

# Association of urinary incontinence and depression or anxiety: a meta-analysis

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## Abstract

**Objective:** We explored the relationship between urinary incontinence (UI) and depression or anxiety.

**Methods:** We searched the Cochrane Library, Embase, and PubMed for articles on the association between depression, anxiety, and UI. We calculated pooled 95% confidence intervals (CIs) and odds ratios (ORs).

**Results:** Twelve articles (31,462 participants) were included. The UI group had significantly higher depression and anxiety levels than the non-UI group (OR = 1.73, 95%CI: 1.64–1.82,  $I^2 = 75.5%$ ). In subgroup analysis, depression and anxiety were significantly higher in participants with UI than in those without UI (OR = 1.95, 95%CI: 1.82–2.10,  $I^2 = 64.3%$  and OR = 1.54, 95%CI: 1.43–1.65,  $I^2 = 59.2%$ , respectively).

In subgroup analysis by age, participants with UI had significantly higher depression and anxiety, regardless of age, than the non-UI group (OR = 1.59, 95%CI: 1.29–1.95,  $I^2 = 59.1%$  and OR = 1.98, 95%CI: 1.62–2.43,  $I^2 = 75.5%$ , respectively).

**Conclusion:** Patients with UI had significantly higher depression and anxiety levels than those without UI. Depression and anxiety were higher in patients with UI than in those without UI, regardless of age. Larger sample sizes and more high-quality studies are needed to validate our findings.

## Keywords

Urinary incontinence, depression, anxiety, meta-analysis, subgroup analysis, Newcastle–Ottawa Scale

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## Introduction

Urinary incontinence (UI) does not cause organic lesions, but long-term UI is closely related to the occurrence and development of various mental symptoms, such as depression and anxiety.<sup>1,2</sup> Some scholars believe that chronic depression and anxiety are closely related to UI.<sup>3</sup> About 30% to 65% of the world's population has UI.<sup>3,4</sup> With the accelerated pace of life in society, increased social pressure, and aging populations, the incidence of UI will continue to rise, as will the prevalence of depression and anxiety. Some scholars have been investigating UI as it is related to mental health since 1978.<sup>5</sup> However, there is still a lack of comprehensive research on the relationship between UI and depression and anxiety. Therefore, in this study, we performed a systematic review and used analytical methods to evaluate the relationship between UI and depression and anxiety. Our study findings can provide a reliable basis for future research on how to improve UI and mental health.

## Methods

### *Literature search and selection*

The methodology involved in this meta-analysis was based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement, and this meta-analysis was registered a priori in the International Prospective Register of Systematic Reviews (PROSPERO). We systematically searched the published literature using the databases PubMed, Embase, and Cochrane Library. We manually searched for relevant journals using the Population, Intervention, Comparator, Outcomes (PICO) methodology. PICO is defined as follows: Population (P), With UI (I), Without UI (C), Depression or anxiety (O). The database

search included articles through November 15, 2019. We made auxiliary use of the literature track method as far as possible, to find detailed article information. After reading the full text of the identified articles, we extracted the relevant data. Two evaluators (H.T.H. and C.L.) selected the articles to be included; the other two evaluators (C.S.L. and L.D.) extracted the data. Inconsistencies were resolved in discussion. The extracted data included the first author, country, publication, study type, follow-up time (years), group, age (if mentioned), female proportion, and definition of depression and anxiety used (Table 1).

### *Data extraction and inclusion criteria*

We excluded such items as literature reviews, editorial reviews, background articles, studies involving animal models, case reports, journal catalogs, column introductions, submission instructions, conference notices, and news reports. Study participants with UI and depression or anxiety included in our meta-analysis met the standard definitions of depression and anxiety (Table 1).

Owing to the nature of this study, an ethics review and informed consent were not required.

### *Statistical analysis*

We performed statistical analysis using Stata v.12.0 (StataCorp LLC, College Station, TX, USA). For dichotomous variables, the odds ratio (OR) and 95% confidence interval (95%CI) were used. According to whether the homogeneity was low ( $P \geq 0.10$ ,  $I^2 \leq 50\%$ ) or high ( $P < 0.10$ ,  $I^2 > 50\%$ ), we used a fixed- or random-effects model in the meta-analysis. If heterogeneity among the studies was high ( $P < 0.10$ ,  $I^2 > 50\%$ ), we identified the cause of heterogeneity and performed subgroup or sensitivity analysis. If heterogeneity

