.03]	0.93 [−0.23, 2.08]
Alcohol intake	0.44 [−0.40, 1.28]	0.13 [−0.58, 0.84]	0.19 [−0.75, 1.14]	0.41 [−0.33, 1.15]	0.49 [−0.32, 1.30]	0.74 [−0.06, 1.54]	0.00 [−0.65, 0.64]	−0.26 [−1.52, 0.99]	−0.85 [−2.33, 0.63]
Life event index	1.14 [0.51, 1.77]	1.10 [0.67, 1.52]	1.39 [0.92, 1.86]	1.12 [0.70, 1.53]	1.31 [0.71, 1.91]	1.66 [0.91, 2.41]	1.58 [0.97, 2.20]	1.44 [0.42, 2.46]	0.56 [−0.56, 1.68]

BMI = body mass index.

TABLE 4. Quantile Regression Coefficients and 95% Confidence Intervals Between Blood Pressure and Common Factors for Subjects on Antihypertensive Therapy

Related Factors	Quantile 10	Quantile 20	Quantile 30	Quantile 40	Quantile 50	Quantile 60	Quantile 70	Quantile 80	Quantile 90
Systolic blood pressure									
Gender	−2.32[−8.52,3.89]	−4.04[−9.06,0.98]	−3.36[−7.82,1.11]	−4.48[−9.33,0.38]	−4.21[−7.64,−0.78]	−3.19[−6.73,0.35]	−1.82[−7.60,3.96]	−1.13[−7.47,5.20]	1.18[−5.72,8.08]
Age	0.03[−0.23,0.29]	0.21[0.05,0.37]	0.29[0.09,0.48]	0.33[0.09,0.57]	0.29[0.09,0.49]	0.17[−0.10,0.43]	0.27[−0.11,0.65]	0.42[−0.06,0.90]	0.26[−0.11,0.63]
Education	1.92[−0.27,4.10]	−0.30[−2.38,1.79]	−0.76[−3.46,1.93]	−1.11[−4.24,2.03]	−1.18[−4.20,1.84]	−1.00[−4.01,2.01]	−0.59[−3.93,2.75]	−1.02[−5.56,3.52]	−1.19[−5.22,2.83]
BMI	1.08[0.60,1.57]	0.96[0.54,1.39]	0.91[0.32,1.50]	0.77[0.21,1.33]	0.66[0.25,1.08]	0.29[−0.27,0.86]	0.35[−0.30,0.99]	0.33[−0.47,1.14]	0.32[−0.75,1.39]
Fasting capillary glucose	1.17[0.03,2.31]	0.12[−0.51,0.74]	−0.39[−1.92,1.13]	0.70[−1.21,2.60]	1.14[−0.89,3.16]	1.38[−1.41,4.18]	0.72[−2.40,3.85]	1.40[−2.43,5.22]	−0.70[−4.47,3.06]
Physical activity	−0.41[−3.02,2.20]	−0.13[−2.16,1.89]	1.18[−0.72,3.09]	1.45[−0.51,3.41]	0.91[−0.38,2.21]	1.59[−0.46,3.65]	1.75[−0.50,3.99]	2.62[−0.58,5.81]	5.20[2.09,8.32]
Diet risk index	1.20[−0.86,3.25]	2.23[0.93,3.52]	2.22[0.07,4.36]	1.25[−0.23,2.73]	1.35[−0.20,2.89]	1.50[−0.31,3.32]	2.50[0.25,4.74]	1.11[−2.38,4.60]	0.63[−2.25,3.52]
Alcohol intake	0.35[−1.00,1.70]	−0.38[−1.60,0.85]	−0.17[−1.60,1.27]	−1.42[−2.71,−0.13]	−1.18[−3.33,0.98]	−0.60[−3.00,1.79]	−0.48[−2.87,1.90]	−0.80[−2.85,1.25]	−1.42[−3.78,0.95]
Life events index	2.00[−0.20,4.20]	1.83[0.24,3.43]	1.16[−0.99,3.31]	1.25[−0.56,3.05]	0.70[−0.82,2.22]	0.95[−1.22,3.11]	0.83[−1.85,3.50]	−1.69[−4.65,1.27]	−2.05[−4.55,0.44]
Diastolic blood pressure									
Gender	−1.80[−4.62,1.03]	−2.34[−4.65,−0.04]	−2.75[−5.08,−0.43]	−1.66[−4.62,1.30]	−2.18[−4.93,0.58]	−2.49[−4.90,−0.09]	−2.58[−5.83,0.67]	−2.60[−5.42,0.23]	−3.20[−7.86,1.46]
Age	−0.36[−0.54,−0.18]	−0.34[−0.49,−0.19]	−0.34[−0.47,−0.22]	−0.30[−0.44,−0.15]	−0.30[−0.49,−0.10]	−0.33[−0.49,−0.17]	−0.34[−0.54,−0.14]	−0.40[−0.61,−0.18]	−0.28[−0.50,−0.07]
