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ORIGINAL ARTICLE

Association of urbanization with psychological well-being in Chinese adults aged 50 years and older: a population-based study

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Objective: To examine the association between urbanization and psychological well-being (PWB) in China.
Methods: Data were obtained from the 2015 China Health and Nutrition Survey (CHNS) and included 3,071 men and 3,385 women aged 50 years or older who lived in 288 communities across 12 provinces and municipalities. The urbanization index, which summarizes 12 urbanization dimensions at community level, was categorized into tertiles representing low, medium, and high levels of urbanization. PWB was assessed by scoring three self-reported questions. Gender-stratified multilevel analyses were used to estimate the association between urbanization and PWB.
Results: After controlling for individual-level factors, the urbanization index was associated positively with PWB. More specifically, an increase of one SD in the score of community population density, economic activity, housing, education, sanitation, or diversity was associated significantly with PWB in both genders. In addition, increases in the score of community communications, social services, transportation, or modern markets were associated significantly with PWB in women, but not in men.
Conclusion: Urbanization has, on average, had an independent and positive effect on PWB in middle-aged and older Chinese populations, with many components of urbanization being separately and positively associated with PWB, especially in women.

Keywords: China; urbanization; psychological well-being; community

Introduction

Urbanization is often defined as a change in the size, density, and heterogeneity of places associated with migration into cities[1] and is identified widely as a driver of globally changing patterns in health and quality of life.[2-4] China has undergone unprecedented urbanization – the largest ever – since its reform and opening-up in 1978. The urbanization rate increased from 17.92 to 63.89% between 1978 and 2020,[5] with an average annual growth rate of 1.09%. It is anticipated that more than one billion people will live in China's cities by 2030.[6] This rapid urbanization has stimulated considerable scholarly attention on the effects of urbanization on the quality of life of Chinese people,[7,8] particularly regarding psychological well-being (PWB).[9,10]

PWB refers to inter- and intra-individual levels of positive functioning, such as happiness and life satisfaction,[11,12] and is considered as a national priority in government policies.[13] As a consequence, efforts to promote PWB have increased around the world.[14] Rural-urban disparities in PWB have been reported in China[10] and elsewhere.[15-17] Previous studies in China have shown that overall PWB is worse in rural compared to urban populations,[10,18] although these studies have tended to focus on dichotomous contrasts between urban and rural areas. Research in China has suggested that a simple urban/rural dichotomy does not capture the enormous heterogeneity that is emerging in urban and rural communities,[19] particularly in the context of rapid social and environmental change.[4] In contrast, a multidimensional index that encompasses the complexity and heterogeneity of the community would adequately characterize variations across the spectrum of urbanicity.[19,20] While it is critical to understand the association between overall urbanization and PWB, identifying the elements of urbanization most closely associated with PWB would inform the approaches necessary to improve human well-being.

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Against this background, we used data from the China Health and Nutrition Survey (CHNS) to examine the association between urbanization and PWB in Chinese adults aged 50 years and older, using a multidimensional urbanization index assessed at the community level.[19]

Methods

Study population and design

The study followed a cross-sectional design and used data from the 2015 wave of the CHNS. The CHNS began in 1989 and has been repeated every 2-4 years through 2015, in 10 waves; it was designed to be representative of rural, urban, and suburban areas, which varied substantially in geography, economic development, public resources, and health indicators.[21] The survey also focused on overall health and well-being during urbanization and economic transitions.[22] Measurements of PWB were conducted only in Chinese adults aged 50 years or older in 2015. The primary survey took place in nine provinces (Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou).[22] A multistage, random cluster process was used to collect the samples surveyed in each of the provinces.[22] Counties and cities in the nine provinces were stratified by income (low, medium, and high), and a weighted sampling scheme was used to randomly select four counties and two cities in each province.[22] Urban and suburban communities within the cities and villages and townships within the counties were chosen randomly.[22] In 2011, the three largest municipalities (Beijing, Shanghai, and Chongqing) were added.[23] By the last survey in 2015, the CHNS included 12 sample units at the primary sampling level (province/municipality), and at the secondary sampling level (community), 288 communities. The survey procedures have been described in detail elsewhere.[23]

This study included 8,970 participants aged 50 years or older from 288 communities across 12 provinces and municipalities in the 2015 dataset. Participants who had missing information on the urbanization index (n=34), PWB (n=231), or control variables (n=2,249) were excluded from the study. A total of 6,456 subjects (3,071 men and 3,385 women) were included in the final analysis.

