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A nationwide population-based survey on the prevalence and risk factors of symptomatic pelvic organ prolapse in adult women in China – a pelvic organ prolapse quantification systembased study

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Objective To determine the prevalence, risk factors and burden of symptomatic pelvic organ prolapse (POP) in adult Chinese women.

Design A nationwide cross-sectional study.

Setting Six geographic regions of mainland China.

Participants Women aged \geq 20 years old were included using a multistage, stratified, cluster sampling method from February 2014 through March 2016.

Methods We conducted a nationwide epidemiological survey. 'Symptomatic POP' was determined by a screening questionnaire and physical examination.

Main outcome measurements Prevalence, odds ratio (OR).

Results A total of 55 477 women (response rate, 92.5%; mean age, 45.1 years old) were included. The prevalence of symptomatic POP was 9.6% (95% CI 9.3–9.8%) and it increased with age in each stage (P < 0.05). Symptomatic POP-Q stage II, which mainly involved anterior compartment prolapse, was the most common

(7.52%). Minor/moderate burden of symptomatic POP was the most common, with a prevalence of 9.7% (95% CI 9.5–10.0%). The odds for each type of symptomatic POP increased with age (>50 vs 20-29 years old in symptomatic POP-Q stage II or higher, OR increased from 1.34 [95% CI 1.32–1.45] to 7.34 [95% CI 4.34–12.41]) and multiple vaginal deliveries (multiparous [\geq 3] vs nulliparous in symptomatic POP-Q stage II or higher, OR increased from 1.91 [1.71–2.13] to 2.78 [2.13–3.64]).

Conclusions We found a lower prevalence of symptomatic POP than that found in other surveys. The main type of symptomatic POP was anterior compartment prolapse, indicating that it should be considered first. Older age and multiple vaginal deliveries increased the odds of each type of symptomatic POP.

Keywords Pelvic organ prolapse quantification, prevalence, risk factor, symptom burden, symptomatic pelvic organ prolapse.

Tweetable abstract The prevalence of female symptomatic pelvic organ prolapse (POP) was 9.6% in China. It is related to old age and multiple vaginal deliveries.

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Introduction

Pelvic organ prolapse (POP) occurs when the fibromuscular supports of the pelvic organs weaken or fail, and the pelvic organs, including the bladder, uterus, rectum and/or small intestine, are abnormally located inside or outside of the vagina.¹ It is a disorder exclusive to women that can affect the anterior vaginal wall, posterior vaginal wall and uterus, or vaginal apex, usually as some combination of these.² Advancing age has been reported as a clear risk factor for POP. It is estimated that by 2040, China's female elderly population (\geq 65 years old) will double compared with 2020 levels.³ The disorder may then become more prevalent, and it will cause both medical and financial difficulties. To allocate resources to the increasing number of patients with this condition and to develop strategies to treat patients suffering from this condition, a large-scale observational study is needed to establish the actual prevalence and to determine the course of the disorder in the general population.

There have been few epidemiological studies of POP in China. A physical examination that assesses vaginal support is a major impediment to accurate determination of the prevalence of POP in a large-scale epidemiology survey. Many studies have used a variety of reporting methodologies but they have rarely involved physical examinations.^{4–10} Standardised criteria, including the use of a specific prolapse grading system that correlates with symptom burden scores, must be established because identifying risk factors can facilitate counselling and prevention in women at risk for developing POP.

The treatment of POP is elective. It aims at enhancing quality of life by reducing the burden of symptomatic POP. The very nature of this highly burdensome condition makes it even more important to consider patient preferences for treatment.¹¹ Therefore, an analysis of worldwide epidemiological data regarding the burden of symptomatic POP is of great significance.

The aim of this study was to estimate the prevalence of symptomatic POP and to determine the potential risk factors associated with symptomatic POP based on the POP quantification (POP-Q) system and the burden of symptomatic POP in a nationwide population-based sample of adult women in China.

Methods

Study design and participants

This cross-sectional study used a multistage, stratified, cluster sampling method to identify a national sample of adult women from the general population who were at least 20 years old. To represent accurately the cultural and economic diversity of China, the sampling frame was generated from six populous provinces in six geographic regions of mainland China (northeast, north, east, south central, northwest and southwest China) (Figure S1). Sampling was stratified according to geographic region, degree of urbanisation (large cities and rural townships) and economic status (based on the gross domestic product of each province). After considering population data from the 2010 Chinese census, samples were stratified according to age during the final step of sampling. Only individuals who had lived in their current residence for ≥ 5 years were included. The survey was conducted at various health service centres hosting survey sites during the National Mass Screening of Breast and Cervical Cancers (NMSBCC), a free nationwide preventive public health service promoted by the Chinese government. After completing the NMSBCC project, the participants continued to be recruited into our POP survey. All participants provided written informed consent before data collection.

Ethical approval for this study was obtained from the Research Ethical Committee of the Peking Union Medical College Hospital in 2014. The study protocol was approved (http://www.chictr.org, ChiCTR-OCH-14004675).

