

An epidemiology study of fecal incontinence in adult Chinese women living in urban areas

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Abstract

Background: Fecal incontinence (FI) has been shown to be a common symptom in Western countries; however, there is few researches focusing on its epidemic condition in Chinese women. We conducted this national population-based epidemiology study to estimate the prevalence and risk factors of FI among adult Chinese women living in urban regions.

Methods: This is a subgroup analysis of a national population-based epidemiology study of FI. Total 28,196 adult women from urban regions of six provinces and municipalities participated in this research from 2014 to 2015. They finished the questionnaire under the direction of trained interviewers. FI was defined as accidental leakage of flatus and/or liquid or solid stool at least once in the past. The FI prevalence trend and risk factors were identified by the Cochran-Armitage test, Chi-square test, and multivariable logistic regression.

Results: The prevalence of FI in adult females in urban China was 0.43% (95% confidence interval: 0.35%–0.51%). Among women with FI, 42.96%, 82.96%, and 42.22% reported having leakage of solid, liquid stool, and gas, respectively. The overall FI prevalence and the incidence rate of solid stool/liquid stool/gas leakage increased with age. The mean Wexner score was 4.0% and 12.0% FI patients reported Wexner score ≥ 9 . Body mass index ≥ 24 kg/m², pelvic organ prolapses, chronic constipation, chronic cough, alcohol consumption, physical diseases including chronic bronchitis and cancer, gynecological diseases like gynecological inflammation are risk factors for FI. Vaginal delivery was the risk factor for FI in females with labor history.

Conclusions: FI was not a common symptom in adult Chinese women living in urban areas and there were some potential modifiable risk factors.

Trial Registration: Chinses Clinical Trial Registry: ChiCTR-OCS-14004675; <http://www.chictr.org.cn/showproj.aspx?proj=4898>

Keywords: Epidemiology; Fecal incontinence; Prevalence; Risk factor; Urban area

Introduction

Fecal incontinence (FI) is the inability to control the discharge of intestinal contents including solid or liquid stool and gas. FI has been reported as a common disorder in Western societies, causing poor quality of life, depression, and social isolation.^[1] However, only a small proportion of patients report the symptoms to their

doctors because of embarrassment, resulting in the low probability of diagnosis and treatment.^[2]

Due to different definitions of FI and population samples, the prevalence of FI varies. Menees *et al* recruited 71,812 American individuals aged 18 years and older in 2015 and reported an FI prevalence of 14.4% (experienced FI in the past) and 5% (FI event within the past week).^[3] We found a high prevalence of FI in some specific samples, such as old

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people in Japan (6.6%) and Taiwan, China or residents of Bali, Indonesia (22.4%).^[4-6] Although some regional studies have been published, there is still no national population-based epidemiology research about the prevalence of and risk factors for FI in Chinese women.^[7] The aims of this study were to identify the prevalence of and risk factors for FI in adult Chinese women living in urban areas.

Methods

Ethical approval

The study was conducted in accordance with the *Declaration of Helsinki* and was approved by the local Ethics Committee of Peking Union Medical College Hospital (PUMCH) approved this survey at May 15, 2013 (No. S-689). Informed written consent was obtained from all patients before their enrollment in this study.

Study design and participants

The data came from the national survey on the standardized diagnosis and treatment of pelvic floor disorders among adult Chinese women conducted by PUMCH in 2014 to 2015. This was a cross-sectional, face-to-face interview survey, conducted along with a national cervical cancer and breast cancer screening project which was free for all adult females. Six provinces (Liaoning, Gansu, Guangdong, Jiangsu, Shanxi, and Guizhou) were selected by computer-generated random number from the six geographic regions of the mainland of China (Northeast, North, East, South central, Northwest, and Southwest China) to reflect the diversity of economy and race of Chinese women. Three counties were selected from each province by a multicenter, stratified random sampling method according to urbanization and age distribution. A target sample size of 4500 urban living individuals for each province was selected in a stratified random sampling method by age according to the sixth national demographic investigations. Adult females who took part in the cancer screening project would be invited to finish the questionnaire under the direction of trained interviewers. To deal with the problem of population movement, only women who had lived in the current residence for more than 5 years were recruited. Pregnant and lactating women were excluded because the pelvic floor disorder would be worse in them. The ethics committee approved this survey, and each participant provided signed informed consent. Total 29,613 women living in urban China participated in this survey. And after excluding ineligible questionnaires, 28,196 women were enrolled in final analysis. The flowchart shows all the detailed information about this survey [Figure 1].