Assessment of urbanization

The level of urbanization of the sampled communities was measured using an urbanization index developed by Jones-Smith & Popkin.[19] The index comprised 12 components: communications (e.g., television, mobile, post, and cinema), population density, economic activity, housing (e.g., electricity, indoor tap water, and flushing toilets), traditional markets, modern markets, social services, transportation, education (i.e., average educational level in adults older than 21 years), diversity (i.e., community variance in education and income levels), health infrastructure, and sanitation (i.e., availability of treated water and presence of excrement in public spaces). Each component was scaled from 0 to 10, and then added together for a possible range of 0-120. Higher scores indicated greater development of community urbanization. The indicators measuring the proportion of households were collected from the household responses, while the remaining indicators were obtained from the community-level survey offered to community officials. The construction procedure has been described in detail elsewhere.[19,24] The urbanization index has been demonstrated to have adequate reliability (α = 0.85-0.89) and construct validity (r = 0.90-0.94).[19,25] As in prior studies, the urbanization index was categorized into tertiles representing low ($<$ 63.90), medium (63.90-84.27), and high ($>$ 84.27) levels of urbanization.

Assessment of PWB

PWB was measured by asking the participants to respond to three questions: "I have as much energy as I had in 2014"; "I am as happy now as when I was younger"; and "As I get older, things are better than I thought they would be."[26,27] The participants rated each question on a five-point scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. All three scores were summed to create a total PWB score, with higher scores representing a better PWB. This measurement of PWB has been well validated and used widely in previous studies.[26,27]

Assessment of control covariates

A structured questionnaire was used to collect individual information including sociodemographic, lifestyle parameters, and medical history. Education level was divided into three categories: 0-6 years, 7-9 years, or $\geqslant$ 10 years. Marital status was categorized as married or unmarried (including single, separated, divorced, or widowed). Work status was divided into two categories (employed or unemployed). Annual household income per capita was categorized into three tertiles: low ($<$ 11,100.0 RMB), medium (11,100.0-26,566.7 RMB), or high ($\geqslant$ 26,566.7 RMB). Lifestyle factors included in the analysis were current smoking (yes or no), alcohol drinking (yes [drank beer/alcohol the year before the examination] or no [did not drink beer/alcohol the year before the examination]), and sleep. Sleep duration was categorized as $\leqslant$ 6 h, 7-8 h, or $\geqslant$ 9 h. Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared, and was divided into four categorical groups based on Chinese criteria[28]: underweight ($<$ 18.5 kg/m^2), normal (18.5-23.9 kg/m^2), overweight (24.0-27.9 kg/m^2), or obesity ($\geqslant$ 28.0 kg/m^2). Hypertension was defined as a systolic blood pressure $\geqslant$ 140 mmHg, diastolic blood pressure $\geqslant$ 90 mmHg, and/or a self-reported physician diagnosis of hypertension.[29] Participants with a history of diabetes mellitus (DM), stroke, myocardial infarction (MI), or cancer were defined as those having a hospital record of these diseases diagnosed by professional doctors.

Statistical analysis

The continuous variables had a non-normal distribution; therefore, the results are presented as medians

(interquartile ranges [IQRs]) for continuous variables and numbers (percentages) for categorical variables. The characteristics were grouped by tertiles of the urbanization index and compared using the Kruskal-Wallis H test or chi-square test, as appropriate. A multilevel linear regression model was used to investigate the gender-specific association between exposure to urbanization and PWB after controlling for individual variables. The three levels specified in our model were as follows: individuals at level 1; nested within communities at level 2; and nested within provinces/municipalities at level 3. The modeling was conducted in four steps. Initially, model 1 (null model) examined only between-group heterogeneity. Secondly, the community-level variable (urbanization index tertiles) was added in model 2. Thirdly, in model 3, the individual-level explanatory variables were introduced into model 2. These individual variables included age, education level, marital status, work status, household income per capita, current smoking, alcohol drinking, sleep duration, BMI, hypertension, and history of DM, stroke, MI, or cancer. Finally, the urbanization index was substituted with each of the 12 urbanization components (increase of 1 SD) in the separate models. The individual variables were the same as those in model 3.

