

Prevalence Rates and Associated Factors of Urinary Incontinence in Chinese Women

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Abstract

Background: This review of studies on urinary incontinence (UI) was focused primarily on UI prevalence rates and associated factors across the adult lifecourse of Chinese women. UI is a urologic symptom that has a significant impact on women's physical and mental health and quality of life. Although researchers from many countries have reported UI, little is known about the prevalence of UI specifically for women in China's especially large female population. Of the published studies, language may act as a barrier to their inclusion in English-language journals. To overcome this barrier and to add to the global knowledge base about UI in women, the authors reviewed and discussed findings from epidemiological studies published in Chinese language. **Method:** The authors retrieved research studies from databases: Wanfang, China National Knowledge Infrastructure, VIP for Chinese Technical Periodicals and China Biology Medicine. The authors used PubMed to search English-language studies published in Chinese journals on UI in Chinese women. **Results:** This literature review includes 40 articles published between January 2013 and August 2017. The overall UI prevalence rates reported in adult Chinese women ranged from 8.7% to 59.4%, representing 43 to 297 million women, respectively. For women aged 17 to 40 years, 41 to 59 years, and 60 years and older, prevalence rates ranged from 2.6% to 30.0%, 8.7% to 47.7%, and 16.9% to 59.4%, respectively. Significant associated factors for overall UI included age, body mass index, constipation, parity, and menopause. Despite the 17 to 40 age range being peak reproductive years, the literature revealed little focus on UI prevalence rates. For women aged 41 to 59 years, the main associated factors included those related to pregnancy and gynecologic diseases. For women 60 years and older, chronic diseases represented most of the associated factors. **Conclusions:** About 43 to 297 million Chinese women may experience UI. Many of the identified associated factors could be mitigated to reduce UI prevalence rates. Little is known about the prevalence rates and associated factors for UI among young (aged 17 to 40) Chinese women. Future research should investigate UI in young women to improve bladder health across their lifecourse.

Background

Urinary incontinence (UI), which is defined as the complaint of the involuntary loss of urine [1], is one of the most frequently reported lower urinary tract symptoms in women [2]. The three main types of UI are stress urinary incontinence (SUI), urgency urinary incontinence (UUI), and mixed urinary incontinence (MUI) [1]. The definition of each UI type is as follows: SUI is "the complaint of involuntary loss of urine on effort or physical exertion (e.g., sporting activities) or on sneezing or coughing"; UUI is the "observation of involuntary leakage from the urethra synchronous with the sensation of a sudden, compelling desire to void that is difficult to defer"; and MUI is the "complaint of involuntary loss of urine associated with urgency and also with effort or physical exertion or on sneezing or coughing" [1].

Prevalence rates of UI for women reported across the world can vary as a result of the methodological variations used in the studies or reports, women's underreporting of their symptoms, and providers underdiagnosing the condition [3]. As an example, the UI prevalence rate for women between 45 and 60 years old living in Brazil was 23.6% [4], whereas the prevalence rates for adult women (over 18 years old) in Germany, Denmark, and Norway were 48.3%, 46.4% [5], and 18.7% [6], respectively. The number of women with UI in the United States has been estimated to be about 28.4 million [7]. Evidence shows that 31.9% (approximately 160 million) women in China are affected by UI [8]. Although this prevalence rate of UI in China falls within the reported prevalence ranges of other countries (e.g., 48.3% in Germany and 46.4% in Denmark [5]), the absolute numbers of women with UI is significantly higher in China than in other countries, indicating the overwhelming need for health and social resources to manage and treat UI.

Many factors are associated with UI, including unmodifiable factors (e.g., age, gender, menopause, history of vaginal delivery) and potentially modifiable factors (e.g., smoking, alcohol intake, toileting behaviors, constipation, and obesity). In addition to UI's impact on women's physical and mental health, UI affects women's quality of life by limiting social activities [9] and interactions, interfering with the ability to work [10], and increasing the financial burden on women and society [11-13]. Therefore, UI should be viewed as both a women's health issue and a public health issue [14].

Studies of UI prevalence rates and associated factors often appear in English-language journals, but research findings published in non-English-language journals or English-language journals that are not published outside of China are seldom disseminated widely. The resultant knowledge gap could negatively affect potential research and clinical advances with regard to Chinese women's bladder health. This gap could also delay the development of culturally appropriate interventions to prevent and treat UI across women's lifecourse. Thus, the need to close the knowledge gap is important, especially considering China's large female population. For example, 650 million women were living in China in 2010, with more than 500 million women over 20 years old [15].