Data collection and diagnostic criteria

A standard questionnaire was administered by trained staff to obtain demographic characteristics including age, current marital status, height, weight, parity, residence, job, and race. We also collected information about the potential risk factors for FI, including history of surgery, chronic constipation (lasting more than 1 year), chronic cough (lasting more than 3

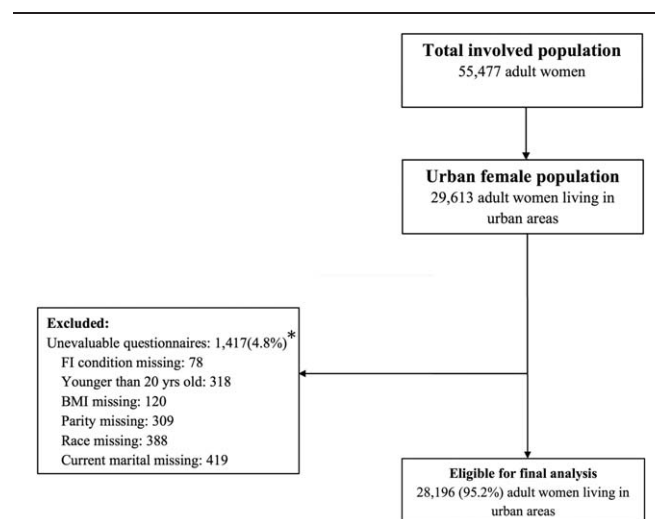


Figure 1: The flowchart of this study. *There are 215 questionnaires lacking information of two or more items.

weeks), smoking, general medical diseases (including hypertension, diabetes mellitus, stroke, chronic bronchitis, cancer, and depression), and obstetric diseases (including inflammation, chronic pelvic pain, endometriosis, and uterine fibroids). Pelvic organ prolapse quantification (POP-Q) stages were measured by clinical doctors. If participants had both cesarean section (CS) and vaginal delivery history, they would be marked as vaginal delivery individuals and only those participants just had CS history would be marked as CS individuals. If participants had obstetric forceps/fetus aspiration history, they would also be marked as obstetric forceps/fetus aspiration individuals.

The women who answered “yes” to the question “Do you have any experience of uncontrollable defecation, or leakage of intestinal contents including gas, liquid, and solid stool, after feeling of bowel movement, but before going to the toilet?” were considered as FI patients. Jorge-Wexner score was used to estimate FI degree.^[8] Patients can choose scores of 0 to 4 to represent the frequency of flatus, solid stool leakage, liquid stool leakage, using pads, and lifestyle alternations, including “never, occasional (less than once per month), sometimes (once per month–once per week), usually (once per week–once per day), or always (everyday),” respectively.

Statistical analysis

IBM® SPSS® 21.0 statistical package (SPSS Inc., Chicago, IL, USA) and R Programming Language 3.5.1 were used in this research to deal with the data analysis. Measurement data were presentation as mean \pm standard deviation. Demographic information and potential risk factors that have been reported in previous studies were analyzed by the Chi-square test. Cochran-Armitage test was used to investigate the trend of FI prevalence and the prevalence of flatus and solid and liquid stool leakage in the age groups. Multivariable logistic regression was used to estimate the adjusted odds ratios (OR) and 95% confidence intervals (CIs) of the potential risk factors. A two-sided P value ≤ 0.05 was considered to indicate statistical significance.

Table 1: Characteristics of the 28,196 subjects interviewed.

Characteristics	Values
Age (years), mean \pm SD	44.60 \pm 16.24
Age, <i>n</i> (%)	
20–29 years	6365 (22.57)
30–39 years	6599 (23.40)
40–49 years	5497 (19.50)
50–59 years	3930 (13.94)
60–69 years	3070 (10.89)
≥ 70 years	2735 (9.70)
Current marital status, <i>n</i> (%)	
Single, never married	2648 (9.39)
Married	24,097 (85.46)
Divorced/Separated	295 (1.05)
Widowed	1156 (4.10)
BMI (kg/m ²), mean \pm SD	22.46 \pm 2.99
BMI, <i>n</i> (%)	
Underweight (<18.5 kg/m ²)	1921 (6.81)
Normal (18.5–23.9 kg/m ²)	6230 (22.10)
Overweight (24.0–27.9 kg/m ²)	1382 (4.90)
Obese (≥ 28 kg/m ²)	18,663 (66.19)
Parity (time), median (range)	1 (0–10)
Parity, <i>n</i> (%)	
Nulliparous	5192 (18.41)
Semelparous (Parity = 1)	13,730 (48.69)
Multiparous (Parity = 2)	5663 (20.08)
Multiparous (Parity ≥ 3)	3611 (12.81)
Job, <i>n</i> (%)	
Physical labor	6,959 (24.68)
Mental labor	21,237 (75.32)
Race, <i>n</i> (%)	
Han	27,279 (96.75)
Minority	917 (3.25)

SD: Standard deviation; BMI: Body mass index.