Education	−0.02[−1.76,1.72]	−0.09[−1.53,1.34]	0.24[−1.35,1.82]	0.57[−1.59,2.73]	1.25[−0.55,3.06]	1.08[−0.88,3.04]	0.80[−1.29,2.90]	0.06[−2.39,2.51]	0.39[−1.92,2.71]
BMI	0.58[0.31,0.84]	0.53[0.32,0.73]	0.51[0.29,0.74]	0.40[0.10,0.70]	0.64[0.25,1.02]	0.66[0.33,1.00]	0.59[0.22,0.96]	0.49[0.04,0.94]	0.41[−0.25,1.07]
Fasting capillary glucose	0.37[−0.52,1.26]	0.44[−0.97,1.86]	0.60[−0.65,1.85]	0.35[−0.99,1.68]	0.42[−1.12,1.95]	−0.05[−1.13,1.02]	0.01[−1.05,1.06]	−0.42[−1.68,0.83]	0.22[−1.43,1.87]
Physical activity index	0.82[−0.61,2.25]	0.91[−0.14,1.95]	0.42[−0.75,1.59]	0.81[−0.38,2.00]	1.35[0.02,2.67]	0.85[−0.31,2.01]	0.42[−0.71,1.54]	0.42[−1.03,1.87]	1.18[−0.95,3.30]
Diet risk index	−0.19[−1.82,1.44]	−0.16[−1.21,0.89]	0.16[−0.85,1.17]	0.34[−0.98,1.66]	0.23[−1.10,1.57]	0.37[−0.97,1.70]	0.93[−0.05,1.90]	0.99[−0.49,2.47]	0.95[−0.27,2.18]
Alcohol intake	−0.63[−2.06,0.80]	0.04[−1.38,1.46]	0.03[−0.89,0.94]	0.07[−0.89,1.03]	−0.11[−1.48,1.25]	−0.17[−1.72,1.39]	0.16[−1.47,1.78]	0.31[−0.61,1.22]	0.02[−2.17,2.20]
Life event index	0.41[−1.12,1.94]	1.30[0.19,2.41]	1.66[0.80,2.51]	1.24[−0.07,2.55]	1.20[−0.01,2.41]	0.92[−0.33,2.16]	0.70[−0.62,2.02]	−0.06[−1.31,1.19]	−0.32[−2.83,2.19]
Pulse pressure									
Gender	−0.87[−4.07,2.33]	−0.71[−3.88,2.46]	−2.39[−5.49,0.72]	−2.83[−6.31,0.66]	−0.85[−4.54,2.84]	−0.78[−6.84,5.28]	−0.87[−7.72,5.99]	0.65[−5.90,7.20]	0.35[−6.16,6.85]
Age	0.41[0.27,0.55]	0.46[0.32,0.60]	0.51[0.37,0.64]	0.47[0.32,0.62]	0.55[0.38,0.72]	0.62[0.48,0.76]	0.69[0.47,0.90]	0.78[0.53,1.03]	1.11[0.79,1.42]
Education	0.02[−1.03,1.07]	−0.39[−2.60,1.81]	−0.73[−2.70,1.24]	−1.48[−3.67,0.72]	−1.68[−3.69,0.33]	−1.14[−4.12,1.84]	−1.09[−3.75,1.57]	−0.86[−2.97,1.24]	−0.89[−4.07,2.28]
BMI	0.44[0.05,0.84]	0.28[−0.08,0.64]	−0.06[−0.45,0.33]	−0.05[−0.46,0.35]	0.00[−0.42,0.42]	0.03[−0.21,0.27]	0.05[−0.28,0.38]	−0.04[−0.62,0.55]	−0.38[−1.21,0.45]
Fasting capillary glucose	−0.30[−2.11,1.50]	0.45[−0.68,1.59]	1.05[−0.20,2.30]	0.72[−0.59,2.03]	0.87[−0.12,1.86]	0.41[−0.72,1.54]	0.05[−1.50,1.60]	−0.40[−1.74,0.93]	−1.05[−3.21,1.10]
Physical activity	1.21[−0.08,2.50]	1.23[0.12,2.34]	1.14[−0.32,2.59]	0.97[−0.69,2.62]	0.82[−0.48,2.13]	0.87[−0.33,2.07]	0.31[−1.62,2.25]	0.23[−3.11,3.57]	1.83[−1.90,5.56]
Diet risk index	0.20[−1.70,2.10]	0.73[−0.47,1.92]	1.08[0.00,2.17]	1.49[0.53,2.46]	2.10[1.19,3.00]	2.33[1.07,3.59]	1.61[−0.08,3.30]	1.64[0.01,3.27]	1.65[−1.30,4.60]
Alcohol intake	−0.15[−1.17,0.87]	−0.52[−1.86,0.82]	−0.12[−1.29,1.04]	−0.29[−0.98,0.40]	−0.18[−1.33,0.97]	−0.84[−1.93,0.25]	−1.76[−3.34,−0.19]	−1.52[−3.21,0.17]	−3.39[−5.92,−0.85]
Life event index	1.14[−0.76,3.05]	0.99[−0.57,2.56]	1.24[−0.17,2.64]	1.26[−0.55,3.06]	1.25[−0.15,2.65]	1.02[−0.50,2.55]	0.60[−0.88,2.09]	−0.31[−2.12,1.49]	1.24[−1.13,3.62]