The aims of this study were to: 1) summarize findings from studies in non-English-language journals and journals published only in China that investigate UI prevalence in Chinese women, 2) categorize the findings by life stage (i.e., age range categories), and 3) facilitate dissemination of this existing information to researchers and clinicians to aid in their planning to prevent, manage, and treat female UI.

Methods

The authors searched the relevant literature using the Wanfang full-text database, China National Knowledge Infrastructure Database, VIP Database for Chinese Technical Periodicals, China Biology Medicine database, and PubMed. The Wanfang full-text database search expression was Subject (Female / Women) * Subject (Urinary incontinence) * Subject (Prevalence) * Date: 2013-2017 or Subject: (Lower urinary tract symptoms) * Subject (Prevalence) * Date: 2013-2017. The authors used the same search strategy for the other three databases: China National Knowledge Infrastructure VIP, China Biology Medicine, and PubMed. After the electronic retrieval of relevant articles, the authors obtained further studies from the references cited in those articles. The search period for eligible published articles was January 2013 to August 2017.

2.2 Eligibility criteria

The inclusion criteria for this review were that 1) the studies must be a cross-sectional research design; 2) study participants were adult women (≥ 17 years old) living in China; 3) studies discussed prevalence rates and/or associated factors of UI; and 4) sample sizes were greater than or equal to 100 women. The exclusion criteria were that the studies were not 1) narrative or systematic reviews, meta-analyses, or clinical guidelines; 2) case-control studies of UI treatment or care; 3) focused on UI mechanisms; and 4) focused on prevalence data in their findings.

2.3 Study selection

Two native Chinese-speaking reviewers independently screened the article titles and abstracts. Duplicate articles were excluded. Full texts were obtained for the selected studies to assess their eligibility and their reference lists were scanned for further relevant articles. Any disagreement that arose between the reviewers regarding the inclusion or exclusion of articles was resolved through discussion. See Figure 1.

2.4 Data extraction and analysis

The study team developed a standardized abstraction table. Given the review objective (provide a broad overview of prevalence rates and associated factors of urinary incontinence in Chinese women), there was no assessment of the quality of individual studies. Data abstraction was done by two

reviewers. One author independently read the included studies and extracted data from them but consulted one other author to resolve ambiguities. The studies were described and then summarized using a narrative descriptive approach. Data in the abstraction table was double checked by reviewers.

The age ranges of the participants differed among the studies selected for review. Thus, we adopted the following age range categories to examine the studies more closely in terms of participant age: 17 to 40 years old for young women, 41 to 59 years old for middle-aged women, and 60 years old and over for older women. Two reviewers independently abstracted data onto a data extraction summary sheet regarding prevalence rates and associated factors for UI in young, middle-aged, and older Chinese women.

Results

The articles initially retrieved included 244 Chinese-language and 713 English-language articles after removing 162 duplicates. Of those articles, we selected 61 Chinese-language articles and 15 English-language articles after screening their titles and abstracts. We then reviewed the full texts of each article and selected 34 Chinese-language and 6 English-language articles for final analyses (Figure1).

Studies selected for review were conducted in different provinces and regions in China including: Shanghai [16], Beijing [17], Guangzhou [18], and Taiwan [19, 20]). Figure 2 presents a map of China that shows the UI prevalence rates in various areas throughout the country.

The prevalence rates and associated factors for female UI in China were presented in the Appendix. The reported prevalence rates of overall UI (overall UI includes all types of UI) in Chinese adult women ranged from 8.7 % [21] to 59.4% [22]. Where prevalence of specific UI types were reported, the following ranges were; SUI prevalence rates ranged from 6.7% [21] to 38.8% [23], UUI prevalence rates ranged from 1.2% [24] to 21.0% [17], and MUI prevalence rates ranged from 1.5% [24] to 15.7% [25]).