Results

A total of 29,613 women living in urban areas participated in this survey; 28,196 (95.2%) women completed the questionnaire. The age distribution ranged from 20 to 99 years old, with a mean age of (44.6 \pm 16.2) years. A total of 917 (3.3%) individuals were minorities. Table 1 shows the demographic characteristics of these urban participants.

FI prevalence among urban women

The unadjusted FI prevalence in adult Chinese women living in urban areas was 0.48% (95% CI: 0.41%–0.56%). After adjusting the weighting of each age-group according to the sixth national demographic investigations, the FI prevalence of urban Chinese women was 0.43% (95% CI: 0.35%–0.51%). The unadjusted FI prevalence in Gansu, Shanxi, Liaoning, Jiangsu, Guizhou, and Guangdong was 1.03%, 0.65%, 0.68%, 0.45%, 0.17%, 0.05%, and the adjusted FI prevalence was 0.86%, 0.55%, 0.75%, 0.36%, 0.18%, and 0.04%, respectively. Liquid stool leakage was the most common type of FI. Some participants reported more than one type of stool leakage experience. Figure 2 shows a clear age-related trend for overall FI prevalence and the incidence rate of solid stool, liquid stool and gas leakage ($P < 0.001$). The mean Wexner score was 4.0 and 12% FI patients reported Wexner score ≥ 9 .

Potential risk factors for FI among urban Chinese women

Risk factors associated with FI events were estimated by logistic regression analysis. Table 2 shows all potential risk factors accessed in the univariate analysis. Table 3 shows their adjusted OR, 95% CI and P value. Age, BMI ≥ 24 kg/m², POP-Q stage, Chronic constipation, chronic cough, alcohol consumption, physical diseases including chronic bronchitis and cancer, gynecological diseases like gynecological inflammation increase the risk of FI ($P < 0.05$).

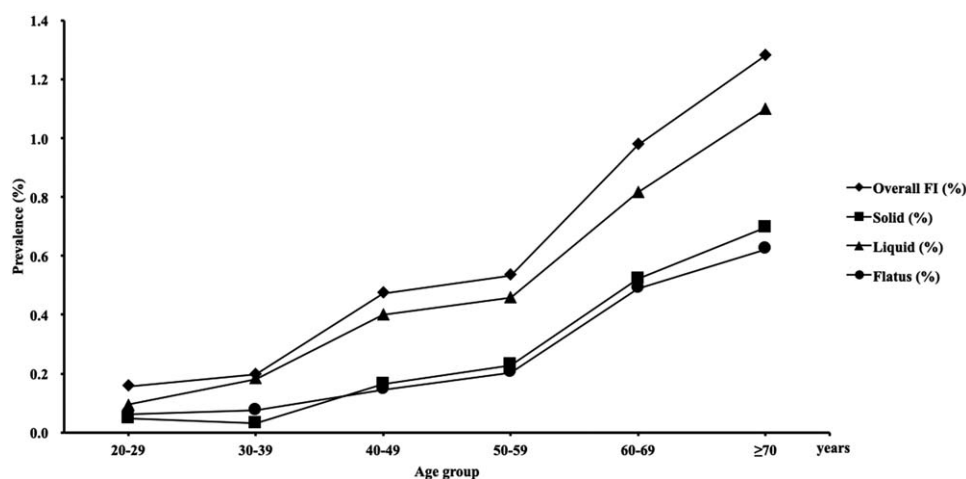


Figure 2: Trends of FI prevalence by age (years). The prevalence of overall FI, flatus, liquid stool, and solid stool leakage shows an obvious age-related increasing trend. P for trend < 0.001 . FI: Fecal incontinence.

Table 2: Univariate analysis of potential risk factors of urban participants (N=28,196).