BMI = body mass index.

TABLE 5. Quantile Regression Coefficients and 95% Confidence Intervals Between Blood Pressure and Common Factors for Subjects Not on Antihypertensive Therapy

Related Factors	Quantile 10	Quantile 20	Quantile 30	Quantile 40	Quantile 50	Quantile 60	Quantile 70	Quantile 80	Quantile 90
Systolic blood pressure									
Gender	−3.01[−5.62,−0.41]	−3.93[−6.11,−1.75]	−3.86[−5.53,−2.18]	−3.49[−5.17,−1.81]	−2.52[−4.36,−0.68]	−3.20[−5.41,−0.98]	−2.67[−5.35,0.00]	−3.17[−5.79,−0.54]	−4.00[−7.90,−0.09]
Age	0.38[0.28,0.48]	0.40[0.32,0.49]	0.40[0.32,0.48]	0.48[0.38,0.57]	0.51[0.40,0.63]	0.64[0.52,0.76]	0.72[0.59,0.86]	0.78[0.64,0.92]	0.94[0.74,1.14]
Education	0.69[−0.56,1.93]	0.70[−0.40,1.81]	0.62[−0.76,1.99]	.0.50[−0.92,1.92]	0.73[−1.05,2.50]	1.32[−0.36,3.00]	2.38[0.73,4.03]	1.34[−0.52,3.21]	1.13[−1.62,3.88]
BMI	1.37[1.08,1.67]	1.45[1.18,1.71]	1.47[1.24,1.70]	1.58[1.35,1.81]	1.56[1.33,1.79]	1.59[1.33,1.85]	1.67[1.28,2.06]	1.57[1.11,2.03]	1.67[0.97,2.38]
Fasting capillary glucose	0.35[−1.06,1.75]	0.67[−0.12,1.45]	0.04[−0.67,0.74]	0.55[−0.76,1.85]	0.78[−0.39,1.94]	0.94[−0.32,2.20]	1.44[0.04,2.85]	1.30[−0.75,3.34]	3.79[0.34,7.24]
Physical activity	0.94[−0.51,2.39]	0.97[−0.04,1.98]	0.71[−0.05,1.47]	0.97[0.34,1.60]	0.21[−0.68,1.10]	0.25[−0.67,1.18]	0.66[−0.49,1.82]	0.19[−0.61,0.98]	0.82[−0.73,2.37]
Diet risk index	0.10[−0.77,0.97]	0.65[−0.20,1.50]	0.44[−0.14,1.01]	0.60[−0.23,1.44]	0.97[−0.16,2.10]	1.11[−0.09,2.31]	1.13[0.26,2.01]	0.68[−0.28,1.64]	0.76[−1.19,2.71]
Alcohol intake	0.52[−0.53,1.57]	0.65[−0.29,1.60]	0.45[−0.29,1.18]	0.79[0.22,1.36]	0.77[−0.18,1.71]	0.64[−0.26,1.54]	0.83[−0.69,2.36]	0.70[−0.47,1.88]	0.71[−0.74,2.17]
Life events index	1.41[0.39,2.43]	1.50[0.68,2.32]	1.46[0.69,2.24]	1.96[1.12,2.79]	2.24[1.26,3.22]	2.15[1.32,2.97]	2.21[1.27,3.15]	1.99[0.95,3.03]	1.65[0.02,3.28]
Diastolic blood pressure									
Gender	−2.10[−4.42,0.21]	−1.40[−2.91,0.10]	−1.68[−3.03,−0.33]	−2.38[−3.69,−1.08]	−2.61[−4.34,−0.87]	−2.80[−4.23,−1.37]	−3.20[−5.20,−1.20]	−4.21[−6.69,−1.73]	−2.86[−4.58,−1.14]
Age	0.01[−0.10,0.12]	0.03[−0.06,0.11]	0.05[−0.03,0.12]	0.04[−0.03,0.11]	0.08[0.02,0.14]	0.08[0.02,0.15]	0.11[0.04,0.18]	0.11[0.04,0.19]	0.20[0.07,0.33]
Education	0.68[−0.34,1.70]	0.98[0.33,1.62]	0.71[0.07,1.36]	0.90[0.30,1.50]	1.31[0.66,1.95]	1.26[0.64,1.88]	1.18[0.21,2.14]	1.20[−0.28,2.68]	1.36[−0.14,2.85]
BMI	0.94[0.77,1.12]	1.02[0.87,1.17]	1.03[0.83,1.23]	1.04[0.90,1.19]	1.10[0.95,1.24]	1.09[0.91,1.26]	1.08[0.79,1.37]	1.09[0.83,1.35]	0.99[0.74,1.24]
Fasting capillary glucose	0.61[−0.50,1.72]	0.36[−0.19,0.91]	−0.02[−0.51,0.47]	0.24[−0.16,0.64]	0.27[−0.24,0.78]	0.34[−0.32,1.00]	0.22[−0.64,1.08]	1.02[−0.05,2.10]	1.10[0.08,2.11]
Physical activity index	0.08[−0.70,0.86]	0.21[−0.40,0.82]	0.23[−0.26,0.73]	0.07[−0.45,0.59]	−0.02[−0.58,0.54]	0.12[−0.38,0.63]	0.06[−0.53,0.65]	−0.13[−0.86,0.61]	−0.27[−1.25,0.72]
Diet risk index	−0.51[−1.09,0.08]	−0.31[−0.78,0.15]	0.07[−0.52,0.65]	0.68[0.26,1.09]	0.92[0.34,1.50]	0.98[0.54,1.42]	0.88[0.35,1.41]	0.77[0.02,1.53]	0.99[0.19,1.80]
Alcohol intake	0.43[−0.40,1.27]	0.41[−0.25,1.07]	0.21[−0.46,0.88]	0.51[−0.21,1.24]	0.41[−0.38,1.21]	0.32[−0.48,1.12]	0.29[−0.58,1.16]	0.32[−0.84,1.48]	1.56[0.59,2.53]
Life event index	0.83[0.07,1.58]	0.58[−0.09,1.24]	0.49[−0.06,1.04]	0.60[0.12,1.07]	0.88[0.22,1.53]	0.92[0.26,1.59]	0.98[0.27,1.69]	1.29[0.67,1.92]	1.00[0.06,1.94]
Pulse pressure									
Gender	−0.23[−1.73,1.27]	0.57[−0.86,1.99]	0.40[−1.05,1.85]	−0.26[−1.42,0.89]	0.30[−1.11,1.71]	0.25[−1.42,1.92]	−0.16[−1.67,1.34]	−0.73[−3.10,1.64]	−0.67[−3.80,2.47]
Age	0.30[0.20,0.39]	0.36[0.25,0.47]	0.39[0.31,0.47]	0.45[0.37,0.53]	0.48[0.38,0.57]	0.50[0.40,0.60]	0.55[0.47,0.64]	0.60[0.50,0.69]	0.75[0.56,0.94]
Education	−0.08[−0.86,0.70]	0.38[−0.26,1.02]	−0.01[−0.82,0.80]	−0.01[−0.67,0.66]	−0.07[−1.12,0.98]	0.23[−0.60,1.07]	−0.30[−1.14,0.54]	−0.05[−1.19,1.10]	−0.11[−1.29,1.06]
BMI	0.47[0.27,0.67]	0.48[0.29,0.67]	0.39[0.23,0.55]	0.26[0.09,0.43]	0.29[0.14,0.44]	0.40[0.21,0.59]	0.53[0.33,0.72]	0.51[0.33,0.68]	0.54[0.19,0.88]
Fasting capillary glucose	−0.12[−0.80,0.57]	−0.18[−0.68,0.32]	−0.07[−0.62,0.49]	−0.07[−0.68,0.55]	0.80[−0.12,1.73]	0.56[−0.20,1.32]	0.36[−0.52,1.24]	1.05[−0.22,2.32]	3.00[1.34,4.66]
Physical activity	0.36[−0.30,1.02]	0.28[−0.28,0.84]	0.25[−0.53,1.03]	0.39[−0.20,0.98]	0.36[−0.24,0.95]	0.51[−0.09,1.11]	0.53[−0.13,1.18]	0.62[−0.18,1.42]	0.70[−0.34,1.74]
Diet risk index	0.02[−0.74,0.77]	0.80[0.00,1.60]	0.77[−0.03,1.56]	0.68[0.13,1.24]	0.69[0.17,1.21]	0.85[0.27,1.42]	0.69[0.11,1.27]	0.30[−0.37,0.96]	0.65[−0.10,1.39]
Alcohol intake	0.21[−0.82,1.24]	0.02[−0.80,0.85]	0.53[−0.46,1.52]	0.43[−0.27,1.13]	0.69[−0.02,1.40]	0.47[−0.27,1.22]	0.45[−0.20,1.10]	0.03[−1.28,1.34]	−0.18[−1.68,1.32]
Life event index	1.05[−0.22,2.31]	0.86[−0.02,1.73]	1.31[0.61,2.00]	1.18[0.61,1.74]	1.10[0.37,1.83]	1.39[0.77,2.02]	1.56[0.86,2.25]	1.77[0.95,2.59]	1.48[−0.07,3.02]