We calculated the sample size of this survey using a previous study that reported a POP prevalence of 5%.⁹ We surveyed at least six areas. The minimal sample size was calculated to detect a prevalence of 5%, with a 0.5% estimated error and a 95% confidence interval (CI). After considering a refusal rate of 20%, at least 52 532 participants were needed, as calculated by the formula:

$$n = Z_{\alpha/2}^2 \times (\pi \times (1 - \pi)) / \delta^2 \times 6 \times (1 + 20\%)$$
$$= 1.96^2 \times (5.0\% \times (1 - 5.0\%)) / (0.005 \times 0.005)^2 \times 6 \times (1 + 20\%) = 52\,532$$

We aimed to include 60 000 participants.

Data collection of general information

A basic questionnaire was administered to obtain information about demographic characteristics, education level, partnership status, employment status, personal and family medical histories, lifestyle risk factors, smoking, alcohol use and gynaecological history.

Questionnaires and examinations were made available at local maternal and child health centres. All investigators



Figure 1. Study flowchart.

and other clinical personnel successfully completed a training session, at which time interviewers were given detailed instructions for the administration of questionnaires. Clinical personnel was trained to determine the POP quantification (POP-Q) stage by a principal investigator using a standard protocol.¹²

Measurements and diagnostic criteria of symptomatic POP

We designed a screening questionnaire with eight questions that addressed the main symptoms of POP in agreement with the definition of prolapse (Table S1). The eight questions were adopted from the Pelvic Floor Distress Inventory-20¹³ (five and three questions were from the POPDI-6 and the UDI-6, respectively). The participants who reported a positive response to any question on the screening questionnaire were given a physical examination. 'Symptomatic POP' was defined as a positive response to any question on the screening questionnaire and a POP-Q stage of II or higher. We evaluated the sensitivity and specificity of each symptom on the screening questionnaire (Table S2, Figure S2).

The physical examinations were performed by an experienced gynaecologist who was blinded to the questionnaire responses. In cases of maximal extrusion of the prolapse,

the examination position was documented as lithotomy and was confirmed by the patients. The prolapse stage was determined using the POP-Q system. Findings of pelvic examinations were referred to as anatomical prolapse, and stages II–IV and III–IV were considered anatomical and advanced prolapse, respectively.

Determination of burden of symptomatic POP

If patients were found to have stage I or higher, they were asked to complete the Chinese version of the Pelvic Floor Impact Questionnaire (short form, PFIQ-7).¹⁴ The PFIQ-7 was used to measure the impact of the prolapse on the patient's quality of life. The PFIQ-7 consists of three subscales: Urinary Impact Questionnaire (UIQ-7), Colorectal—Anal Impact Questionnaire (CRAIQ-7) and Pelvic Organ Prolapse Impact Questionnaire (POPIQ-7). Each subscale received a total score as follows: 1–32 indicated minor distress, 33–66 indicated moderate distress, and 67–100 indicated severe distress.¹⁵ We defined burden symptoms as 'POP-Q stage I or higher and PFIQ-7 score >0'.

Statistical analysis

Normally distributed continuous data are expressed as means \pm SD, and non-normally distributed continuous data are expressed as medians (25th and 75th percentiles). Categorical variables are presented as numbers and proportions. To compare differences in prevalence between the groups, we performed Chi-square tests. We investigated associations between outcome variables and potential risk factors to estimate odds ratios (ORs) and 95% CIs using multivariable logistic regression analysis. For multivariable analysis, variables were chosen if they were found to be associated in univariate analysis (P < 0.2) or were identified in previous studies as being associated with or a potential confounder of an association. A two-sided Pvalue < 0.05 was considered statistically significant. EPI-DATA software, version 3.1, was used for data entry and error detection. SAS software, version 9.3 (SAS, Cary, NC, USA), was used for statistical analysis.

Results

As shown in the flowchart (Figure 1), of 55 477 participants, 2299 subjects (4.1%) were excluded: 596 because they were younger than 20 years old, 345 subjects because there was no information on their birth date and age, 649 subjects because there was no information on their partnership status, 529 subjects because there was no information on parity, 106 subjects because there was no information on ethnicity, and 74 subjects because they failed to complete the POP-Q survey. Thus, 53 178 (95.9%) women with complete data were included in the final analysis. The age ranged from 20 to 99 years old, with a mean age of

Tahle	1	Characteristics	of the	subjects	interviewed
lable	•••	Characteristics	or the	Subjects	intervieweu

Characteristic	n = 53 178
Age (y), Mean (SD)	45.10 (16.03)
Age (y), n (%)	
20–29	11 279 (21.2)
30–39	12 011 (22.6)
40–49	11 053 (20.8)
50–59	7880 (14.8)
60–69	5680 (10.7)
≥70	5275 (9.9)
Residence, n (%)	
Urban	28 264 (53.2)
Rural	24 914 (46.9)
Current marital status, n (%)	
Single, never married	4061 (7.6)
Married	46 406 (87.3)
Divorced/Separated	475 (0.9)
Widowed	2236 (4.2)
BMI (kg/m ²), Mean (SD)	22.72 (3.06)
BMI (kg/m ²), <i>n</i> (%)	
Underweight (<18.5)	3269 (6.2)
Normal (18.5–23.9)	33 597 (63.2)
Overweight (24–27.9)	13 309 (25.0)
Obese (≥28)	3003 (5.7)
Parity (time), Median (range),	1 (0–10)
Parity (time), n (%)	
Nulliparous	8049 (15.1)
Primiparous (=1)	22 963 (43.2)
Multiparous (=2)	12 958 (24.4)
Multiparous (≥3)	9208 (17.3)
Job, n (%)	
Physical labour	42 552 (80.0)
Mental labour	10 626 (20.0)
Race, <i>n</i> (%)	
Han	51 507 (96.9)
Minority	1671 (3.1)

BMI, body mass index.