Statistical significance was determined at the $p < 0.05$ level. All statistical analyses were conducted using SAS 9.4 for Windows.

Ethics statement

The study protocol was approved by the institutional review committees of the Institute for Nutrition and Health of the Chinese Center for Disease Control and Prevention and the University of North Carolina at Chapel Hill, United States. Written informed consent was obtained from all the participants.

Results

Characteristic of the participants

Table 1 shows the individual-level characteristics of the 6,456 participants aged 50-99 years old. The median (IQR) age of the total population was 62 (56-68) years. Across both genders, participants in the high urbanization communities tended to have higher education levels and household income per capita, be unemployed, smoke and drink less, and have a history of DM, while those in the low urbanization communities tended to be short sleepers ($\leqslant$ 6h), have a high prevalence of hypertension, and a low median PWB score. Men who lived in low-urbanization areas were more likely to be unmarried, and less likely to have a history of cancer, while those who lived in areas of high urbanization tended to have a high prevalence of overweight/obesity. The proportion of older women ($\geqslant$ 60 years) was higher in the most urbanized communities compared to that in the least urbanized communities.

Urbanization index and PWB

Model 1 in Tables 2 and 3 shows the null model (consisting only of a constant term as the fixed part, without any variables at any level), which indicated statistically significant variations in PWB at the individual, community, and provincial levels (all $p < 0.05$). It was therefore rational for us to perform multilevel modeling. Model 2 shows the fixed effects results for the community-level factors. The urbanization index was associated significantly with an increased level of PWB in men and women. Additional adjustment for the individual-level variables in model 3 attenuated the association between the urbanization index and PWB, although the association remained statistically significant. Specifically, the participants were significantly more likely to have reported better PWB at medium (men, $\beta = 0.259$, $p = 0.031$; women, $\beta = 0.587$, $p < 0.001$) and high (men, $\beta = 0.421$, $p = 0.001$; women, $\beta = 0.645$, $p < 0.001$) levels of urbanization than at low urbanization.

Urbanization components and PWB

Table 4 shows the association between urbanization components (per 1-SD increase) and PWB after adjusting for clustering of data at multiple levels (individual, community, and province/municipality) and controlling for potential confounders. In general, higher urbanization across the 12 components was associated positively with PWB in men and women, albeit with variation in statistical significance. Comparatively stronger associations were observed for women except for health infrastructure. In both genders, a 1-SD increase in the score of population density (men, $\beta = 0.143$, $p = 0.010$; women:, $\beta = 0.223$, $p < 0.001$), economic activity (men, $\beta = 0.135$, $p = 0.008$; women, $\beta = 0.215$, $p < 0.001$), housing (men, $\beta = 0.154$, $p = 0.004$; women, $\beta = 0.270$, $p < 0.001$), education (men, $\beta = 0.148$, $p = 0.009$; women, $\beta = 0.255$, $p < 0.001$), diversity (men, $\beta = 0.152$, $p = 0.002$; women, $\beta = 0.279$, $p < 0.001$), and sanitation (men, $\beta = 0.167$, $p = 0.001$; women, $\beta = 0.249$, $p < 0.001$) at the community level was associated significantly with the PWB score. In addition, a 1-SD increase in the score of communications ($\beta = 0.123$, $p = 0.019$), social services ($\beta = 0.111$, $p = 0.030$), modern markets ($\beta = 0.151$, $p = 0.003$), and transportation ($\beta = 0.098$, $p = 0.048$) at the community level was also associated significantly with PWB in women, but not in men.