Definitions for UI, SUI, UUI, and MUI differed across some of the studies. Most of the authors used the International Continence Society (ICS) definition of UI: “complaint of involuntary loss of urine” [1]. Five studies [26-30] did not include a definition for UI. Other definitions that were used varied slightly from the ICS definition, including: 1) UUI was defined as, “the occurrence of urinary frequency, urgency, increased frequency of nocturnal discharge and decreased urine output; or cannot control urine leaking out, waited

too late to urinate leading to leakage of urine” [22, 31]; and 2) UUI was defined as, “urinating without any warning or a weak or faint amount of early warning, sudden urge sensation resulting in uncontrolled urine outflow” [17]. SUI was defined as “urine leaks out when exercising” [17]. Appendix includes the UI definitions used in the reviewed studies.

No article reported UI prevalence rates specifically for young women (17- 40 years old). Based on the data extracted from studies that included adult women, UI prevalence rates for community-living young women (18-40 years old) ranged from 2.6% [32] to 30.0% [33], and the prevalence rates of SUI, UUI, and MUI were reported as 4.7% [16] to 24.5% [34], 0% [35] to 8.1% [31], and 0.7% [36] to 10.7% [37], respectively. Five articles [18, 19, 21, 38, 39] were focused on middle-aged, perimenopausal, and menopausal women, and five articles [22, 30, 40-42] were focused on older women. The prevalence rates of UI for middle-aged women ranged from 8.7% [21] to 47.7% [25], and the prevalence rates of UI for older women ranged from 16.9% [41] to 59.4% [22]. Table 1 provides a summary of the UI prevalence rates and risk or associated factors.

Table 1 Prevalence Rates and Factors Associated with Urinary Incontinence in Chinese Women

Population	Age	Prevalence	Associated Factors
Young women	17 [#] -40 years	UI 2.6%-30.0%	Not reported
		SUI 4.7%-24.5%	
		UUI 0- 8.1%	
		MUI 0.7%-10.7%	
Middle-aged women	41-59 years	UI 8.7%-47.7%	Age*, overweight, BMI, level of education, constipation, menstrual disorders, parity, perineal laceration, postpartum urinary incontinence, pelvic operation history, POP, menopause, atrophic vaginitis, history of hormone replacement therapy, urinary tract infection, mental disease, hyperlipidemia, chronic bronchitis or asthma, respiratory system diseases.
		SUI 6.7%-40.5%	
		UUI 2.1%-62.9%	
		MUI 1.2%-20.4%	
Older women	≥60 years	UI 16.9%-59.4%	Age, more than 80 years old, BMI, low level of education, constipation, gravidity, parity, pregnancy >4, leakage of urine, gynecological diseases, urinary tract infection, malnutrition, autonomic activity limitation, chronic pain, sleep disorders, chronic respiratory, urinary, cardiovascular disease, diabetes, drugs.
		SUI 10.0%-62.4%	
		UUI 3.3%-21.1%	
		MUI 3.3%-26.6%	

UI: Urinary incontinence; SUI: Stress urinary incontinence; UUI: Urgency urinary incontinence; MUI: Mixed urinary incontinence; BMI: Body mass index; POP: Pelvic organ prolapse.

*Of the 40 studies included, one study reported that UI was independent of age.

Factors associated with UI fell into several categories. Under general characteristics, 23 articles discussed age, 19 articles discussed body mass index (BMI) or body weight, 17 articles discussed educational level, 7 articles discussed place of residence, 5 articles discussed information about alcohol consumption, 3 articles discussed manual labor or occupation, 3 articles discussed information about smoking, and 2 articles discussed daily amounts of water intake.

In the obstetric and postpartum categories, 15 articles discussed parity, 10 articles discussed vaginal delivery, 6 articles discussed mode of delivery, 5 articles discussed perineal tear, 4 articles discussed cesarean delivery, 4 articles discussed number of times the woman was pregnant, and 3 articles discussed prolonged labor. While under gynecological factors, 11 articles discussed menopause, 7 articles discussed pelvic organ prolapse (POP), 5 articles discussed chronic pelvic pain, and 3 articles discussed vaginitis.

In the chronic diseases category, 15 articles discussed constipation, 7 articles discussed hypertension, 6 articles discussed chronic cough, 6 articles discussed diabetes, 6 articles discussed respiratory diseases, 2 articles discussed hyperlipidemia, 2 articles discussed chronic bronchitis, 2 articles discussed cardiovascular diseases, and 2 articles discussed mental disorder. Under other health factors, 7 articles discussed urinary tract infections, 6 articles discussed history of pelvic surgery, 2 articles discussed urinary diseases, and 2 articles discussed history of hormone replacement therapy.