45.1 years (± 16.0 years). In all, 1671 participants (3.1%) were ethnic minorities. The participants from urban and rural areas accounted for 53.2% and 46.9% of the total sample, respectively. Table 1 shows the socio-demographic characteristics of the participants.

Prevalence of symptomatic POP

In total, 11 643 (21.9%) women reported suffering from at least one of the symptoms listed on the screening questionnaire and received physical examinations, which confirmed symptomatic POP in 5125 (44.0%) of these women. The frequencies of the stages and burden of symptomatic POP are shown in Table 2. The prevalence of symptomatic stage II POP was 7.5% (95% CI 7.3–7.7); this stage mainly comprised anterior compartment prolapse (91.2%). The prevalence of symptomatic stage III POP was 1.7% (95% CI

POP-Q	Total				Age (y)					Residence	
(1) % c6) (%) 11	n = 53 178	20–29 n = 11 279	30–39 <i>n</i> = 12 011	40–49 n = 11 053	50–59 n = 7880	60–69 n = 5680	≥70 n = 5275	P-value*	Urban <i>n</i> = 28 264	Rural n = 24 914	<i>P</i> -value*
Symptomatic POP-C 0 or 1	2 stage 48 053 (90.4)	11 075 (98.2)	11 352 (94.5)	9787(88.6)	6795 (86.2)	4783 (84.2)	4261 (80.8)	<0.0001	25 461 (90.1)	(2,09) 292 22	0.0105
	(90.1–90.6)	(98.0–98.4)	(94.1–94.9)	(88.0-89.2)	(85.5–87.0)	(83.3–85.2)	(79.7–81.9)		(89.7–90.4)	(90.3–91.0)	
2	3999 (7.5)	181 (1.6)	589 (4.9)	1078 (9.8)	841 (10.7)	623 (11.0)	687 (13.0)		2112 (7.5)	1887 (7.6)	
	(7.3–7.7)	(1.4–1.8)	(4.5-5.3)	(9.2–10.3)	(10.0–11.4)	(10.2–11.8)	(12.1–13.9)		(7.2–7.8)	(7.3–7.9)	
m	928 (1.7)	21 (0.2)	62 (0.5)	167 (1.5)	213 (2.7)	232 (4.1)	233 (4.4)		537 (1.9)	391 (1.6)	
	(1.6–1.9)	(0.1–0.3)	(0.4-0.6)	(1.3-1.7)	(2.3–3.1)	(3.6-4.6)	(3.9–5.0)		(1.7–2.1)	(1.4–1.7)	
4	198 (0.4)	2 (0.0)	8 (0.1)	21 (0.2)	31 (0.4)	42 (0.7)	94 (1.8)		154 (0.5)	44 (0.2)	
	(0.3-0.4)	(0.0-0.0)	(0.0-0.1)	(0.1–0.3)	(0.3-0.5)	(0.5-1.0)	(1.4–2.2)		(0.5–0.6)	(0.1–0.2)	
Burden of symptom	latic POP										
No	47 966 (90.2)	11 002 (97.5)	11 294 (94.0)	9825 (88.9)	6787 (86.1)	4786 (84.3)	4272 (81.0)	<0.0001	25 769 (91.2)	22 197 (89.1)	<0.0001
	(90.0–90.5)	(97.3–97.8)	(93.6–94.5)	(88.3–89.5)	(85.4–86.9)	(83.3–85.2)	(79.9–82.0)		(90.8–91.5)	(88.7–89.5)	
Minor/moderate	5167 (9.7)	275 (2.4)	713 (5.9)	1221 (11.1)	1086 (13.8)	885 (15.6)	987 (18.7)		2462 (8.7)	2705 (10.9)	
	(9.5–10.0)	(2.2–2.7)	(5.5–6.4)	(10.5–11.6)	(13.0–14.5)	(14.6–16.5)	(17.7–19.8)		(8.4–9.0)	(10.5–11.2)	
Severe	45 (0.1)	2 (0.0)	4 (0.0)	7 (0.1)	7 (0.1)	9 (0.2)	16 (0.3)		33 (0.1)	12 (0.1)	
	(0.1–0.1)	(0.0-0.0)	(0.0-0.1)	(0.0-0.1)	(0.0-0.2)	(0.1–0.3)	(0.2–0.5)		(0.1–0.2)	(0.0-0.1)	
Cl, confidence inter *Pearson's Chi-squa	val; POP-Q, pelvic re test or Wilcoxo	: organ prolapse q nr's sum rank test	uantification. was used to com	ipare the preval	ence difference	s in individual s	symptomatic PO	P by age and	d residence.		