Individual-level factors and PWB

Model 3 in Tables 2 and 3 shows the results of the multilevel analyses between individual-level factors and PWB in men and women. There was a positive association between education levels and PWB in both men ($\beta = 0.115$, $p = 0.190$ for 7-9 years and $\beta = 0.329$, $p = 0.001$ for $\geqslant$ 10 years vs. 0-6 years of education) and women ($\beta = 0.138$, $p = 0.127$ for 7-9 years and $\beta = 0.311$, $p = 0.003$ for $\geqslant$ 10 years vs. 0-6 years of education). The multilevel analyses also showed a positive association between household income per capita and PWB in men ($\beta = 0.188$, $p = 0.030$ for medium and $\beta = 0.554$, $p < 0.001$ for high vs. low levels of household income) and women ($\beta = 0.094$, $p = 0.271$ for medium and $\beta = 0.499$, $p < 0.001$ for

Table 1 Individual-level characteristics of community-level urbanization index grouped by tertiles and gender

Characteristic	Total	Men				Women			
		Low	Medium	High	p-value	Low	Medium	High	p-value
Participants (n)	6,456	1,047	1,020	1,004		1,101	1,129	1,155	
Median age, years (IQR)	62 (56-68)	61 (55-68)	62 (56-68)	62 (56-69)	0.335	62 (55-68)	61 (56-68)	62 (57-70)	0.012
Age, years					0.149				0.008
50-59	2,580 (39.96)	436 (41.64)	395 (38.73)	405 (40.34)		444 (40.33)	461 (40.83)	439 (38.01)	
60-69	2,470 (38.26)	396 (37.82)	413 (40.49)	361 (35.96)		422 (38.33)	454 (40.21)	424 (36.71)	
⩾ 70	1,406 (21.78)	215 (20.53)	212 (20.78)	238 (23.71)		235 (21.34)	214 (18.95)	292 (25.28)	
Education level, years					< 0.001				< 0.001
0-6	2,769 (42.89)	512 (48.90)	314 (30.78)	186 (18.53)		830 (75.39)	574 (50.84)	353 (30.56)	
7-9	1,834 (28.41)	366 (34.96)	372 (36.47)	290 (28.88)		197 (17.89)	293 (25.95)	316 (27.36)	
⩾ 10	1,853 (28.70)	169 (16.14)	334 (32.75)	528 (52.59)		74 (6.72)	262 (23.21)	486 (42.08)	
Marital status					0.003				0.071
Married	5,681 (88.00)	960 (91.69)	948 (92.94)	958 (95.42)		930 (84.47)	948 (83.97)	937 (81.13)	
Unmarried	775 (12.00)	87 (8.31)	72 (7.06)	46 (4.58)		171 (15.53)	181 (16.03)	218 (18.87)	
Work status					< 0.001				< 0.001
Unemployed	4,386 (67.94)	483 (46.13)	587 (57.55)	663 (66.04)		752 (68.30)	900 (79.72)	1,001 (86.67)	
Employed	2,070 (32.06	564 (53.87)	433 (42.45)	341 (33.96)		349 (31.70)	229 (20.28)	154 (13.33)	
Household income per capita					< 0.001				< 0.001
Low	2.148 (33.27)	563 (53.77)	296 (29.02)	137 (13.65)		633 (57.49)	342 (30.29)	177 (15.32)	
Medium	2.157 (33.41)	326 (31.14)	368 (36.08)	342 (34.06)		311 (28.25)	404 (35.78)	406 (35.15)	
High	2.151 (33.32)	158 (15.09)	356 (34.90)	525 (52.29)		157 (14.26)	383 (33.92)	572 (49.52)	
Current smoking					< 0.001				< 0.001
No	4,941 (76.53)	489 (46.70)	571 (55.98)	599 (59.66)		1,047 (95.10)	1,099 (97.34)	1,136 (98.35)	
Yes	1,515 (23.47)	558 (53.30)	449 (44.02)	405 (40.34)		54 (4.90)	30 (2.66)	19 (1.65)	
Alcohol drinking					< 0.001				0.007
No	4,699 (72.79)	456 (43.55)	498 (48.82)	524 (52.19)		1,065 (96.73)	1,060 (93.89)	1,096 (94.89)	
Yes	1,757 (27.21)	591 (56.45)	522 (51.18)	480 (47.81)		36 (3.27)	69 (6.11)	59 (5.11)	
Sleep duration, hours					< 0.001				< 0.001
⩽ 6	1,037 (16.06)	158 (15.09)	144 (14.12)	152 (15.14)		174 (5.14)	201 (5.94)	208 (6.14)	
7-8	4,217 (65.32)	641 (61.22)	695 (68.14)	701 (69.82)		657 (59.67)	744 (65.90)	779 (67.45)	
⩾ 9	1,202 (18.62)	248 (23.69)	181 (17.75)	151 (15.04)		270 (7.98)	184 (5.44)	168 (4.96)	
BMI classification					< 0.001				0.294
Underweight	240 (3.72)	66 (6.30)	29 (2.84)	30 (2.99)		43 (3.91)	36 (3.19)	36 (3.12)	
Normal	2,840 (43.99)	555 (53.01)	433 (42.45)	407 (40.54)		495 (44.96)	463 (41.01)	487 (42.16)	
Overweight	2,419 (37.47)	330 (31.52)	412 (40.39)	428 (42.63)		375 (34.06)	440 (38.97	434 (37.58)	
Obesity	957 (14.82)	96 (9.17)	146 (14.31)	139 (13.84)		188 (17.08)	190 (16.83)	198 (17.14)	
Hypertension					0.019				0.004
No	3,258 (50.46)	550 (52.53)	479 (46.96)	476 (47.41)		607 (55.13)	543 (48.10)	603 (52.21)	
Yes	3,198 (49.54)	497 (47.47)	541 (53.04)	528 (52.59)		494 (44.87)	586 (51.90)	552 (47.79)	