Discussion

The studies selected for this review revealed a wide range of prevalence rates for overall UI and the specific types of UI, which may be due in part to the country's size. China is a large country with 9.6 million square kilometers and it includes numerous cultures in urban and rural locations. Genetic factors, diet, lifestyle, local environment, climate, economic development level, occupation, and toileting behaviors may differ across these regions. These factors may act as determinants of UI, and thus affect variation in UI prevalence rates. Other potential reasons for the variations in UI prevalence rates and UI types are the different research definitions and statistical and sampling methods used in the selected studies. Researchers used different methods when creating samples (e.g., based on general outpatient [29] or gynecological clinics [27] or physical examination [43]). The study participants had different occupations (i.e., nurses [17] and railway workers [44]), and different living conditions (i.e., rural [45] and urban [32]).

Also, in some studies, clinicians conducted physical examinations and documented medical histories, which may have yielded different results from women's self-reported questionnaires.

Researchers identified several factors associated with overall UI in Chinese women. Some of these factors are modifiable, such as BMI, smoking, drinking alcohol, and toileting behaviors. Some factors can be remedied or controlled (i.e., constipation, hypertension, chronic cough, diabetes, respiratory diseases, and vaginitis). Lastly, although some of the identified factors are unmodifiable (i.e., age, vaginal delivery, cesarean section delivery, and menopause), interventions can nonetheless be designed and tested to promote bladder health and help delay the onset or slow worsening of UI.

Age is often associated with UI risk factors such as education level, number of pregnancies and deliveries, menopause, and chronic conditions such as hypertension, diabetes, and respiratory diseases. Thus, studying clusters of factors that increase UI risk across the lifecourse is important. Moreover, using a lifecourse perspective is advocated in bladder health research [46].

Chinese scholars have largely confined their research on prevalence of UI in adult women (≥ 17 years old), but in their findings of subgroup analyses for discrete age groups were not reported. Despite this limitation, when using the prevalence rate range of 2.6% [32] to 30% [33] for young women aged 17 to 40 years old, the number of Chinese women in this age group who are affected by UI is estimated to be between 6.6 million and 75.8 million. This finding alone indicates that screening young women for risk factors, especially modifiable ones, and taking actions to minimize or eliminate the effects of these factors could potentially prevent or delay incident cases of UI throughout the lifecourse and especially later in life.

For example, in a prospective cluster-randomized controlled trial of UI among young women (18-40 years), SUI prevalence was 14.3% [47]; 49.5% of these women had SUI during pregnancy, 43.6% had postpartum SUI, and 6.9% had SUI before pregnancy. Because muscle, connective, and nervous system pelvic structures are subjected to anatomical, morphological, functional, and hormonal changes during pregnancy, clinicians should initiate primary prevention interventions[48]. The pelvic floor also undergoes an enormous amount of stretching to allow the passage of a newborn during vaginal delivery [49]. Evident or hidden injuries to the pelvic floor may manifest as urinary and fecal incontinence, prolapse symptoms, or sexual dysfunction, all of which have a considerable impact on quality of life. Because

pregnancy and childbirth can put young women at risk of developing UI [50], research and clinical attention should be focused on understanding the underlying mechanisms of UI as well as developing effective strategies to preserve bladder health for young Chinese nulligravid women.

Evidence from studies of young women who live outside of China provides compelling evidence that UI in young women should be investigated further and intentionally. For example, the prevalence rate of UI for Swedish women ($N = 653$) between the ages of 18 and 30 years was 12% [51]. In nulligravid Australian women aged 16 to 30 years (average age 22.5 ± 3.2 years), the prevalence of overall UI was 12.6% [52], and women who were sexually active and those who were not using oral contraceptives had the highest rate of UI [52]. Mishra et al.'s study found that the UI prevalence rate for Australian women aged 22 to 27 years was 6.8% at baseline and increased to 16.5% nine years later [53]. These researchers also reported that women with depressive symptoms or a history of depression were more likely than those without depressive symptoms to report subsequent UI symptoms [53]. For nulligravid Italian women between 15 and 25 years old, age, BMI, depression/ anxiety/panic attacks, eating disorders, and constipation were risk factors for UI [54]. Participating in organized sports that involves high-volume exercise for competition also increased the risk of developing UI (OR = 2.53, 95%CI = 1.3 – 2.7) [55]. Other studies conducted outside of China showed that UI is an issue for many nulliparous female athletes [56].