						, , ,		
POP-Q stage			Symptoms				PFIQ-7	
	Total n (%)	Anterior n (%)	Middle n (%)	Posterior n (%)	P-value*	UIQ-7 (Mean \pm SD)	CRAIQ-7 (Mean \pm SD)	POPIQ-7 (Mean \pm SD)
0 or 1					<i>P</i> < 0.0001	4.43 ± 9.40	0.73 ± 4.03	1.30 ± 5.47
2	3999 (7.5)	3649 (6.9)	97 (0.2)	1602 (3.0)		7.13 ± 11.85	1.68 ± 5.95	2.91 ± 8.22
3	928(1.7)	728 (1.4)	293 (0.6)	277 (0.5)		17.43 ± 19.71	6.01 ± 12.41	16.71 ± 19.72
4	198 (0.4)	100 (0.2)	156 (0.3)	58 (0.1)		27.82 ± 22.61	14.36 ± 18.04	26.25 ± 23.15
						<i>P</i> < 0.0001	<i>P</i> < 0.0001	<i>P</i> < 0.0001

 Table 3. The burden of symptomatic POP on three domains and the compartment involved by POP-Q stage

CRAIQ, Colorectal-Anal Impact Questionnaire; POPIQ, Pelvic Organ Prolapse Impact Questionnaire; POP-Q, Pelvic Organ Prolapse Quantification; UIQ, Urinary Incontinence Impact Questionnaire.

*Pearson's Chi-square test was used to compare the prevalence differences of individual POP by symptoms.

1.6–1.9) and of stage IV 0.4% (95% CI 0.3–0.4). Symptomatic stage IV POP primarily involved the middle compartment (Table 3). A total of 1514 (2.8%) women had anterior and middle compartment prolapse, 195 (0.4%) women had middle and posterior compartment prolapse, 387 (0.7%) women had anterior compartment and posterior compartment prolapse.

An age-related growth trend was observed for the prevalence of each stage; however, this trend was more obvious in symptomatic stage II POP (Figure S3). The prevalence of symptomatic POP in women aged \geq 70 years old was eight-fold higher than that in women aged 20–29 years old. Symptomatic stages III and IV POP were more common in women residing in urban communities (P < 0.05).

Burden of symptomatic POP

The extent to which the participants were burdened by the symptoms of POP is summarised in Tables 2 and 3. The prevalence of burden of any symptomatic POP was 9.8% (95% CI 9.6–10.1). The prevalence of minor/moderate burden and severe burden was 9.7% (95% CI 9.5–10.0) and 0.1% (95%, 0.1–0.1), respectively. In stage II symptomatic POP patients, urinary system symptoms were the most burdensome, based on the score of each domain of the PFIQ-7, following by vaginal system symptoms. Intestinal system symptoms were the least burdensome. In stage III and IV patients, urinary system and vaginal system symptoms were equally burdensome, and intestinal system symptoms were the most bothersome in stage IV patients.

Potential risk factors for each stage and burden of symptomatic POP

Potential risk factors for each stage of symptomatic POP and burden of symptomatic POP were determined by logistic regression analysis (Tables 4 and 5). Older age increased the odds of each type of symptomatic POP (P < 0.05).

Compared with nulliparous women, there was a higher risk in each stage (1.91-fold, 2.78-fold, 1.93-fold, respectively) and burden of symptomatic POP (3.18-fold) in women with multiple vaginal deliveries. Pathological conditions and lifestyle factors, such as higher body mass index (BMI) and alcohol consumption, affected each stage and the burden of symptomatic POP differently (Tables 4 and 5). Higher stage was the strongest risk factor for burden of symptoms, with stages II, III and IV having a 9.17-fold, 25.70-fold, and 56.75-fold higher risk, respectively, of experiencing burdensome symptomatic POP.

Discussion

Main findings

The current nationwide epidemiological survey included 55 477 women. The prevalence of symptomatic POP was 9.6% (95% CI 9.3–9.8%). Symptomatic POP-Q stage II, which mainly involved anterior compartment prolapse, was the most common (7.52%). Regarding burden of symptomatic POP, a minor/moderate burden was the most common, with a prevalence of 9.7% (95% CI 9.5–10.0%). Urinary system symptoms were most likely to be rated as burdensome. Older age and multiple vaginal deliveries increased the odds of each type of symptomatic POP.

Strengths and limitations

The strengths of this study are that it included a large population of women and a high response rate, which enabled us accurately to estimate the prevalence of symptomatic POP and its burden. Furthermore, this study is the first nationwide epidemiological survey of symptomatic POP based on the POP-Q system. In this study, the definition of symptomatic POP was based on the presence of prolapse-related symptoms and the findings of physical examinations.