Continued on next page

Table 1 (*continued*)

Characteristic	Total	Men				Women			
		Low	Medium	High	p-value	Low	Medium	High	p-value
History of DM					< 0.001				< 0.001
No	5,993 (92.83)	1,011 (96.56)	931 (91.27)	913 (90.94)		1,053 (95.64)	1,038 (91.94)	1,047 (90.65)	
Yes	463 (7.17)	36 (3.44)	89 (8.73)	91 (9.06)		48 (4.36)	91 (8.06)	108 (9.35)	
History of MI					0.596				0.683
No	6,369 (98.65)	1,029 (98.28)	1,006 (98.63)	992 (98.80)		1,088 (98.82)	1,112 (98.49)	1,142 (98.87)	
Yes	87 (1.35)	18 (1.72)	14 (1.37)	12 (1.20)		13 (1.18)	17 (1.51)	13 (1.13)	
History of stroke					0.657				0.882
No	6,334 (98.11)	1,019 (97.33)	988 (96.86)	979 (97.51)		1,090 (99.00)	1,117 (98.94)	1,141 (98.79)	
Yes	122 (1.89)	28 (2.67)	32 (3.14)	25 (2.49)		11 (1.00)	12 (1.06)	14 (1.21)	
History of cancer					0.042				0.074
No	6,358 (98.48)	1,037 (99.04)	997 (97.75)	991 (98.71)		1,090 (99.00)	1,113 (98.58)	1,130 (97.84)	
Yes	98 (1.52)	10 (0.96)	23 (2.25)	13 (1.29)		11 (1.00)	16 (1.42)	25 (2.16)	
PWB score	10 (9-12)	9 (8-11)	10 (9-12)	10 (9-12)	< 0.001	9 (8-10)	10 (9-12)	10 (9-12)	< 0.001

Data presented as n (%), unless otherwise specified.
BMI = body mass index; DM = diabetes mellitus; IQR = interquartile range; MI = myocardial infarction; PWB = psychological well-being.

high vs. low levels of household income). A history of DM or stroke showed a significant negative relationship with increased PWB in men (DM, β = -0.538, $p < 0.001$; stroke, β = -1.145, $p < 0.001$) and women (DM, β = -0.330, p = 0.010; stroke, β = -0.829, p = 0.009). There was no significant association between age and PWB in men. In contrast, women aged 60-69 years (β = -0.234, p = 0.004), or $\geqslant$ 70 years (β = -0.467, $p < 0.001$) had significantly lower PWB scores than those aged 50-59 years. Employed men reported higher PWB than unemployed men (β = 0.332, $p < 0.001$), while unmarried men reported lower PWB compared with those who were married (β = -0.611, $p < 0.001$). A statistically significant association was observed between short sleep duration ($\leqslant$ 6 h) and PWB in women (β = -0.267, p = 0.003). The prevalence of being overweight was associated with PWB in men (β = 0.214, p = 0.005), while there was an association between the prevalence of hypertension and PWB in women (β = -0.145, p = 0.038). Moreover, male participants with a history of MI (β = -0.575, p = 0.041) or cancer (β = -0.784, p = 0.004) had lower PWB than those without a history of MI or cancer.

