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Community Built Environment and Multilevel Social Determinants of Obesity: Evidence from China Health and Nutrition Survey

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Background, Purpose and Theoretical Framework

Background

- The prevalence of overweight and obesity is highest in wealthy countries like the United States, but is rapidly increasing in less developed countries.
- From 1992 to 2002, China had an increase from 14.6% to 21.8% in overweight and obesity
- Social determinants of obesity in developing countries remain poorly understood
- Further, these associations may vary by community built environment (BE) of developing countries

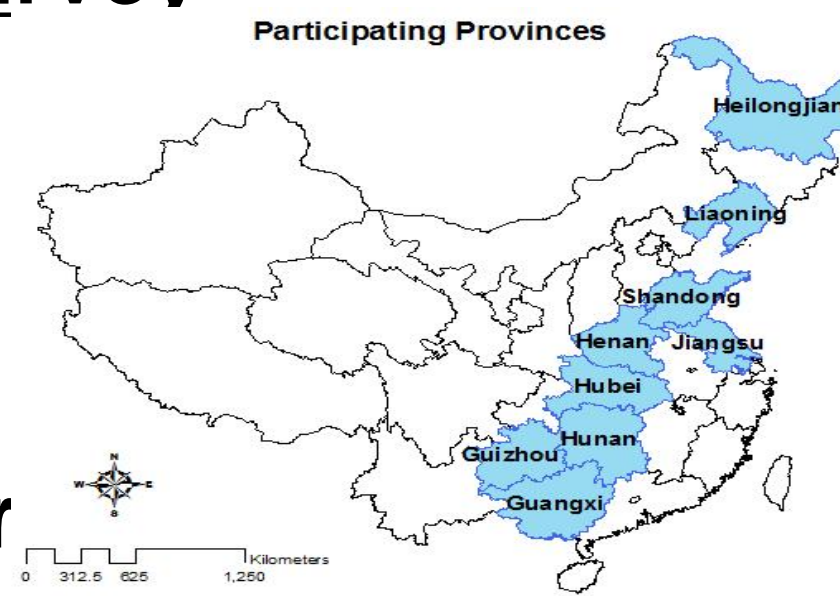
Methods

2006 China Health and Nutrition Survey

- Multistage, multi-level random cluster survey
- 9,586 adults from 9 provinces and 218 PSUs

2006 China General Social Survey

- Nationally representative
- Income inequality



Multilevel Variables

Dependent: BMI and obesity risk

Independent:

- Level-1: individual level**
Education, Occupation, Absolute Income, Wealth quintiles, and Relative income
Age, Sex, Marital status
Smoking, Alcohol consumption
- Level-2: community level**
Mean income, Mean education, Urbanicity index, Gini coefficient, Cross-level interactions