BMI = body mass index.

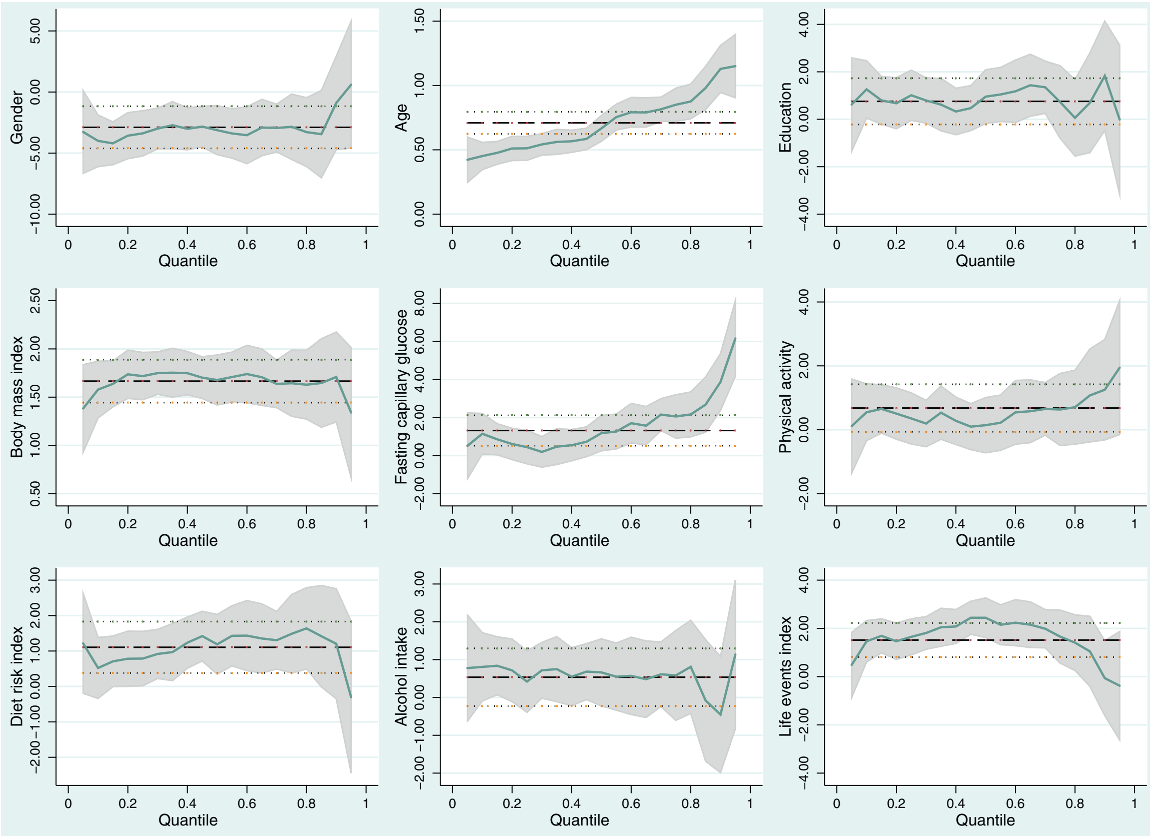

FIGURE 1. Quantile regression between systolic blood pressure and common factors for total subjects.

(but not PP) and the magnitude of its association with SBP displayed a slight increasing (from low to high quantiles) trend. Age was positively linked with all the 3 BP measures and all these relations showed a clear and steadily increasing trend with the highest coefficients being observed with SBP followed by PP and DBP. Education was only positively associated with DBP for part of the quantiles (eg, quantile $\geq$0.40) with barely discernable increasing trend. Similar to age, BMI presented positive associations but less obvious trends with all the BP measures. FCG had statistically significant coefficients with SBP only for high quantiles ($\geq$0.50). Physical activity did not present significant relations with SBP and DBP but presented positive coefficients with PP for most of the quantiles ($\geq$0.30). Alcohol intake was only positively linked with DBP for a small part of very high quantiles ($\geq$0.90). Diet risk index manifested slightly increasing positive relations with all the 3 BP measures for most of the quantiles ($\geq$0.30). Life event index displayed positive coefficients with SBP, DBP, and PP forming a mixed (increasing followed by decreasing) trend. By excluding the LBFs not on treatment against hypertension, almost all of the trends and directions in the associations observed above remained unchanged but part of the trends (eg, the increasing line representing the regression coefficients between SBP and age) became smoother and part of the magnitudes of the associations (eg, the regression coefficients between SBP and gender) became greater(see Figure, Supplemental Figures 1–3, http://links.lww.com/MD/A74, which depict the QR coefficients of SBP, DBP, and PP with the 9 influence factors for LBFs not on antihypertensive therapy). As for LBFs on medication therapy for hypertension, most of the trends and significant associations observable among the total LBFs disappeared with only a few exceptions. These included the associations of age with PP and DBP for most of the quantiles; BMI with SBP for the first half of quantiles and with DBP for most of the quantiles; physical activity with SBP for highest few quantiles; and life event index with DBP and diet risk index with PP for a small range of middle quantiles.