Discussion

To our knowledge, the present study is the first to evaluate the effects of urbanization on PWB in the CHNS data using multilevel analyses. We found that urbanization index was associated positively with PWB in middle-aged and older Chinese populations. This association was stronger in women than in men, with the association remaining after adjustment for individual-level factors. Further analysis of the results showed that women appeared to be more sensitive than men to the components of urbanization. Many of the components were separately and positively associated with PWB levels in women after controlling for individual-level factors. The observed gender difference in our study may be partly due to the stereotype that women are more emotionally expressive than men.[30] As influenced by gender role expectations, women and men are exposed to different socialization settings and experiences, leading to gendered emotionality.[31] Interestingly, the gender difference of emotion expressions applies widely to Chinese society as it undergoes rapid urbanization.[31] Previous studies have revealed that the expression of emotions is associated positively with life satisfaction and PWB.[32] Therefore, it is possible that gender differences in emotional experience moderate the influence of urbanization on PWB.

Generally, our results were consistent with those of previous studies on the emotional health effects of urbanization in the Chinese setting.[10,18,33] For example, the China Inequality and Distributive Justice Project showed that urban citizens had a slightly higher level of subjective well-being than that of rural citizens.[10] The positive associations between urbanization as a community-level construct and PWB are complex, with several potential mechanisms. One speculation is that residents living in relatively more urbanized areas have a stronger sense of urban identity, a recognized important factor that contributes to the quality of life of people.[11,34,35] In China,

Table 2 Results of multilevel modeling on psychological well-being in men

	Model 1[†]			Model 2[‡]			Model 3[§]		
Fixed part	β coefficient	SE	p-value	β coefficient	SE	p-value	β coefficient	SE	p-value
Individual variables									
Intercept	9.790	0.145	< 0.001	9.475	0.144	< 0.001	8.949	0.174	< 0.001
Age, years (ref. = 50-59)									
60-69							0.047	0.084	0.580
⩾ 70							-0.084	0.109	0.442
Marital status (ref. = married)							-0.611	0.137	< 0.001
Work status (ref. = unemployed)							0.332	0.082	< 0.001
Education level, years (ref. = 0-6)									
7-9							0.115	0.088	0.190
⩾ 10							0.329	0.097	0.001
Household income per capita (ref. = low)									
Medium							0.188	0.087	0.030
High							0.554	0.099	< 0.001
Current smoking (ref. = no)							0.095	0.072	0.185
Alcohol drinking (ref. = no)							0.131	0.072	0.069
Sleep duration, hours (ref. = 7-8)									
⩽ 6							-0.030	0.098	0.757
⩾ 9							0.113	0.091	0.212
BMI (ref. = normal)									
Underweight							-0.240	0.173	0.167
Overweight							0.214	0.076	0.005
Obesity							0.180	0.111	0.106
Hypertension (ref. = no)							-0.031	0.071	0.658
History of DM (ref. = no)							-0.538	0.134	< 0.001
History of MI (ref. = no)							-0.575	0.281	0.041
History of stroke (ref. = no)							-1.145	0.207	< 0.001
History of cancer (ref. = no)							-0.784	0.274	0.004
Community variable									
Urbanization index (ref. = low)									
Medium				0.324	0.119	0.007	0.259	0.121	0.031
High				0.628	0.120	< 0.001	0.421	0.127	0.001
Random part									
Province/municipality variance	0.223	0.107	0.019	0.165	0.082	0.022	0.101	0.055	0.033
Community variance	0.316	0.056	< 0.001	0.264	0.052	< 0.001	0.275	0.052	< 0.001
Residual variance	3.436	0.092	< 0.001	3.438	0.092	< 0.001	3.203	0.086	< 0.001
-2 log likelihood	12.725.0			12.704.0			12.530.3		

BMI = body mass index; DM = diabetes mellitus; MI = myocardial infarction; SE = standard error.
[†] Model 1, null model.
[‡] Model 2, addition of the urbanization index at a community level to model 1.
[§] Model 3, addition of individual and community variables to model 2.