Our study has several limitations. First, this cross-sectional study cannot exclude potential information bias,

Age group (y) 20–29 (ref.) 30–39 40–49 50–59 50–59 50–69 50–69 270 Menstrual condition Normal menstruation (ref.) 11 279 (21 12 011 (22 13 011 (22	(1.1.2) (2.1.6) (2.2.6) (2.8.8) (2.8.8) (2.8.8) (2.6) (2.6) (2.6) (2.6) (2.7) (2.6)(u	= 3999							
Age group (y) 20–29 (ref.) 30–39 40–49 50–59 50–59 50–69 60–69 Menstrual condition Normal menstruation (ref.) Postmenopausal status without HRT 463 (8.7)	(1.1.2) (1.2.6	-				n = 894			n = 194	
Age group (y) 20–29 (ref.) 11 279 (21. 30–39 11 2011 (22. 40–49 11 053 (20. 50–59 780 (14. 60–69 5580 (10. ≥70 8275 (9.9 Menstrual condition (ref.) 31 585 (59. Postmenopausal status without HRT 463 (8.7	(1.2) (0.8) (0.8) (0.7) (0.7) (0.7) (0.7)	Adjusted UK	95% CI	P-value	Adjusted OR	95% CI	P-value	Adjusted OR	95% CI	<i>P</i> -value
20-29 (ref.) 11 279 (21. 30-39 10 11 (22. 40-49 12 011 (22. 50-59 7880 (14. 60-69 5680 (10. ≥70 5275 (9.9 Menstrual condition 31 585 (59. Postmenopausal status without HRT 463 (8.7	1.2) (0.8) (0.8) (0.7) (0.7) (0.7)									
30–39 12 011 (22. 40–49 12. 011 (22. 50–59 13. 011 (22. 56. 50–59 7880 (14. 60–69 56. 60–69 55. 61. 5270 (10. 5275 (9.9 Menstrual condition (ref.) 31 585 (59. Postmenopausal status without HRT 463 (8.7 Postmenopausal status without HRT 463	2.6) (0.8) (0.7) (0.7) (9.9)	1.00			1.00			1.00		
40–49 11 053 (20: 50–59 7880 (14. 60–69 5680 (10. ≥70 5275 (9.9 Menstrual condition 5275 (9.9 Normal menstruation (ref.) 31 585 (59. Postmenopausal status without HRT 463 (8.7	0.8) 4.8) 0.7) (9.6) (9.4)	0.70	0.63-0.78	<0.0001	0.40	0.31-0.51	<0.0001	0.33	0.16, 0.67	0.0023
50–59 7880 (14.) 60–69 5680 (10. ≥70 5275 (9.9 Menstrual condition 31 585 (59. Normal menstruation (ref.) 31 585 (59. Postmenopausal status without HRT 463 (8.7	4.8) 0.7) 0.9) (9.4)	1.22	1.13-1.33	<0.0001	0.93	0.77-1.13	0.4782	0.79	0.47,1.33	0.3680
60–69 5680 (10. ≥70 5275 (9.9 Menstrual condition Normal menstruation (ref.) 31 585 (59. Postmenopausal status without HRT 463 (8.7	0.7) (9) (9.4)	1.34	1.32 1.45	<0.0001	1.49	1.26–1.76	<0.0001	1.38	0.87, 2.19	0.1687
≥70 5275 (9.9) Menstrual condition Normal menstruation (ref.) 31 585 (59. Postmenopausal status without HRT 463 (8.7	(9.4) (59.4)	1.32	1.18–1.46	<0.0001	2.19	1.79–2.68	<0.0001	2.95	1.75, 4.98	<0.0001
Menstrual condition Normal menstruation (ref.) 31 585 (59. Postmenopausal status without HRT 463 (8.7	() () ()	1.35	1.20-1.52	<0.0001	2.50	2.01–3.14	<0.0001	7.34	4.34, 12.41	<0.0001
Normal menstruation (ref.) 31 585 (59. Postmenopausal status without HRT 463 (8.7	()-(1)-(1)-(1)-(1)-(1)-(1)-(1)-(1)-(1)-(
Postmenopausal status without HRT 463 (8.7	ì	1.00			1.00			1.00		
	(/)	0.84	0.75-0.94	0.0018	1.35	1.01-1.81	0.0440	1.54	0.76, 3.10	0.2307
Postmenopausal status with HKI 18 9/6 (35.	15.7)	1.29	1.06-1.50	0.0099	0.70	0.30-1.21	0.2031	0.71	0.19, 2.69	0.6120
BMI (kg/m ²)										
Underweight (<18.5) 3269 (6.2	5.2)	0.78	0.68-0.89	0.0002	0.56	0.39-0.79	0.0010	0.16	0.04, 0.72	0.0170
Normal (18.5–23.9) (ref.) 33 597 (63.	13.2)	1.00			1.00			1.00		
Overweight (24–27.9) 13 309 (25.	5.0)	1.14	1.06-1.22	0.0002	1.38	1.18-1.60	<0.0001	1.96	1.16, 3.34	0.0127
Obese (>28) 3003 (5.7)	.7)	1.3	1.18-1.43	<0.0001	1.31	1.07-1.60	0.0103	2.55	1.44, 4.53	0.0014
Parity (time)										
Nulliparous (ref.) 8049 (15.	5.1)	1.00			1.00			1.00		
Primiparous (=1) 22 963 (43.	I3.2)	1.24	1.13-1.36	<0.0001	1.02	0.79–1.32	0.8700	0.74	0.50, 1.09	0.1224
Multiparous (=2) 12 958 (24.	(4.4)	1.62	1.47–1.79	<0.0001	2.27	1.76–2.94	<0.0001	0.87	0.59, 1.27	0.4655
Multiparous (≥3) 9208 (17.	7.3)	1.91	1.71–2.13	<0.0001	2.78	2.13–3.64	<0.0001	1.93	1.33, 2.81	0.0006
Pelvic surgery history										
No (ref.) 39 050 (73.	'3.4)	1.00		<0.0001	1.00		0.6734	1.00		0.1521
Yes 14 128 (26.	(9.9)	0.89	0.86-0.92		0.98	0.91-1.06		0.87	0.72, 1.05	
Cough										
No (ref.) 49 204 (92.	12.5)	1.00		<0.0001	1.00		0.0004	1.00		06409
Yes 3974 (7.5	.5)	1.48	1.39–1.58		1.26	1.11–1.43		1.08	0.79, 1.46	
Smoking										
No (ref.) 51 423 (96.	0.7)	1.00		0.0663	1.00		0.8690	1.00		0.9922
Yes 1755 (3.3	3.3)	0.87	0.75-1.01		1.02	0.78-1.35		1.00	0.54, 1.86	
Alcohol consumption										
No (ref.) 52 836 (99.	1 9 .4)	1.00		<0.0001	1.00		0.8287	1.00		0.8284
Yes 342 (6.4	.4)	1.22	1.13–1.32		0.98	0.80–1.19		1.05	0.68, 1.63	