Factors	Results (n)	Prevalence (%)	χ^2	P value
Age			77.901	<0.001
20–29 years	6365	0.16		
30–39 years	6599	0.20		
40–49 years	5497	0.47		
50–59 years	3930	0.53		
60–69 years	3070	0.98		
≥70 years	2735	1.28		
Race			0.000	1.000
Han	27,279	0.48		
Minority	917	0.44		
Education level			5.317	0.150
Elementary school and below	5153	0.60		
Junior high school	6534	0.47		
Senior high school	7703	0.55		
University degree and above	8806	0.35		
Job			0.004	0.949
Mental	21,237	0.48		
Physical	6959	0.47		
Current mental status			17.880	<0.001
Married	24,097	0.48		
Single, never married	2648	0.15		
Divorced/separated	295	1.02		
Widowed	1156	1.12		
Economic level			1.386	0.847
≤2000	5946	0.52		
2001–4000	11,623	0.51		
4001–6000	7263	0.44		
>6000	2248	0.36		
Unknown	1116	0.45		
Menstrual condition			32.796	<0.001
Post-menopausal	11,755	0.76		
Normal menstruation	16,441	0.28		
Pelvic surgery history			2.006	0.157
No	21,509	0.45		
Yes	6687	0.58		
Spinal surgery history			7.670	0.006
No	28,088	0.47		
Yes	108	2.78		
BMI			30.841	<0.001
Underweight (<18.5 kg/m ²)	1921	0.31		
Overweight (24–27.9 kg/m ²)	6230	0.79		
Obese (≥28 kg/m ²)	1382	1.09		
Normal (18.5–23.9 kg/m ²)	18,663	0.35		
Labor history			15.801	<0.001
No	5192	0.13		
Yes	23,004	0.56		
Chronic constipation			65.552	<0.001
No	26,115	0.38		
Yes	2081	1.68		
Chronic cough			108.661	<0.001
No	27,299	0.40		
Yes	897	2.90		

(continued)

Table 2

(continued).

Factors	Results (n)	Prevalence (%)	χ^2	P value
Smoking			7.079	0.008
No	27,906	0.47		
Yes	290	1.72		
Drinking			19.118	<0.001
No	26,879	0.44		
Yes	1317	1.29		
POP-Q stage			161.779	<0.001
0–I	25,425	0.31		
II	664	2.14		
III–IV	2107	1.81		
Hypertension			57.544	<0.001
No	24,666	0.36		
Yes	3530	1.30		
Diabetes mellitus			21.108	<0.001
No	26,940	0.44		
Yes	1256	1.35		
Stroke			11.571	0.001
No	28,052	0.47		
Yes	144	2.78		
Chronic bronchitis			98.206	<0.001
No	27,647	0.42		
Yes	549	3.46		
Cancer			28.416	<0.001
No	27,812	0.45		
Yes	384	2.34		
Depression			29.591	<0.001
No	28,125	0.47		
Yes	71	5.63		
Gynecological inflammation			16.331	<0.001
No	24,875	0.42		
Yes	3321	0.93		
Chronic pelvic pain			0.099	0.753
No	27,767	0.48		
Yes	429	0.70		
Endometriosis			1.030	0.310
No	27,917	0.47		
Yes	279	1.08		
Uterine fibroids			8.320	0.004
No	26,071	0.44		
Yes	2125	0.89		

BMI: Body mass index. POP-Q: Pelvic organ prolapse quantification.

Role of obstetric factors in FI among women with labor history

There were 23,004 females with labor history. Table 4 shows adjusted OR, 95% CI and P values of parity, delivery pattern, and fetal weight. The results have been adjusted by age. Vaginal delivery showed higher OR than CS.

Discussion

The adjusted FI prevalence for urban Chinese females was 0.43%, much lower than that in Western countries. Same as other studies, the most common FI symptom was liquid

Table 3: Multivariate analysis of the association between FI and potential risk factors.