Statistical analysis

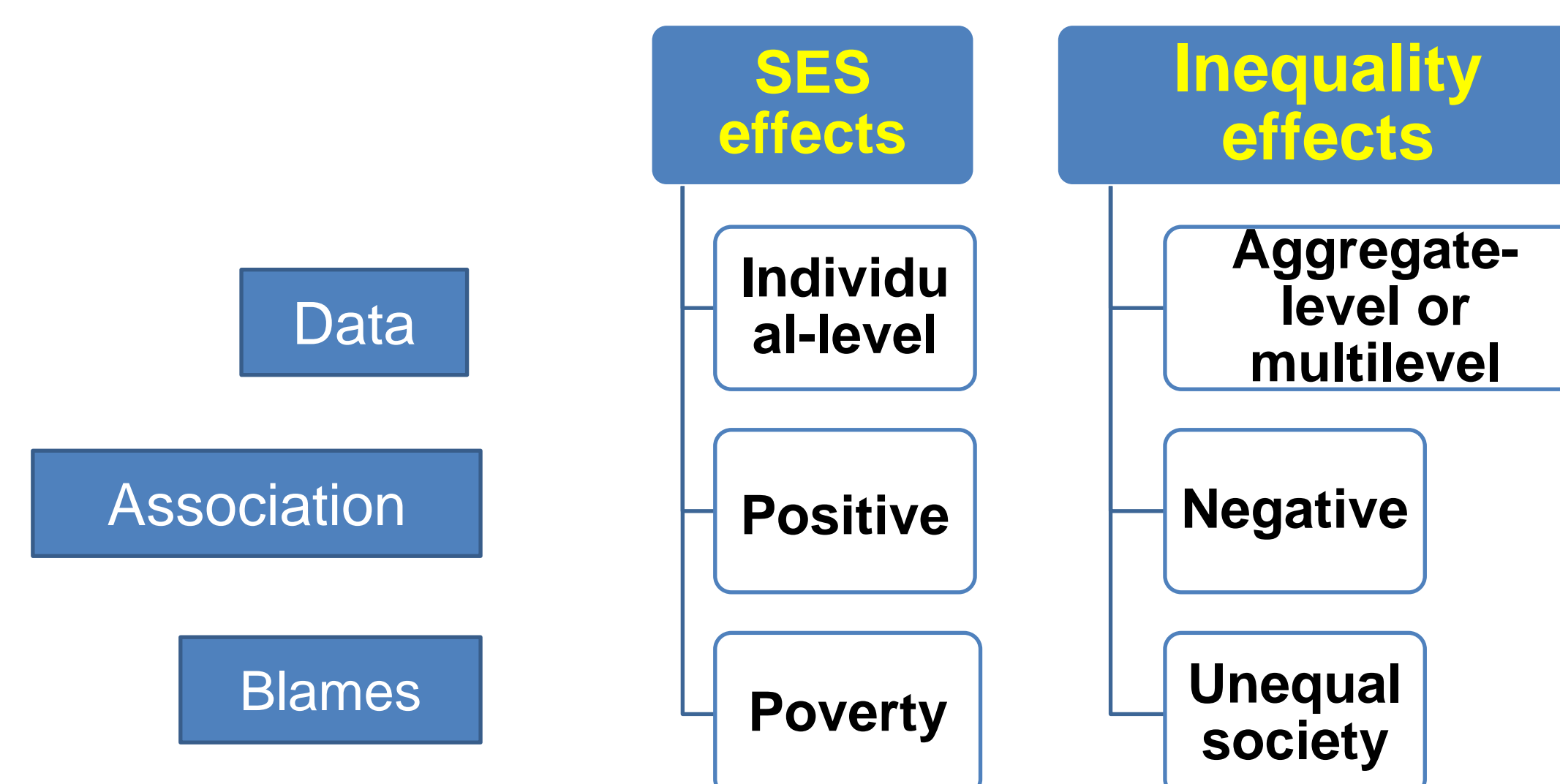
- Bivariate associations
- Hierarchical linear regression and multilevel logistic regression models adjusted for age, sex, marital status, urbanicity index
- Forward selection and Goodness-of-fit (BIC)
- Stratified analysis by BE contexts. Likelihood ratio test (LRT) for comparison across different community BE contexts

		Local Recreational and Sports Environment	
		Yes	No
Local Fast Food Environment	Yes	Presence-Presence	Presence-Absence
	No	Absence-Presence	Absence-Absence