the household registration (*hukou*) system is an economic and social institution that categorizes citizens into urban or rural residents living in a particular location.[34,36] The system has long been considered as the major cause of social exclusion and discrimination of rural residents.[37] An urban identity is regarded as the consequence of a complex relationship between oneself and the urban environment.[11] In China, urban identity is strongly and significantly influenced by *hukou* status.[34] A study by Zhou et al.[38] demonstrated that the social identity of urban living had a greater impact on happiness than the identity of being rural. Therefore, individuals with a higher urban identity are more likely to report positive emotions in daily life. A second explanation is that urbanization can improve access to ecological and cultural services, which may increase the quality of life. The China Health and Retirement Longitudinal Study found that residents living in less urbanized communities generally had fewer resources to cope with depression, such as health care, basic infrastructure, and economic opportunities, than those in more urbanized communities.[39] The present study carried out the first empirical examination of the pathways linking urbanization components and PWB, and showed that community population density, economic activity, housing, education, diversity, and sanitation were associated with PWB in both men and women. In addition, female residents living in more urbanized communities, who had better access to proper communications, social services, transportation, and modern markets, tended to have a higher PWB than those living in less urbanized areas. Although pathways have been proposed to elucidate this association, further studies are necessary to validate the role of other urbanization components in the improvement of human well-being.

Regarding the factors that may have an influence at an individual level, age,[40] marital status,[40] work status,[41] education level,[40] household income,[10] short sleep duration,[42,43] high BMI ($\geqslant$ 24.0 kg/m^2),[40,44] and chronic conditions[45,46] have been reported previously to be associated with quality of life (e.g., happiness, life

Table 3 Results of multilevel modeling on psychological well-being in women

	Model 1[†]			Model 2[‡]			Model 3[§]		
Fixed part	β coefficient	SE	p-value	β coefficient	SE	p-value	β coefficient	SE	p-value
Individual variables									
Intercept	9.610	0.140	< 0.001	9.084	0.132	< 0.001	9.225	0.148	< 0.001
Age, years (ref. = 50-59)									
60-69							-0.234	0.081	0.004
⩾ 70							-0.467	0.105	< 0.001
Marital status (ref. = married)							-0.158	0.094	0.093
Work status (ref. = unemployed)							-0.023	0.089	0.795
Education level, years (ref. = 0-6)									
7-9							0.138	0.091	0.127
⩾ 10							0.311	0.104	0.003
Household income per capita (ref. = low)									
Medium							0.094	0.086	0.271
High							0.499	0.099	< 0.001
Current smoking (ref. = no)							-0.029	0.200	0.884
Alcohol drinking (ref. = no)							0.177	0.156	0.258
Sleep duration, hours (ref. = 7-8)									
⩽ 6							-0.267	0.091	0.003
⩾ 9							-0.049	0.091	0.590
BMI (ref. = normal)									
Underweight							-0.197	0.186	0.289
Overweight							0.085	0.075	0.253
Obesity							0.129	0.098	0.187
Hypertension (ref. = no)							-0.145	0.070	0.038
History of DM (ref. = no)							-0.330	0.128	0.010
History of MI (ref. = no)							0.337	0.293	0.251
History of stroke (ref. = no)							-0.829	0.315	0.009
History of cancer (ref. = no)							-0.269	0.266	0.313
Community variable									
Urbanization index (ref. = low)				0.711	0.124	< 0.001	0.587	0.124	< 0.001
Medium				0.872	0.124	< 0.001	0.645	0.130	< 0.001
High									
Random part									
Province/municipality variance	0.203	0.101	0.022	0.117	0.063	0.032	0.078	0.046	0.044
Community variance	0.450	0.066	< 0.001	0.340	0.056	< 0.001	0.314	0.054	< 0.001
Residual variance	3.551	0.090	< 0.001	3.551	0.090	< 0.001	3.413	0.087	< 0.001
-2 log likelihood	14177.8			14132.8			14020.1		

BMI = body mass index; DM = diabetes mellitus; MI = myocardial infarction; SE = standard error.
[†] Model 1, null model.
[‡] Model 2, addition of the urbanization index at a community level to model 1.
[§] Model 3, addition of individual and community variables to model 2.