$n = 399$ $n = 894$ Adjusted OR95% Cl $P \cdot value$ $n = 894$ Adjusted OR95% Cl $P \cdot value$ Adjusted OROwnexistent (ref.)38 721 (72.8) 1.00 $ 0.0001$ 1.00 $-$ Nonexistent (ref.)38 721 (72.8) 1.30 $ 0.0001$ 1.00 $ 2.07$ $1.93 - 2.22$ 2.08 Nonexistent (ref.) $14 457 (27.2)$ 1.39 $1.34 - 1.44$ 2.07 $1.93 - 2.22$ 2.08 1.00 Present $44 716 (84.1)$ 1.00 $ 2.07$ $1.93 - 2.22$ 0.0025 1.00 Nonexistent (ref.) $8462 (15.9)$ $1.19 - 1.25$ <0.0001 1.00 $ 0.0025$ 1.00 Present $8462 (15.9)$ $1.19 - 1.25$ <0.0001 1.00 $ 0.0025$ 0.037		(%) u	Symptom	atic POP-Q sta	age 2	Symptom	atic POP-Q st	age 3	Sympton	natic POP-Q st	age 4
Adjusted OR95% ClP-valueAdjusted OR95% ClP-valueAdjusted ORAdjusted ORGynaecological disease38 721 (72.8) 1.00 $ <0.0001$ 1.00 $ <0.0001$ 1.00 Nonexistent (ref.)38 721 (72.8) 1.39 $1.34-1.44$ <0.0001 1.00 $ <0.0001$ 1.00 Present $44 77 (27.2)$ 1.39 $1.34-1.44$ <0.0001 1.00 $ <0.0001$ 1.00 Present (ref.) $44 716 (84.1)$ 1.00 $ <0.0001$ 1.00 $ 0.0025$ 1.00 Present (ref.) $8462 (15.9)$ 1.19 $1.14-1.25$ <0.0001 1.00 $ 0.0025$ 1.00 Present (ref.) 0.0025 $1.04-1.22$ 0.0025 0.037 0.037 0.037				ז = 3999			n = 894			n = 194	
Gynaecological disease 38 721 (72.8) 1.00 — <0.0001			Adjusted OR	95% CI	P-value	Adjusted OR	95% CI	P-value	Adjusted OR	95% CI	P-value
Nonexistent (ref.) 38 721 (72.8) 1.00 - <0.0001 1.00 - <0.0001 1.00 Present 14 457 (27.2) 1.39 1.34-1.44 2.07 1.93-2.22 2.98 Physical disease 44 716 8462 1.00 - 0.0021 1.00 Nonexistent (ref.) 8462 1.19 1.14-1.25 1.12 1.04-1.22 0.87	Gynaecological disease										
Present 14 457 (27.2) 1.39 1.34-1.44 2.07 1.93-2.22 2.98 Physical disease Nonexistent (ref.) 44 716 (84.1) 1.00 — <0.0001	Nonexistent (ref.)	38 721 (72.8)	1.00		<0.0001	1.00		<0.0001	1.00		<0.0001
Physical disease 44 716 (84.1) 1.00 — <0.0001 1.00 — 0.0025 1.00 Nonexistent (ref.) 8462 (15.9) 1.19 1.14-1.25 1.12 1.04-1.22 0.87	Present	14 457 (27.2)	1.39	1.34–1.44		2.07	1.93–2.22		2.98	2.55, 3.48	
Nonexistent (ref.) 44 716 (84.1) 1.00 — <0.0001 1.00 — 0.0025 1.00 Present 8462 (15.9) 1.19 1.14-1.25 1.12 1.04-1.22 0.87	Physical disease										
Present 8462 (15.9) 1.19 1.14–1.25 1.04–1.22 0.87	Nonexistent (ref.)	44 716 (84.1)	1.00		<0.0001	1.00		0.0025	1.00		0.0557
	Present	8462 (15.9)	1.19	1.14–1.25		1.12	1.04-1.22		0.87	0.72, 1.00	
			<u></u>			71.17	77.1		0.0	00.1 121.0	