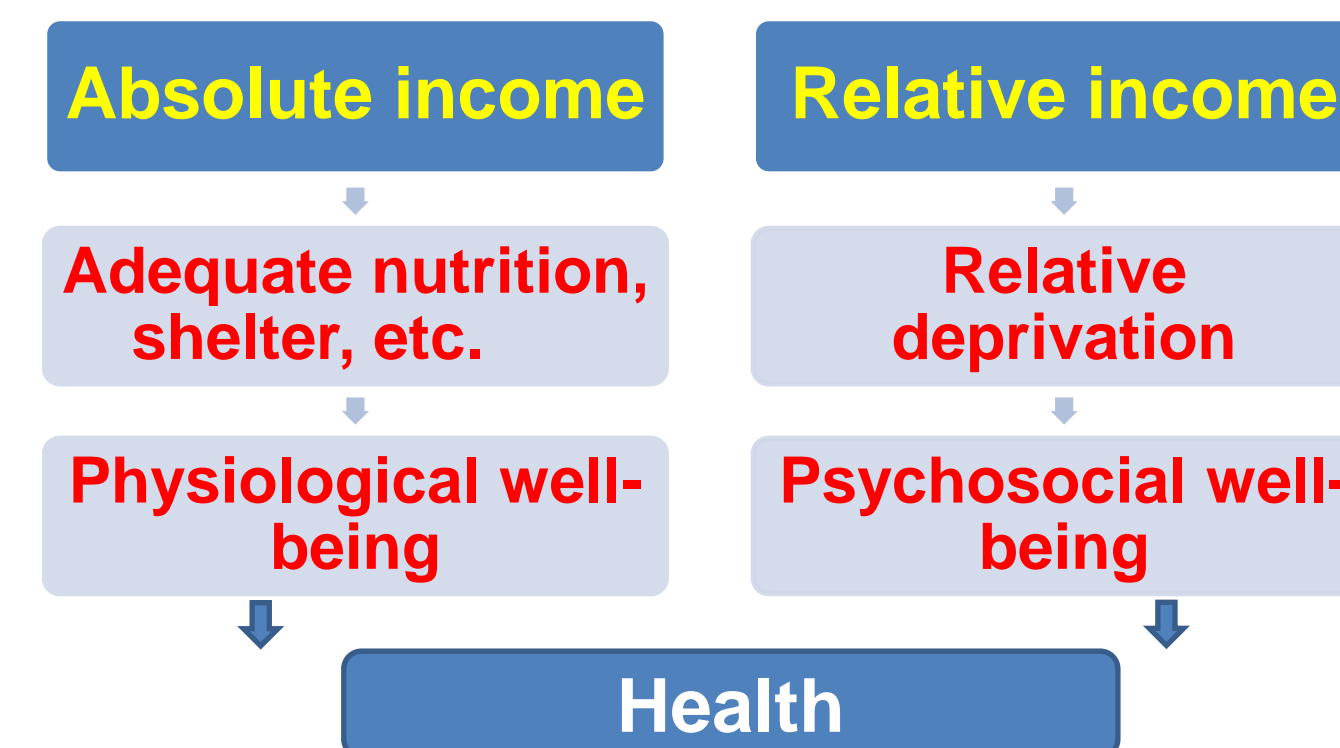
Purpose

To understand how multilevel social determinants of obesity varied by different types of built environments assessed by the presence/absence of local fast food restaurants and sports facilities.