satisfaction, and PWB). These results are consistent with our findings. The PWB scores declined with age, and older adults are known to be more vulnerable to life stresses than their younger counterparts.[39] Married participants had a better PWB than unmarried participants, as a consequence of married people normally experiencing less loneliness[39,47] and benefiting from the social support offered by marriage.[40] Employed participants reported a higher PWB than unemployed participants, due to employment providing financial security.[41] Compared to participants with a low education level, participants with a high education level had a better PWB. This was attributed to people with more education being able to acquire more health information on how to improve their health conditions.[39,47] Higher household income per capita was also linked to greater PWB because participants with higher incomes have more social capital to relieve life pressures.[10,39] Short sleep duration was associated with lower levels of PWB as a result of sleep restriction potentially leading to a series of adverse neurobehavioral consequences and physiological changes.[48,49] A high BMI was associated positively with PWB, because people admire the Chinese cultural saying of "*xin kuan ti pang*"[40,44] ("jolly fat" in English[50]), and gaining weight is generally seen as a sign of being well-groomed and in good health among older Chinese people.[44,51] Finally, participants with chronic conditions had a lower PWB than those without chronic conditions, as a consequence of these conditions being a type of life stressor.[52]

The strengths of the current study were that the multicomponent urbanization index was able to capture more accurately the community attributes that may affect local residents. Using these urbanization components may produce better findings regarding the association between community socioeconomic conditions and PWB. The findings did provide insight related to community-level factors that might be targets for policy change in China and other recently urbanized countries. However, several limitations should be considered when interpreting our findings. First, the CHNS was not a nationally

Table 4 Multilevel-adjusted associations between urbanization components and psychological well-being, stratified by gender[†]

	Men			Women		
Urbanization components	β coefficient[‡]	SE	p-value	β coefficient[‡]	SE	p-value
Population density	0.143	0.055	0.010	0.223	0.057	< 0.001
Communications	0.087	0.051	0.085	0.123	0.052	0.019
Economic activity	0.135	0.051	0.008	0.215	0.053	< 0.001
Housing	0.154	0.053	0.004	0.270	0.055	< 0.001
Traditional markets	0.021	0.048	0.669	0.066	0.050	0.189
Modern markets	0.091	0.049	0.060	0.151	0.051	0.003
Social services	0.070	0.049	0.154	0.111	0.051	0.030
Transportation	0.041	0.048	0.391	0.098	0.050	0.048
Education	0.148	0.057	0.009	0.255	0.059	< 0.001
Diversity	0.152	0.049	0.002	0.279	0.049	< 0.001
Health infrastructure	0.017	0.048	0.727	0.002	0.050	0.966
Sanitation	0.167	0.050	0.001	0.249	0.052	< 0.001

SE = standard error.
[†] A separate multilevel analysis was performed for each urbanization component, adjusting for age (50-59, 60-69, or ⩾ 70 years), education level (0-6, 7-9, or ⩾ 10 years), marital status (married or unmarried), occupational status (employed or unemployed), household income per capita (low, medium, or high), current smoking (yes or no), alcohol drinking (yes or no), sleep duration (⩽ 6, 7-8, or ⩾ 9 h), BMI (underweight, normal, overweight, or obesity), hypertension (yes or no), and history of diabetes mellitus (yes or no), stroke (yes or no), myocardial infarction (yes or no), and cancer (yes or no).
[‡] β coefficient representing the effect of a 1-SD increase in the component score.

representative survey, although the sampling design encompassed communities from 12 different provincial regions in northeast, central, and south China.[53] This diversity made our analysis possible.[54] Second, the study used a cross-sectional design, which precluded interpretations about causality. It is possible that people with better mental health are more likely to migrate to more urbanized communities for better educational and employment opportunities.[39,53,55] Third, we adjusted the data for multiple confounders but could not exclude the possibility of residual bias due to unmeasured factors such as mental conditions. Fourth, the outcome measurement was based on a three-item PWB; therefore, comprehensive tools, such as the pleasure subscale of the Quality of Life Scale (CASP-19), should be used in future studies.

The current study in a middle-aged and older Chinese population showed that a higher index of urbanization was associated positively with PWB, even after adjustment for individual-level factors. The study also observed that many components of urbanization, particularly community population density, economic activity, housing, education, diversity, sanitation, communications, social services, transportation, and modern markets, were independently and positively associated with PWB in middle-aged and older adults, especially women. These findings provide novel insights to support decision-makers on how to equitably allocate public resources to improve human well-being in the face of rapid urbanization.

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Disclosure

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