such as symptom screening and burden, as symptomatic POP was self-reported, which might have affected the accuracy of the data. Secondly, similar to other large-scale, population-based surveys, our survey was conducted at local maternal and child health centres, so selection bias is inevitable, as women with mobility issues could not reach the survey site. Thirdly, although our screening questionnaire included the main symptoms related to POP, it still did not include all the symptoms, such as colo-recto-anal symptoms, which may lead to an underestimation of the prevalence of symptomatic POP. Finally, we did not perform an assessment of intra-observer and interobserver reliability in gynaecological examinations. However, all examiners were trained by the principal investigator in POP-Q physical examination with the unified standards, and only those who passed the examination were allowed to work.

Interpretation

There have been few population-based epidemiological studies of POP, which found an overall prevalence of 3-50%. However, its prevalence is only 3-6% when POP is defined and graded according to its symptoms and 41-50% when it is defined according to findings of physical examinations.^{7,9,16,17} The symptomatic complaints of women in developing countries were similar to those in developed countries. However, the consequences were more severe for women in developing countries, and their quality of life was more drastically affected. Most women with prolapse did not seek medical attention,¹⁷ the main reasons being reluctance to mention it, embarrassment and the financial burden of medical intervention. We found that the nationwide prevalence of symptomatic POP (POP-Q stage II or higher) was 9.6%, mainly comprising anterior compartment prolapse. These findings were similar to the prevalence of POP in developing countries, which was 19.7% (range, 3.4–56.4%).¹⁸

The assessment of the burden of symptomatic POP is of key importance because it allows clinicians can gauge a patient's quality of life and likelihood of seeking treatment. There have been few studies examining the prevalence of symptom burden because some women with POP, even with advanced POP, deny their symptoms. We found that symptomatic POP is mainly caused by anterior compartment prolapse, and it affects the urinary system, whereas only higher stages of POP caused vaginal discomfort.

There have been few epidemiological studies of symptomatic POP because of the difficulty in obtaining standardised methodological measurements. In an attempt to standardise the physical examination, the POP-Q system was developed.¹⁹ However, the POP-Q system is not optimised for nationwide surveys. We used a screening questionnaire of eight questions from the Pelvic Floor Distress

Prevalence and risk factors of symptomatic POP

	n (%)	Bur	den of symptomatic POP	
			n = 5212	
		Adjusted OR	95% CI	<i>P</i> -value
Age group (y)				
20–29 (ref.)	11 279 (21.2)	1.00	_	
30–39	12 011 (22.6)	1.25	1.07–1.47	<0.0001
40–49	11 053 (20.8)	1.66	1.42-1.94	0.1593
50–59	7880 (14.8)	1.86	1.52-2.24	<0.0001
60–69	5680 (10.7)	1.93	1.56-2.39	<0.0001
≥70	5275 (10.0)	1.94	1.55-2.43	0.0004
POP-Q stage				
No or I	48 091 (90.4)	1.00	_	
II	3999 (7.5)	9.17	8.49–9.91	0.0078
III	894 (1.7)	25.70	22.08-29.99	<0.0001
IV	194 (0.4)	56.75	38.63-86.02	<0.0001
Menstrual condition				
Normal menstruation (ref.)	31 585 (59.4)	1.00	_	
Postmenopausal status without HRT	463 (8.7)	1.29	0.92-1.79	0.1737
Postmenopausal status with HRT	18 976 (35.7)	1.08	0.95–1.23	0.5384
BMI (kg/m ²)				
Underweight (<18.5)	3269 (6.2)	0.95	0.80-1.13	0.0194
Normal (18.5–23.9) (ref.)	33 597 (63.2)	1.00		
Overweight (24–27.9)	13 309 (25.0)	1.23	1.14–1.32	0.0041
Obese (≥28)	3003 (5.7)	0.95	0.80-1.13	0.0194
Parity (time)				
Nulliparous (ref.)	8049 (15.1)	1.00	_	
Primiparous (=1)	22 963 (43.2)	2.37	1.87–3.04	0.0032
Multiparous (=2)	12 958 (24.4)	2.62	2.05-3.40	<0.0001
Multiparous (>3)	9208 (17.3)	3.18	2.46-4.15	<0.0001
Pelvic surgery history				
No (ref.)	39 050 (73.4)	1.00	_	< 0.0001
Yes	14 128 (26.6)	0.82	0.76-0.88	
Cough				< 0.0001
No (ref.)	49 204 (92.5)	1.00	_	
Yes	3974 (7.5)	2.00	1.75-2.28	
Smoking				0 0009
No (ref)	51 423 (96 7)	1 00	_	0.0005
Yes	1755 (3 3)	1 54	1 19–1 98	
Alcohol consumption	.,		1110 1100	
No (ref)	52 836 (99 4)	1 00	_	0.0010
Ves	342 (6.4)	1 31	1 11_1 53	0.0010
Gynaecological disease	542 (0.4)	1.51	1.11 1.55	
Nonevistent (ref.)	38 721 (72 8)	1 00		~0.0001
Present	14 457 (27 2)	2 12	1 97_2 27	<0.0001
Physical disease	1, 27.2/	2.12	1.57 2.27	
Nonexistent (ref.)	44 716 (84 1)	1 00		~0.0001
Present	8462 (15 9)	1.30	1 21_1 //	<0.0001
i lesent	0402 (15.5)	1.52	1.21-1.44	