**Table 1.** Characteristics of the included studies.

First author	Country	Publication	Study type	Years of follow-up	Group	Average age (mean±SD)*, mean [range]**, mean age [years]***)	No. of participants	Female participants sex	Definition of depression and anxiety	NOS score (Max: 9)
Aguilar-Navarro 2012	Mexico	J Gerontol A Biol Sci Med Sci	Cross-sectional, prospective	1.25	UI (mild, moderate, severe) No-UI	82.1 (8.2)*, 80.5 (7.8)*, 80.7 (7.2)* 78.6 (7.0)*	202	56.20%	Depression was assessed using the CES-D.	8
Bradley 2012	USA	Am J Obstet Gynecol	Cross-sectional, prospective	2.25	No-UI	N/A	922	N/A	Depression was defined using the CIDI-SF.	7
Felde 2012	Norway	Int Urogynecol J	Cross-sectional	3	UI (anxiety) No-UI (anxiety)	N/A	1391	N/A	Anxiety and depression was in HUSK measured using the HADS.	7
Fultz 2001	USA	J Am Geriatr Soc	Cohort	1	UI (depression) No-UI (depression)	N/A	3790	N/A		
Gascon 2018	Brazil	Braz J Infect Dis	Cross-sectional, retrospective	0.33	UI	56.56 (40-95)** 59.87 (40-95)**	1116	53.40%	Defined using standard scales for depression.	8
Hsu 2014	USA	BMC Geriatr	Cross-sectional	6	No-UI	50.88 (2.47)* 51.31 (2.19)*	18	67.50%	Anxiety and depression defined using HADS.	7
Kwak 2016	Republic of Korea	Republic of Aging Ment Health	Cross-sectional	1.25	UI (seldom, often) No-UI	80 (8.1)*, 81 (8.0)* 78 (8.2)*	198	N/A	Depressive symptoms were defined using the GDS.	7
Malmstrom 2010	USA	J Am Geriatr Soc	Cross-sectional	1	UI (anxiety, depression) No-UI (anxiety, depression)	73 (0.6)* 73.3 (0.2)*	249 189	N/A	The EQ-5D was used to measure health-related QOL, which included anxiety/depression.	7
					UI	59.3 (4.3)* 59.6 (4.4)*	102 739	N/A	Depression was assessed using the CESD-11. Scores ≥ 9 represent clinically relevant levels	8

(continued)

Table 1. Continued.

First author	Country	Publication	Study type	Years of follow-up	Group	Average age (mean $\pm$ SD <sup>*</sup> , mean [range] <sup>**</sup> , mean age [years] <sup>***</sup> )	No. of participants	Female sex	Definition of depression and anxiety	NOS score (Max: 9)
Meade 2001	USA	Urol Nurs	Prospective	1	UI No-UI	58.5 <sup>***</sup> 54.4 <sup>***</sup>	310 260	N/A	Depression was defined using the Beck Depression Index. Scores > 12 are considered depression.	5
Perry 2006	UK	Br J Health Psychol	Prospective	N/A	UI No-UI	57 (48-68) <sup>**</sup> 62 (52-74) <sup>**</sup> N/A	1851 10,272	N/A	Depression was defined using the CIDI-SF.	7
Smith 2010	USA	J Am Geriatr Soc	Cross-sectional	2	UI No-UI	N/A	154 418	77.10%	Depressive symptoms were defined using the GDS.	8
Yoshida 2007	Japan	J Jpn Geriatr Soc	Cross-sectional	0.17	UI (male) No-UI (male) UI (female) No-UI (female)	76.9 (3.8) <sup>*</sup> 75.7 (3.8) <sup>*</sup> 76.1 (4.1) <sup>*</sup> 75.8 (4.0) <sup>*</sup>	103 665 237 778	56.90%	Depression was defined using the M.I.N.I.	5

N/A, not applicable; UI, urinary incontinence; NOS, Newcastle-Ottawa Scale; EQ-5D, EuroQol-5; CES-D, Center for Epidemiologic studies-Depression; CIDI-SF, Composite International Diagnostic Interview-Short Form for Major Depression; HADS, Hospital Anxiety and Depression Scale; CESD-11, 11-item Center for Epidemiologic Studies Depression Scale; GDS, Geriatric Depression Scale; M.I.N.I., Mini-International Neuropsychiatric Interview.

\* Mean  $\pm$  standard deviation, \*\* mean (range), \*\*\* mean age (years).

persisted, we used a random-effects model in the meta-analysis. The quality of the included studies was evaluated using the Newcastle–Ottawa scale (NOS). Publication bias was tested using Begg’s and Egger’s tests.