Mechanisms that SES and inequality affect health



Theoretical framework of social determinants of health



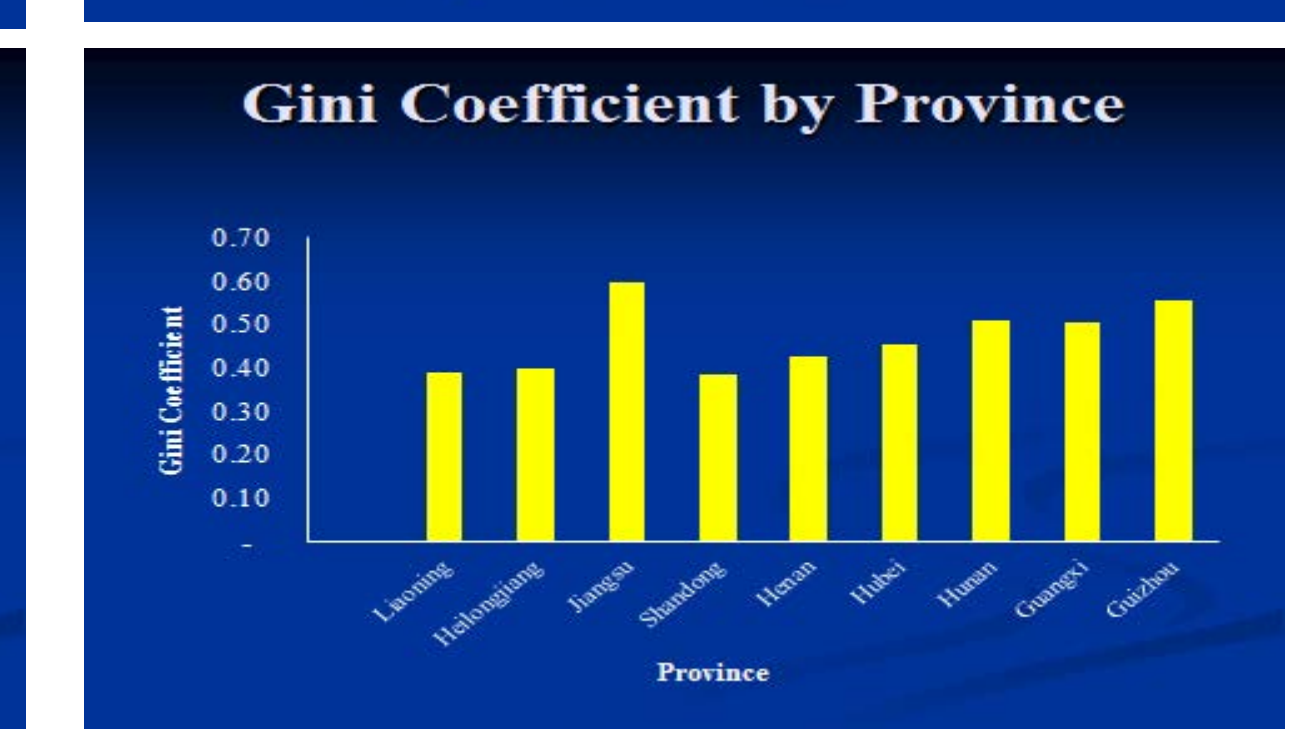
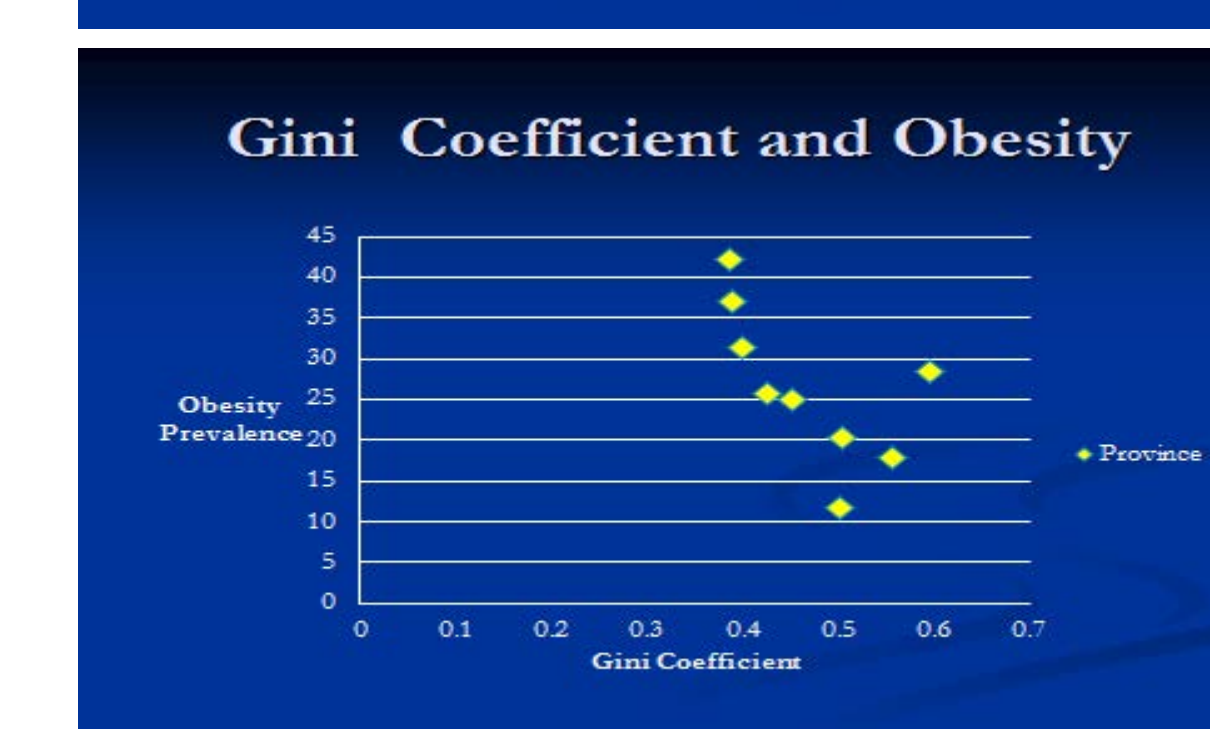
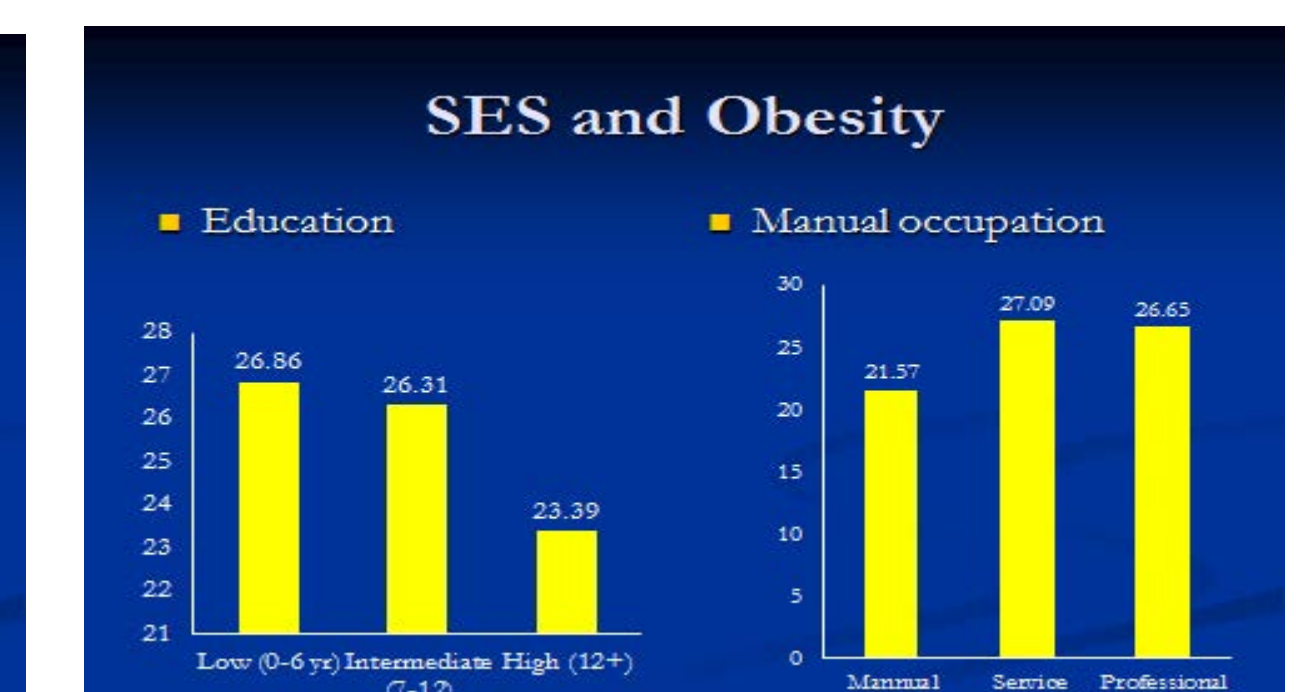
Characteristics of 2006 CHNS participants