Risk factors	FI (n=28,196)		
	Adjusted OR	95% CI	P value
Age			
20–29 years (ref.)	1.00		
30–39 years	0.86	0.33–2.21	0.747
40–49 years	1.48	0.59–3.71	0.398
50–59 years	1.52	0.54–4.24	0.425
60–69 years	3.29	1.11–9.74	0.031
≥70 years	3.70	1.21–11.33	0.022
Race			
Han (ref.)	1.00		
Minority	1.04	0.38–2.87	0.941
Education level			
Elementary school and below (ref.)	1.00		
Junior high school	1.32	0.77–2.26	0.311
Senior high school	2.13	1.21–3.75	0.009
University degree and above	2.26	1.10–4.66	0.027
Job			
Physical (ref.)	1.00		
Mental	1.22	0.74–2.01	0.434
Current mental status			
Married (ref.)	1.00		
Single, never married	1.25	0.32–4.92	0.750
Divorced/separated	1.54	0.47–5.10	0.477
Widowed	0.92	0.48–1.75	0.791
Economic level			
≤2000 (ref.)	1.00		
2001–4000	1.16	0.72–1.86	0.543
4001–6000	1.08	0.62–1.89	0.782
>6000	0.80	0.34–1.90	0.612
Unknown	1.73	0.65–4.61	0.272
Menstrual condition			
Normal menstruation (ref.)	1.00		
Post-menopausal	1.01	0.54–1.89	0.964
Pelvic surgery history			
No (ref.)	1.00		
Yes	1.15	0.78–1.69	0.491
Spinal surgery history			
No (ref.)	1.00		
Yes	2.15	0.61–7.55	0.232
BMI			
Underweight (<18.5 kg/m ²)	1.15	0.49–2.72	0.751
Normal (18.5–23.9 kg/m ²) (ref.)	1.00		
Overweight (24–27.9 kg/m ²)	1.59	1.07–2.35	0.021
Obese (≥28 kg/m ²)	1.86	1.02–3.38	0.042
Labor history			
No (ref.)	1.00		
Yes	1.72	0.57–5.23	0.337
Chronic constipation			
No (ref.)	1.00		
Yes	1.90	1.24–2.92	0.003
Chronic cough			
No (ref.)	1.00		
Yes	2.04	1.14–3.65	0.016

(continued)

Table 3

(continued).

Risk factors	FI (n=28,196)		
	Adjusted OR	95% CI	P value
Smoking			
No (ref.)	1.00		
Yes	1.59	0.57–4.18	0.388
Drinking			
No (ref.)	1.00		
Yes	2.70	1.51–4.83	<0.001
POP-Q stage			
0–I (ref.)	1.00		
II	3.20	2.13–4.80	<0.001
III–IV	3.03	1.58–5.82	<0.001
Hypertension			
No (ref.)	1.00		
Yes	1.37	0.89–2.11	0.151
Diabetes mellitus			
No (ref.)	1.00		
Yes	1.10	0.62–1.93	0.751
Stroke			
No (ref.)	1.00		
Yes	1.24	0.41–3.72	0.706
Chronic bronchitis			
No (ref.)	1.00		
Yes	2.15	1.13–4.08	0.020
Cancer			
No (ref.)	1.00		
Yes	4.10	1.98–8.45	<0.001
Depression			
No (ref.)	1.00		
Yes	2.61	0.80–8.47	0.111
Gynecological inflammation			
No (ref.)	1.00		
Yes	2.25	1.44–3.53	<0.001
Chronic pelvic pain			
No (ref.)	1.00		
Yes	0.82	0.23–2.85	0.750
Endometriosis			
No (ref.)	1.00		
Yes	1.86	0.53–6.48	0.330
Uterine fibroids			
No (ref.)	1.00		
Yes	1.65	0.97–2.81	0.067

FI: Fecal incontinence; CI: Confidence interval; ref.: Reference; POP-Q: Pelvic organ prolapse quantification; BMI: Body mass index.

stool leakage.^[9-11] Twelve percent of FI patients reported a Wexner Score of 9 or higher, which means restrained mobility.^[12] There are some possible reasons for the low prevalence. First, since the interviewing sites were community hospitals, homebound patients were not involved in this research. And this could underestimate the FI prevalence. Second, considering the traditional conservative values, individuals who have experienced FI events may feel ashamed and difficult to talk with doctors and researchers about the embarrassing symptoms.^[13] Third, FI is not a fatal disease and, thus, may not attract sufficient attention from females, especially those who experience FI at a very low frequency. Fourth, we hypothesize that race is also an influence factor.^[14]

Table 4: Multivariate analysis of the association between FI and obstetric factors (N= 23,004).

Risk factors	Results	Adjust OR	95% CI	P value
Parity, <i>n</i>				
Semelparous (Parity = 1) (ref.)	13,730	1.00		
Multiparous (Parity = 2)	5663	0.82	0.50–1.35	0.436
Multiparous (Parity ≥3)	3611	1.36	0.79–2.35	0.270
Delivery pattern, <i>n</i>				
Cesarean (ref.)	4382	1.00		
Obstetric forceps/ fetus aspiration	347	0.59	0.34–1.01	0.589
Vaginal	18,275	4.31	2.03–9.15	<0.001
Fetal weight, <i>n</i>				
Normal (ref.)	21,319	1.00		
Fetal macrosomia	1685	1.51	0.87–2.61	0.143

FI: Fecal incontinence; OR: Odds ratio; CI: Confidence interval; ref.: Reference.