Cultural differences may be evident with regard to UI risk and associated factors in China and abroad. A relatively new factor under investigation is toileting behaviors, i.e., actions women take immediately prior to and during urination [57-60]. Toileting behaviors may play a role in developing or worsening urinary symptoms, but more research is required, especially studies that focus on young women in China. It is often during youth and young adulthood when women develop habitual behaviors and form beliefs and attitudes about bladder health for themselves and their children. This period in women's lifecourse may be pivotal in influencing prevalence rates because evidence is mounting that research to prevent or reduce UI in this age stage is important [46].

This review also found that UI prevalence rates for middle-aged Chinese women ranged from 8.7% [21] to 47.7% [25], which represents 15.5 to 85.0 million middle-aged women with UI. The associated factors relate mainly to obstetrics-related ones, such as parity, perineal laceration, and postpartum UI, and gynecological factors, such as menstrual disorder, menopause, pelvic organ prolapse, pelvic operation

history, and hormone replacement therapy (see Table1). Research conducted in China found that the protective effect of cesarean section delivery compared with vaginal delivery was more obvious at five years postpartum than at one year postpartum [61]. Vaginal delivery appears to aggravate pelvic floor structure injuries. Further research is needed to determine the mechanism(s) of such injury, identify associated factors and interventions that prevent or lessen adverse effects of childbirth on bladder health.

Compared to this study, studies conducted in other countries had similar findings. In Norway, a survey of middle-aged women (average age 47 years) who had delivered either vaginally or by Caesarian section 15 to 23 years previously had 46.9% UI prevalence; the study also found cesarean section delivery was a protective factor and UI prevalence rate was lower in this group [62]. The UI prevalence rate for women between 45 and 60 years old living in Brazil was 23.6% [4]. UI prevalence rate was found to be significantly higher in a postmenopausal group than a premenopausal age group [63], which may be related to the change of hormone levels in postmenopausal women [64].

Although UI is common across the lifecourse, its prevalence peaks in the older age group of women [3]. China's older female UI prevalence rate ranged from 16.9% [41] to 59.4% [22], which translates to more than 12.8 to 44.9 million older Chinese women living with UI. Risk factors associated with UI include being 80 years old and over, BMI, malnutrition, low educational level, sleep disorders [42], unspecified number and types of medications, history of pregnancy, urine leakage during pregnancy, chronic respiratory disease, cardiovascular disease, gynecological diseases, diabetes, urinary tract diseases [20], chronic pain, constipation, and restricted activity [30] (see Table1). Compared to middle-aged women, older women have a higher prevalence of chronic diseases (i.e., respiratory disease, hypertension, diabetes, etc.), limited physical activity, malnutrition, and other factors that could be contributing risk factors for UI.

Scholars outside of China have found similar UI prevalence rates for older women. A survey of 622 older women living in Brazil (average age 64 years) revealed that the UI prevalence rate was 52.3% [65]. The UI prevalence rate for women over 65 years old in Turkey was 51.6% [66]. A longitudinal study of older women with baseline ages of 51 to 74 years who did not have UI found that the incidence of UI was

37.2% ten years later [67]. This study also found that UI prevalence in later in life has strong associations with obesity, functional ability, and medical comorbidities but not with parity [67].

Although we used rigorous methods to conduct this epidemiological review, some limitations are noted. First, we may have inadvertently overlooked eligible articles that did not appear in the database searches. Second, research into UI prevalence rates has not been conducted in all 34 provinces in China (e.g., 21 of the 34 provinces are represented in the included studies), which could result in an incomplete picture of the distribution of UI across the Chinese female adult population.

Conclusions

Most of the information in this review has been previously unavailable to researchers in countries outside of China. Thus, in addition to adding to the specific knowledge about UI in Chinese women, this review adds to the global knowledge base about female UI. Findings from the reviewed studies revealed that UI prevalence rates for Chinese women range from 23.0% to 49.9 percent. Most of the studies focused on middle-aged and older women. Little information about UI prevalence for women in their teens and twenties was found for this review. Given the prevalence of UI and size of China's female population, research is needed to better understand the risk, and protective, factors for UI across the lifecourse of women. This information should stimulate interest in further multi-country comparisons and the development and testing of evidence-based interventions to prevent UI.