Variables	Mean	SD	Min	Max
Dependent Variable				
BMI	23.35	3.63	15	40
Obesity (Yes=1)	0.26	0.44	0	1
Independent Variables, individual-level				
Female	0.52	0.50	0	1
Age	49.34	15.29	18	97
Marital status (Married=1)	0.83	0.37	0	1
Work Status (Working=1)	0.59	0.49	0	1
Education				
Low (0-6)	7.42	4.43	0	19
Intermediate (7-12)	0.43	0.49	0	1
High (12+)	0.51	0.50	0	1
Occupation				
Professional	0.17	0.37	0	1
Manual	0.63	0.48	0	1
Service	0.20	0.40	0	1
Smoking	0.32	0.47	0	1
Alcohol Consumption	0.31	0.46	0	1
Wealth Index				
1st Quintile	2.32	1.02	0	5.00
2nd Quintile	0.91	0.36	0	1.37
3rd Quintile	1.67	0.16	1.38	1.93
4th Quintile	2.20	0.16	1.93	2.54
5th Quintile	2.86	0.20	2.54	3.26
Income (in 1000 yuan)	3.76	0.36	3.26	5.00
1st Quintile	11.92	15.28	-6.44	315.61
2nd Quintile	1.68	1.07	-6.44	3.2
3rd Quintile	4.74	0.89	3.21	6.34
4th Quintile	8.29	1.21	6.34	10.57
5th Quintile	13.55	1.96	10.57	17.33
Deaton's RDI	31.35	24.72	17.36	315.61
0.23	0.18	0	1	
Independent Variables, community-level				
Mean Income (in 1000 yuan)	11.92	7.52	2.58	55.01
Mean Education (in years)	7.43	2.17	2.24	13.64
Urbanicity Index	64.43	20.40	27.22	101.6
Urban Community (Urban=1)	0.31	0.46	0	1
Gini Coefficient * 100	47.30	7.02	38.63	59.61
Jiangsu	0.11	0.32	0	1
Guangxi	0.12	0.33	0	1