DISCUSSION

Descriptive Statistics

Our descriptive analysis portrayed a preliminary profile of BP and factors commonly believed to be associated with BP among LBFs aged 40 to 70 years in rural Anhui, China. Being a newly emerged group, there is a general lack of and a clear need for such information. This study revealed substantially higher prevalence of hypertension than that among farmers derived from the latest available China National Hypertension Survey conducted in 1991 (43.2% vs 24.2% for similar ages) and that among a combined group of urban and rural residents in China documented by a more recent study (35.5% vs 29.3% for ages 40 to 59).[14] This may be partly due to lifestyle changes that occurred among rural farmers during the past decades when China experienced the most profound reformation and development.[15] Another probable contributor to this phenomenon may be the ''movement of farmers'' caused by the nation's rapid urbanization that had been driving most farmers move to

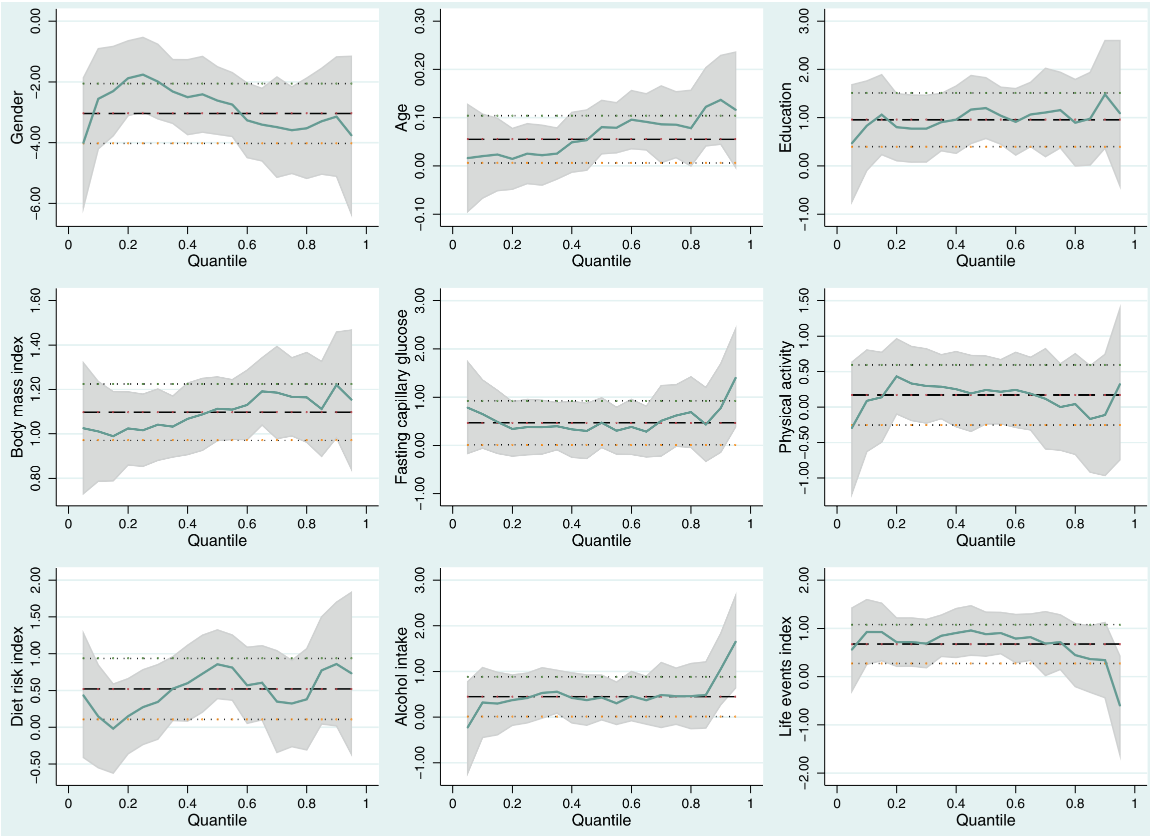

FIGURE 2. Quantile regression between diastolic blood pressure and common factors for total subjects.

cities for jobs in which gender, age, and health served as important direct or indirect selection criteria.[16] This is consistent with our findings that female and the 60 to 70-year LBFs overcounted male and 40 to 50 or 50 to 60-year LBFs and that gender (male vs female) difference in hypertension prevalence observed from our study group (48.9% vs 40.1%) turned out to be apparently higher than that from the 1991 national survey (24.61% vs 24.84%).[17] Fewer male LBFs reflected greater confidence and chances for male than female farmers to find jobs (mostly manual jobs) in cities, and as greater proportion of relatively healthy males had left, the remaining male farmers eventually showed poorer health (including BP) status than females.

Multivariate Regression Analysis

Our multivariate regression analysis revealed useful findings for understanding BP among the LBFs. These included age, BMI, FCG, diet risk index, and life events index, which showed substantially greater coefficient with SBP than DBP, while other factors, for example, alcohol intake and education, demonstrated the contrary; still others, for example, gender, had approximately equal associations with both SBP and DBP. Most of these findings are consistent with the previous studies. For instance, Franklin et al[18] reported that SBP increased with age steadily, while DBP increased with age at a lower rate and for only part of lifetime (<50 years). Drøyvold et al[19] revealed that changes in BMI were closely associated with changes in SBP and DBP and the extent of changes in SBP following a certain BMI change was about 2-folds that in DBP following the same BMI changes. Quite a few studies have documented positive associations of FCG with both SBP and DBP although little of them had compared the magnitude of the associations.[20–22] Tremendous publications have identified statistically significant relationships between diet behaviors and BP.[23–25] Yet given the heterogeneity of diet behaviors between study groups and the fact that we used a self-compiled diet risk index, there is little sense to compare our findings in this regard with that of others. Contemporary research on BP associations with life events resemble that with diet behaviors,[26,27] that is, although there are evidences that chronic stressful life events lead to sustained elevation in SBP and DBP, little is known about which of the two BP indicators is more sensitive to life events.[28]