Table 5. Multivariate analysis of the associations of characteristics with burden of symptomatic POP

BMI, body mass index; CI, confidence interval; OR, odds ratio; POP-Q, Pelvic Organ Prolapse Quantification.

Adjusting the covariables: residence, race, job, current marital status and economic level.

Inventory-20. Participants who answered 'yes' to any question underwent the POP-Q examination. A comprehensive understanding of the prevalence, risk factors and course of symptomatic POP can help us improve treatment strategies and enhance the quality of life of women with this disorder in developing countries.

In other studies, age and parity have been reported to be associated with the prevalence of POP.²⁰⁻²⁵ For instance, a study from Iran²⁶ showed that there was an association between age and POP prevalence in women. However, in women from Gambia, in multivariable logistic regression analysis,²⁷ high parity was the strongest risk factor for POP, after considering other significant demographic, reproductive and gynaecological variables. Multiparous women with eight or more deliveries had a 15-fold higher rate of prolapse (P < 0.0001) than nulliparous women did. In agreement with previous studies, we found that older age, specific lifestyle factors, pathological conditions and multiple vaginal deliveries increased the odds of each type of symptomatic POP after adjusting for residence, race, job, marital status and economic confounders. The association between pelvic floor disorders and age is usually attributed to age-related changes in connective tissue and neuromuscular function, in addition to co-morbidities such as obesity, pulmonary disease and diabetes, which are more common among older adults. Higher stage was the strongest risk factor for burden of symptomatic POP, and this information can be used to identify patients requiring medical intervention.

Women may present with a single symptom, such as vaginal bulging or pelvic pressure, or with a combination of symptoms, such as urinary incontinence, urinary urgency/frequency, voiding dysfunction and faecal incontinence.^{28,29} We found that urine leakage after coughing, sneezing or laughing was the most common symptom.

Analysis of epidemiological data (not a screening test design) revealed the specificity of symptoms to be inaccurate; therefore, we focused on the sensitivity of symptoms. We found that symptoms of stress urinary incontinence were highly sensitive in the screening of symptomatic stage II–IV POP. Although the symptom of vaginal bulging was highly specific, the sensitivity was very low, indicating that stage II and IV patients requiring medical intervention would be missed.

Conclusions

Currently, this study is the largest population-based epidemiological study examining symptomatic POP in adult women. We found a lower prevalence of symptomatic POP than that found in other studies. However, the burden of symptomatic POP is a more reliable approach because it often results in patients being considered for medical intervention. Urinary system symptoms were most likely to be rated as burdensome. Older age and multiple vaginal deliveries increased the odds of each type of symptomatic POP, and women with a higher stage of symptomatic POP were more likely to experience discomfort.

Disclosure of interests

None declared. Completed disclosure of interests forms are available to view online as supporting information.

Contribution to authorship

Lan Zhu contributed to the study conception, study design, analysis and interpretation of the data, and reviewed and approved the final manuscript. Haiyu Pang and Lei Zhang contributed to the study concept and design, analysis and interpretation of the data, and drafting of the manuscript. Tao Xu and Shaomei Han contributed to the statistical analysis. Zhaoai Li, Jian Gong, Qing Liu, Xiaochun Liu, Juntao Wang, and Zhijun Xia contributed to the acquisition of the data. Jinghe Lang contributed to the study concept and design, and reviewed and approved the final manuscript.

Details of ethics approval

The study protocol was approved by the institutional review board of Peking Union Medical College Hospital (Number: S-689, Date: 15 May 15 May 2014). The study protocol was approved (http://www.chictr.org, ChiCTR-OCH-14004675). Written informed consent was obtained from each participant before data collection.

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Data availability

The data that support the finding of this study are available from the corresponding author upon reasonable request.

Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Figure S1. Six survey sites and the numbers of participants at each site in mainland China.

Figure S2. Frequency distribution for different symptoms.

Figure S3. Age-specific prevalence of symptomatic POP. **Table S1.** Screening questionnaire for symptomatic POP.

Prevalence and risk factors of symptomatic POP

Table S2. Sensitivity and specificity of symptoms by POP stage.■

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