Abbreviations

Body mass index	BMI
International Continence Society	ICS
Mixed urinary incontinence	MUI
Pelvic organ prolapse	POP
Stress urinary incontinence	SUI
Urinary incontinence	UI
Urgency urinary incontinence	UUI

Declarations

Ethics approval and consent to participate:

Not applicable

Consent for publication:

Not applicable

Availability of data and material:

All data generated or analyzed during this study are included in this published article.

Competing interests:

The authors declare that they have no competing interests.

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Authors' contributions:

KKX analyzed and interpreted the literature data regarding UI and was a major contributor in writing the manuscript. FZ and MHP made substantial contributions to the conception and design strategy and revised the article for important intellectual content. All authors read and approved the final manuscript.

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Figures

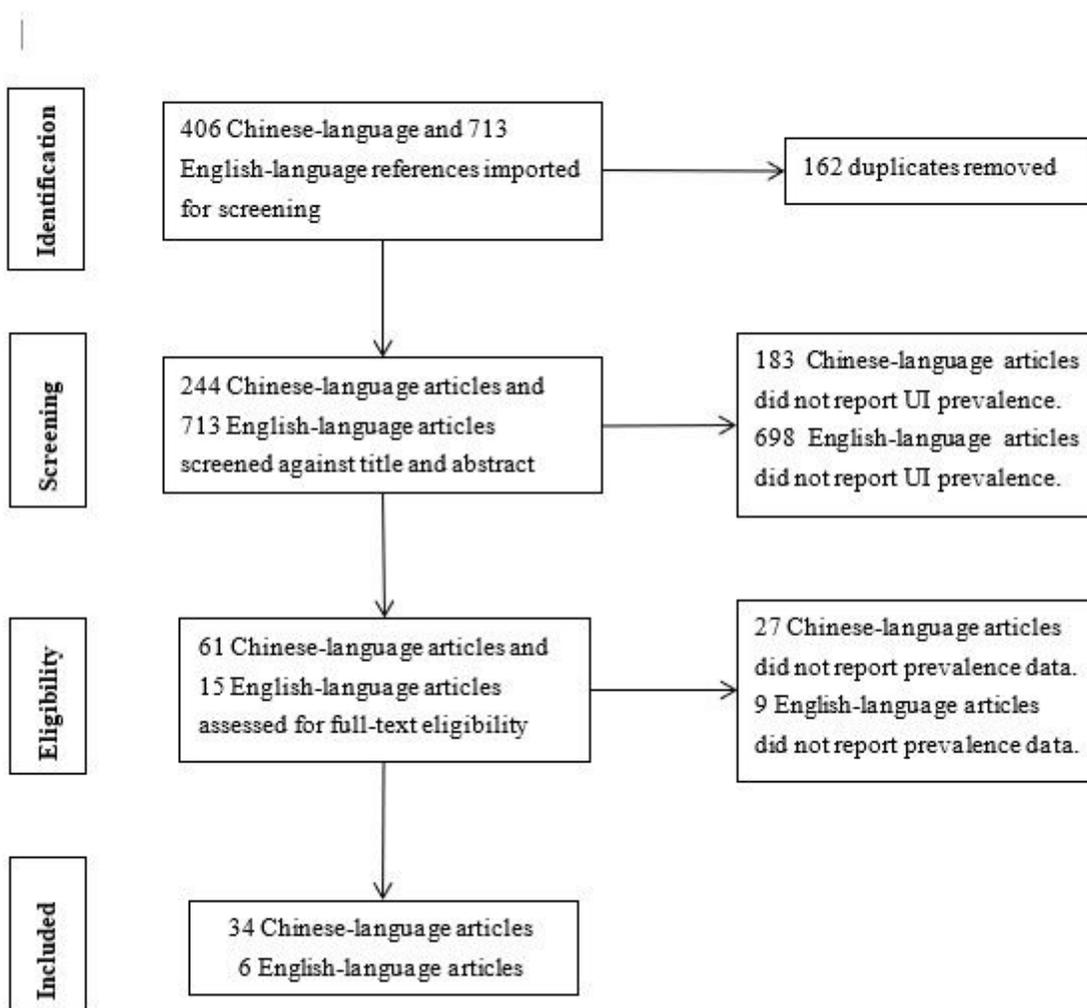


Figure 1

PRISMA Flow Diagram for the review process

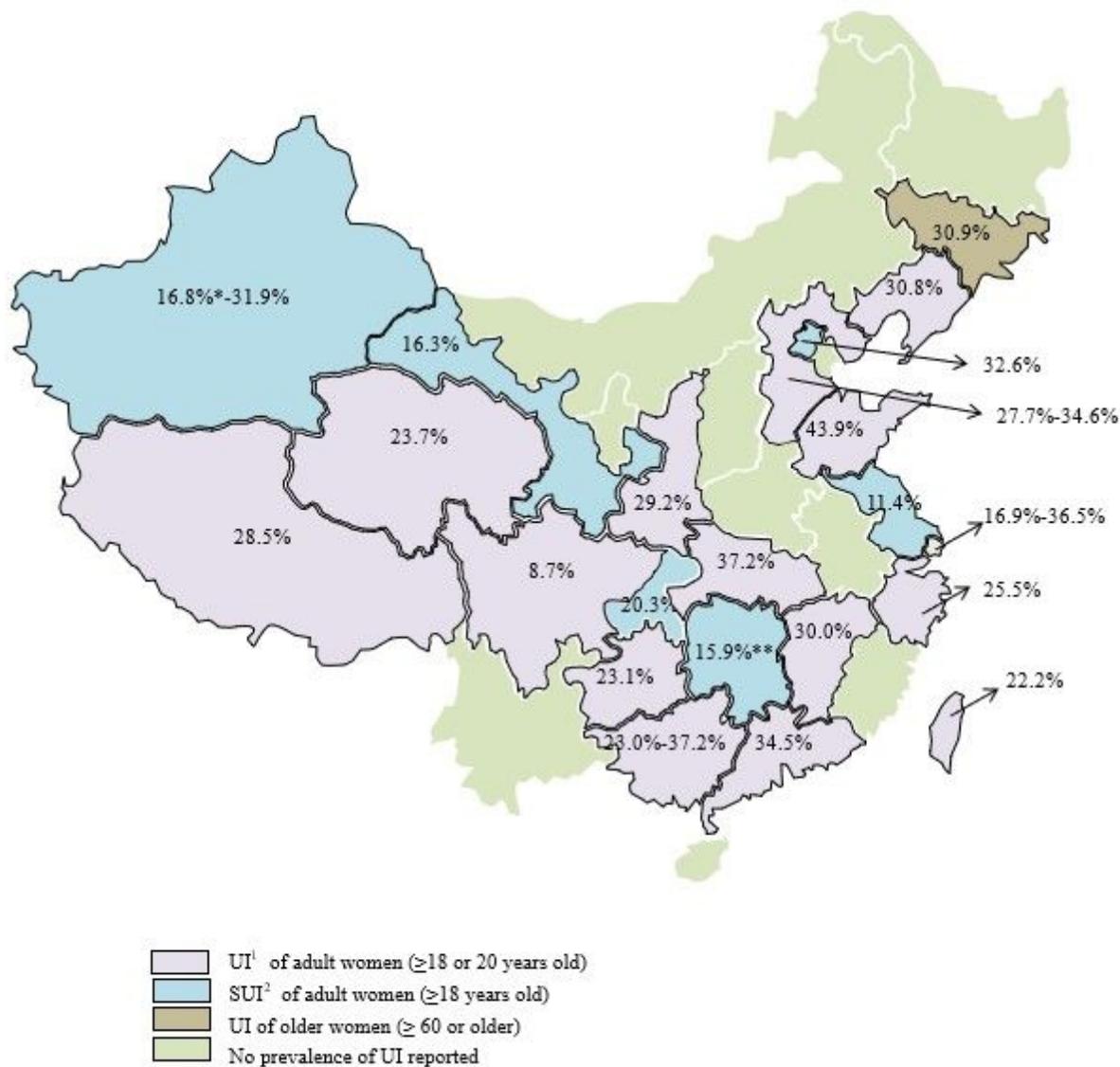


Figure 2

Prevalence rates of female urinary incontinence by location in China. Two studies including women with 17 year olds: *Arzigul A. Epidemiology and risk factors of female stress urinary incontinence in some counties and townships of Xinjiang of Hotan. Xinjiang Medical University 2013. ** Li F, Liu J, Lie TT. An investigation of risk factors for adult female stress urinary incontinence in outpatient clinic. Shanxi Medical Journal 2014, 43(6):756-757. UI: Urinary incontinence, type not specified SUI: Stress urinary incontinence This figure is created by authors. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

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