In our regression models, the coefficient of physical activity was only statistically significant with PP but not SBP and DBP. This contradicts existing findings. Sikiru et al,[29] for example, reported that exercise significantly reduced PP, SBP, and DBP. This discrepancy may be mainly attributed to the fact that our survey questionnaire collected information about the current physical activity levels of the LBFs when the field survey took place rather than their lifetime physical activity. Another inconsistence between our findings and published results refers to alcohol consumption. Briasoulis et al's[30] review of 16 prospective studies uncovered an increased risk of hypertension in male alcohol drinkers than in male nondrinkers and a ''J-shaped'' relationship between alcohol consumption and hypertension in women. These seem to differ from our findings to some extent. But these studies used hypertension incidence rates rather than BP values as dependent variables. A

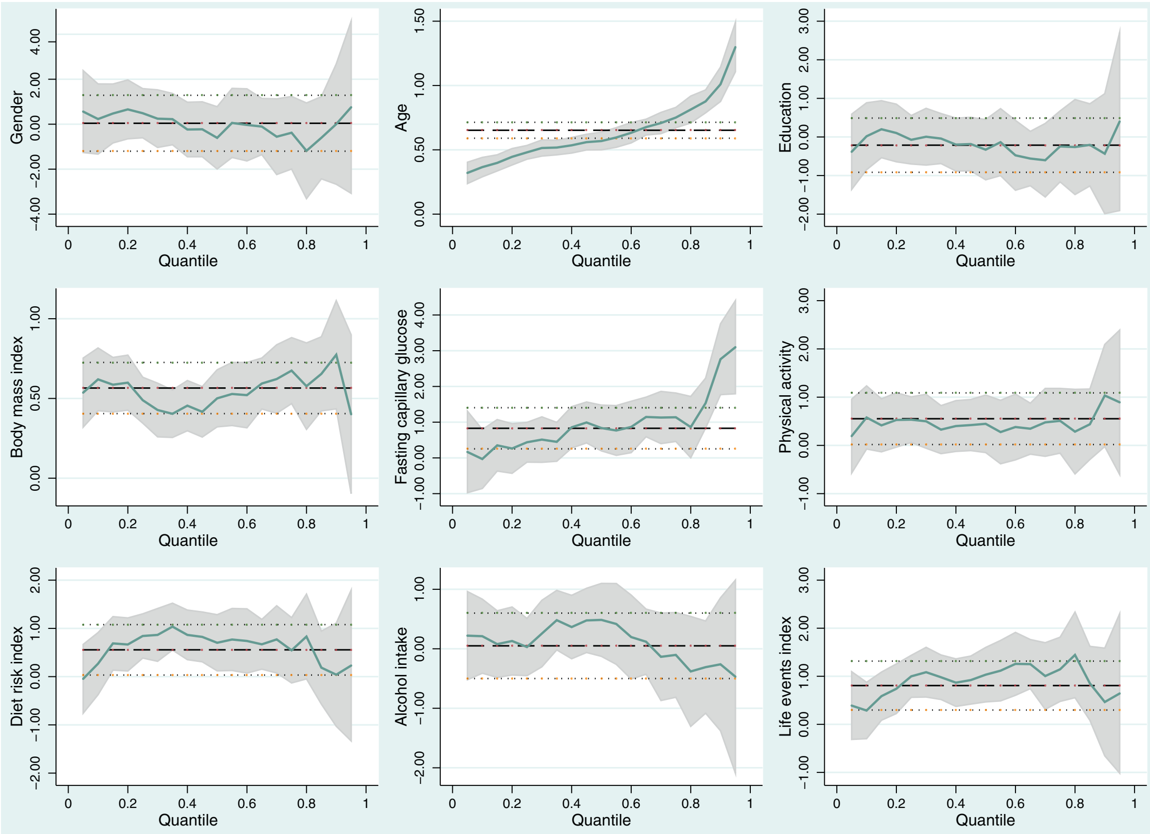

FIGURE 3. Quantile regression between pulse pressure and common factors for total subjects.

more recent cohort study by Zatu et al[31] that did use BP values, produced similar findings of ours, that is, the volume of alcohol intake was positively associated with DBP but not SBP and PP. With regard to gender and education effects on BP, existing findings are mixed,[32–37] making it difficult to compare our findings with that of others.

In addition, our estimation of the ''effect-potential'' based on the multivariate regression models also has useful implications. For example, BMI, FCG, age, and diet risks should be the primary focus for related screening, diagnosis, or intervention.

QR Analysis

The QR analysis yielded detailed views of the effects of the 9 factors on SDP, DBP, and PP from a number of perspectives including regression coefficients of all the factors for a given quantile of a given BP measure; trend in regression coefficients of a given factor for different quantiles of a given BP measure; trends in regression coefficients of all the factors for different quantiles of a given BP measure; and trends in regression coefficients of all the factors for different quantiles of all the factors.

Interpretation of QR coefficients for a given quantile of BP is similar to that of a multivariate regression model. For example, the regression coefficient of age with SBP was 0.45 (Table 3, column 2, row 3) at the 10th quantile (SBP = 110 110 mm Hg) and 1.13 (Table 3, column 10, row 3) at the 90th quantile (SBP = 170 mm Hg). This means, keeping all the other 8 factors unchanged, 1 year increase in age results in 0.45 and 1.13 mm Hg elevation in SBP if the base SBP is 170 and 180 mm Hg, respectively.

Given the number of potential perspectives mentioned above, it is impossible for us to examine in detail the divergent quantile-related coefficient patterns of SBP, DBP, and PP with all the 9 factors. Instead, we propose a few evidence-based hypotheses that might help readers make their own interpretations. These include (H1) peripheral resistance and arterial stiffness define BP jointly and to a large extent[38,39]; (H2) arterial stiffness acts as the dominant contributor to SBP but supplementary reducer of DBP[40]; (H3) peripheral resistance serves as the dominant contributor to DBP and supplementary contributor to SBP[41]; (H4) SBP leads DBP in determining PP[42]; and (H5) the influence of any factor on BP is mainly defined by its path of influence (P1 = arterial stiffness, P2 = peripheral resistance), direction of influence (D1 = increase, D2 = decrease), extent of influence (E1 = marginal, E2 = moderate, E2 = substantial), and manner of influence (M1 = increasingly as the base BP becomes higher, M2 = decreasingly, M3 = indifferently).