Results

Stratified analysis of community BE contexts and obesity

Fixed effects	Overall Model		Absence-Absence		Absence-Presence		Presence-Absence		Presence-Presence	
	OR	SE	OR	SE	OR	SE	OR	SE	OR	SE
Level-1 Variables:										
Demographic Control										
Female	1.000	0.051	1.173*	0.083	0.916	0.087	0.74	0.124	0.685*	0.122
Age	1.123***	0.013	1.111***	0.018	1.128***	0.025	1.161***	0.045	1.172***	0.049
Age ²	0.999***	< .001	0.999***	< .001	0.999***	<0.001	0.999***	<0.001	0.999***	<0.001
Married	1.217*	0.099	1.344*	0.159	1.274	0.193	0.796	0.194	0.889	0.24
SES										
Education (ref.=0-6)										
Medium Education (7-12)	0.918	0.058	1.029	0.087	0.859	0.104	0.528**	0.118	0.908	0.22
High Education (12+)	0.725*	0.096	0.874	0.193	0.826	0.178	0.155***	0.068	0.763	0.301
Work Status (ref.=not working)	0.948	0.083	1.022	0.132	0.969	0.152	0.872	0.245	0.836	0.22
Occupation (ref.= service)										
Professional	0.815	0.093	0.915	0.162	0.686	0.138	0.986	0.333	0.864	0.273
Manual	0.720***	0.064	0.692**	0.087	0.723*	0.117	0.686	0.218	0.716	0.237
Wealth (ref.=1st Q)										
2nd Quintile	1.157	0.101	1.078	0.111	1.371	0.252	1.562	0.713	1.329	0.636
3rd Quintile	1.131	0.101	1.156	0.128	1.108	0.200	1.057	0.467	1.142	0.567
4th Quintile	1.307**	0.126	1.358*	0.171	1.257	0.240	1.313	0.546	1.815	0.843
5th Quintile	1.363**	0.143	1.199	0.181	1.343	0.280	1.932	0.789	1.756	0.788
Income (ref.=1st Q)										
2nd Quintile	1.042	0.097	1.064	0.127	1.086	0.204	1.441	0.529	0.711	0.309
3rd Quintile	1.249*	0.141	1.173	0.177	1.531	0.351	2.100	0.935	1.316	0.619
4th Quintile	1.448**	0.2	1.352	0.252	1.869*	0.529	3.807*	2.073	1.003	0.558
5th Quintile	1.457*	0.269	1.345	0.343	2.467*	0.907	3.123	2.248	0.762	0.548
Relative Income (RDI)	0.702	0.22	0.673	0.299	0.385	0.240	0.263	0.299	1.716	1.895
Level-2 Variables:										
Community Characteristics										
Mean Income (in 1000 yuan)										
	0.989	0.007	0.979	0.012	0.987	0.012	0.919**	0.027	1.036	0.032
Mean Education (in years)	0.951*	0.023	0.953	0.033	0.970	0.045	1.072	0.068	0.828	0.097
Urbanicity Index	1.008**	0.003	1.24	0.164	1.066	0.179	0.694	0.155	1.062	0.411
Urban (ref.=Rural =1)	1.077	0.097	1.006	0.004	1.005	0.006	1.012	0.009	1.027	0.015
Gini Coefficient *100	0.932***	0.006	0.918***	0.009	0.939***	0.011	0.944*	0.027	0.934***	0.019
Province Indicator										
Jiangsu	2.493***	0.353	2.908***	0.713	2.077**	0.524	3.232*	1.699	2.908**	1.210
Guangxi	0.496***	0.061	0.539***	0.085	0.449***	0.094	(omitted)		0.751	0.311
Random-effects Parameters										
ICC	0.025	(0.006)	0.017	(0.008)	0.024	(0.011)	0.001	(0.017)	<0.001	(<0.001)
Level-2 Variance	0.085	(0.001)	0.056	(0.003)	0.082	(0.004)	<0.001	(<0.001)	<0.001	(<0.001)
Model Chi-square	476.58		260.86		171.89		81.11		66.00	
Model df	25		25		24		24		25	
-2 LL	10,285.180		5,411.650		2,997.18		915.616		858.091	
LRT	102.646*									
N	9,586		5,222		2,777		791		796	



Conclusions

- Patterns of SES and inequality affecting obesity risks in developing countries can be uniquely different from that in developed societies.
- To the best of our knowledge, this is the first study reporting consistently strong negative effects of inequality on obesity, opposite of Wilkinson's income inequality hypothesis of health in developed countries.