Research carried out in Taiwan, China has reported a FI prevalence of 2.8% for adult women and 9.3% for women older than 65 years. This is much lower than that in Western countries.^[14]

In the analysis of the association between the FI incidence rate and age, a higher incidence can be found in the older age group, which is consisted with most FI epidemiology studies.^[15] Some authors believe that the association between FI prevalence and age could have been confounded by a sphincter defect, pelvic floor disorders, poor health condition, and limited mobility.^[16]

Overweight and obese, chronic constipation, chronic cough, alcohol consumption, chronic bronchitis, cancer, depression, POP stage, and gynecological inflammation were entered into the logistic regression equation, what means that they are the independent risk factors for FI. In an epidemiology research about constipation and FI in the Netherlands, constipated responders were found to be more likely to suffer from FI than other patients.^[17] An increase in the volume of stool stored in the rectum, a reduction in rectal sensation, incomplete evacuation, and the laxative usage can be the possible mechanisms for the co-occurrence of FI and constipation.^[13,14,18–20] Similar to the studies about urinary incontinence, chronic bronchitis, and chronic cough can cause frequent outbursts of high abdominal pressure, which might lead to exhausted pelvic floor muscles and other related mechanisms.^[21–24] Radiotherapy, poor health, and nerve damage in cancer patients increased the possibility of FI.^[25,26] We should also pay attention to the drugs associated with these physical diseases, such as calcium channel antagonists/broad spectrum antibiotics/metformin/tricyclic anti-depressants, as these compounds can change sphincter tone and/or cause constipation, diarrhea, or reduced alertness.^[27] Consistent with the research on diet and eating patterns of FI individuals, alcohol is an independent risk factor, which suggests that doctors need to provide abstinence

education to the FI individuals.^[28] POP is a common gynecological disorder that leads to many annoying symptoms, such as urinary incontinence and obstacles to intercourse, and a multidisciplinary approach is recommended for POP and incontinence.^[29–31] We found a high correlation between II/III-IV POP stage and FI, which suggests an active attitude to dealing with POP symptoms for the gynecologists if the patients complain of FI symptoms. In addition, this research found that BMI ≥ 24 kg/m² was a risk factor for FI event. Weight loss was strongly suggested, which was also an important method to control POP symptom.^[29] There is few specific research reporting the association between FI and gynecological issues. We estimate chronic pelvic pain, gynecological inflammation, endometriosis, and uterine fibroids' role in FI occurrence, and gynecological inflammation was the risk factor for urban women. The mechanisms need more investigations.

The association between labor history, obstetric factors, and FI was controversial. Though some hypotheses suggested that pregnancy and delivery could cause injury to pelvic tissue, a large number of studies have not reported this specific association.^[32,33] Kepenekci *et al* reported FI by 1.1% in population with cesarean only, 2.9% in women with vaginal delivery, and 3.6% in women with mixed type but the difference disappear after adjusting by ages.^[15] The labor history is not a risk factor for FI in our study. However, in the subgroup analysis of females with labor history, vaginal delivery increased OR compared with female with CS delivery and once or twice deliveries.

This is the largest national population-based epidemiological survey about FI prevalence and risk factors in adult Chinese women living in urban areas. Plenty of potential risk factors including basic demographic information, general medical diseases, gynecology diseases, and obstetric factors were analyzed in this research. Another strength is that we invited clinical doctors to check the POP-Q stage of the interviewees and that the POP-Q stage has been shown to be a great risk factor for FI. The research also has some limitations. Data were collected by self-reporting according to the questionnaires instead of clinical examinations. All participants came from the outpatients of community hospital which may omit some FI patients who were confined to bed.

In conclusion, this was a national population-based epidemiological research about the prevalence of and risk factors for FI in adult women living in urban areas of China. We found a lower prevalence of FI in our cohort compared with that reported in other countries and places. However, with the second-child policy and the demographic change in China, FI could become a more common symptom. Therefore, gynecologists should pay more attention to women who have POP, chronic constipation, chronic cough, and physical diseases and those who consume alcohol.

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Conflicts of interest

None.

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