Based on the above hypotheses, interpreting the coefficient patterns shown by Tables 3 to 5 and Figures 1 to 6 becomes inferring plausible assumptions about the 4 defining characters under H5. For example, the patterns of the quantile-related coefficients of FCG with SBP, DBP, and PP may be explained by assuming that it increased (D1) both arterial stiffness and periphery resistance (P2) in an ''upstream'' way depending on the baseline BP (M1). Therefore, at an early stage when the base SBP was lower than the 45th quantile, the

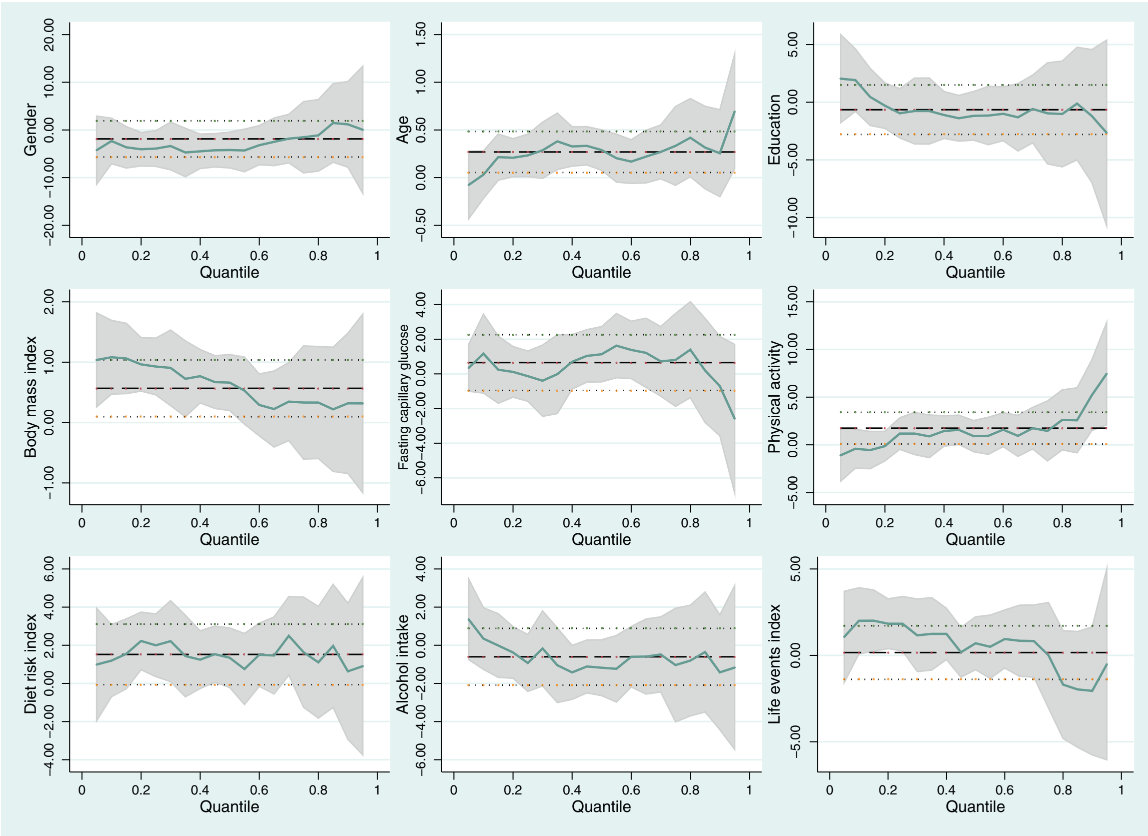

FIGURE 4. Quantile regression between systolic blood pressure and common factors for subjects on antihypertensive therapy.

effects of FCG on arterial stiffness and peripheral resistance (D1 and P3) was too small to be observed and thus resulted in a nonsignificant coefficient with SBP (H2); as the baseline SBP became higher and higher, unit increase in FCG caused greater and greater stiffness and resistance (P3), forming a fast elevation in the later part of the coefficient curve (H2); the increases in arterial stiffness and peripheral resistance due to FCG affected DBP inversely (H2), so the coefficient (FCG with DBP) reflecting the combined effect of the stiffness and resistance remained nonsignificant for a much longer range of quantiles; starting from the 90th quantile, increase in DBP because of peripheral resistance caused by unit FCG increase (M1 and H3) overwhelmed the decrease because of arterial stiffening caused by unit FCG increase (M1 and H3) and thus leaving an end raise in the coefficient curve of DBP; and the coefficient curve of PP resembled primarily that of the SBP (H4).

Perhaps, the most important phenomenon our QR analysis revealed is that the majority of the factors presented some extent, even substantial, BP-dependent effect. Taking the example of age versus SBP again, the coefficient demonstrated a fast and steady quantile-related ‘‘upstream’’ trend, that is, increased from 0.40 for the 5th quantile to 1.15 for the 95th quantile. Such a large discrepancy suggests that simply viewing age as an important determinant of SBP, as we usually do, may not be enough. We may need, for instance, to give a faster yearly growth prediction of SBP for the LBFs with a current SBP above 180 mm Hg than those with a current SBP under 110 mm Hg.

Study Limitations

The readers are cautioned about several issues. The researchers have identified links between BP and a whole range of factors but this study included only 9 of them. If more factors were incorporated, the multivariate and QR models may be different from what this study had produced. The study population characterized limited age range (40–70 years), low education, and overrepresentation of females. The readers should take all these into account in interpreting and generalizing our research findings. The farmers may have different amounts of farm work to do in different seasons. Their food availability and eating habits may also change across seasons. This may result in quite different findings if the survey were carried out in other seasons.[43] As shown by Tables 2 to 5 and Figures 1 to 6, the multivariate regression and QR coefficients greatly differed between the LBFs who were on antihypertensive therapy and those who were not on the treatment. Yet this article provides little elaboration on potential reasons underlying these discrepancies because of study focus and space limit considerations.

CONCLUSIONS

This study revealed interesting clues on how the whole continuum of DBP, SBP, and PP is associated with commonly researched factors of hypertension. Age, gender, education, BMI, FCG, physical activity, diet risk index, alcohol intake, and life event index were all significantly associated with all or part of SBP, DBP, and PP. The QR coefficients of SBP, DBP, or

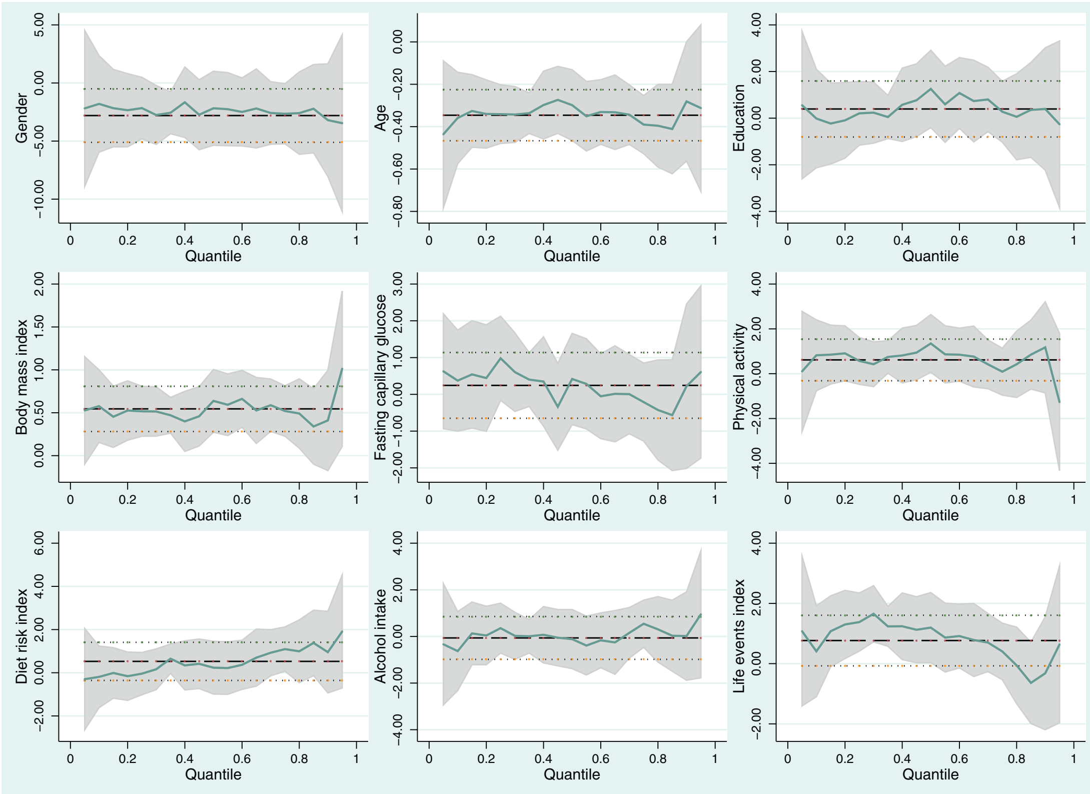

FIGURE 5. Quantile regression between diastolic blood pressure and common factors for subjects on antihypertensive therapy.

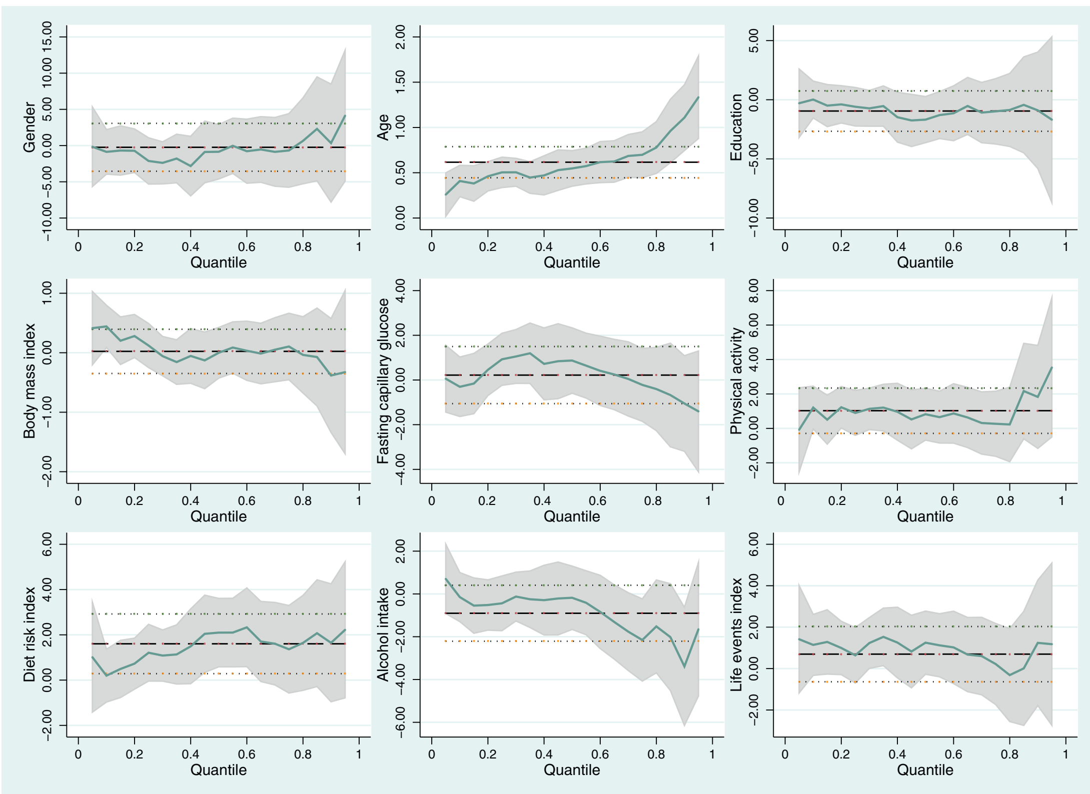

FIGURE 6. Quantile regression between pulse pressure and common factors for subjects on antihypertensive therapy.

PP with different factors demonstrated divergent patterns and some factors, for example, age, BMI, FCG, and life event index, showed substantial trends along the quantile axis. The study also documented as high as 43.2% of hypertension among the LBFs in rural Anhui. These findings suggest that there is a clear need for exploring BP-dependent effects of influencing factors using QR analysis or other alternative methods and hypertension among LBFs in rural China merit specific attention.

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