## Results

### Literature search results

A total 1,780 articles were identified in the initial search, and 166 articles that were duplicated and cross-published were deleted. After reading the text and abstract, another 1,489 articles were excluded. We then conducted a full-text review of the remaining 125 articles, after which 12 studies,<sup>2,6–16</sup> including 7,325 patients with UI and 24,137 patients without UI, met the inclusion criteria and were included in this analysis (Figure 1).

### Meta-analysis results

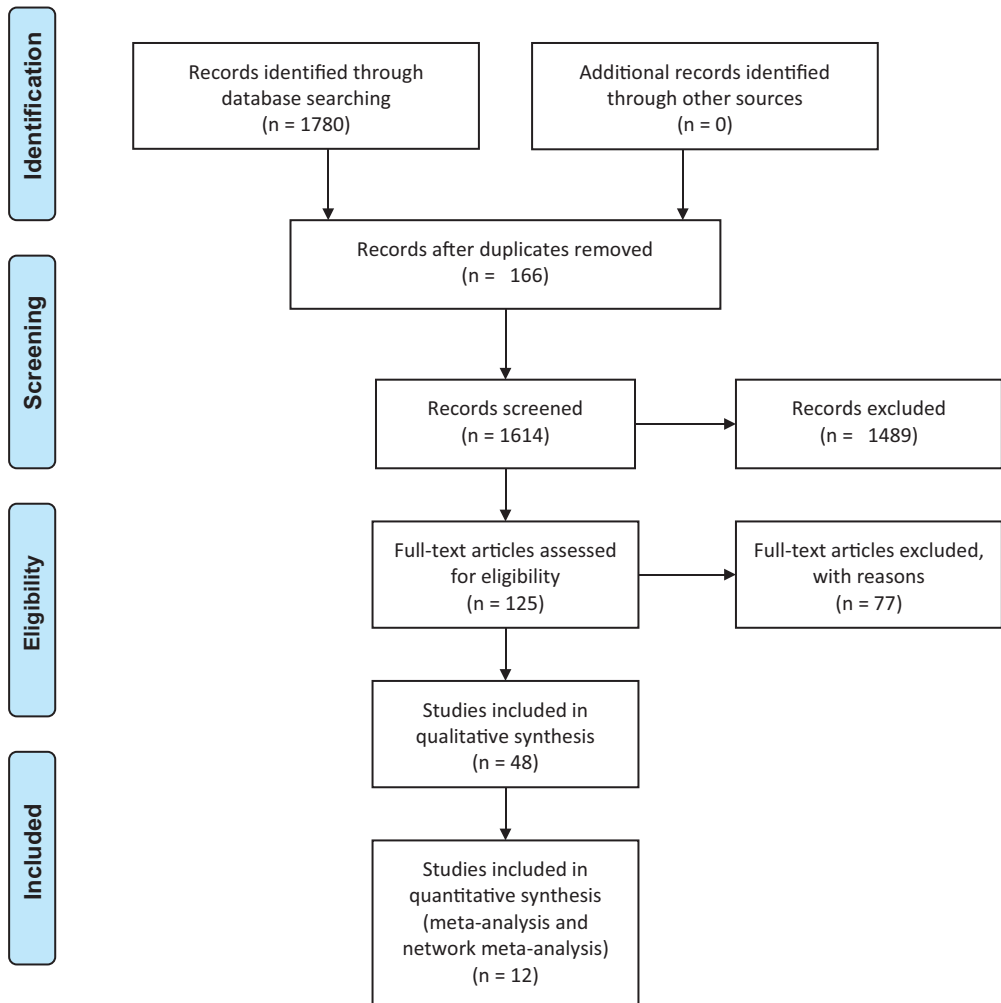
**Association between UI and depression or anxiety.** The relationship between UI and depression or anxiety in participants was reported in all 12 studies. Study participants with UI had significantly higher levels of depression or anxiety than those without UI (OR = 1.73, 95%CI: 1.64–1.82,  $I^2 = 75.5\%$ ,  $P < 0.0001$ ). Furthermore, in subgroup analysis, depression and anxiety were both significantly higher in the UI group (OR = 1.95, 95%CI: 1.82–2.10,  $I^2 = 64.3\%$ ,  $P < 0.0001$  and OR = 1.54, 95%CI: 1.43–1.65,  $I^2 = 59.2\%$ ,  $P < 0.0001$ , respectively) (Figure 2). Owing to high heterogeneity ( $I^2 = 75.5\%$ ), we conducted sensitivity analysis. After omitting the studies by Gasconet al. (anxiety),<sup>10</sup> Meade et al.,<sup>13</sup> and Perry et al. (depression)<sup>14</sup> as samples that were “left out”, the pooled results did not change substantially but the heterogeneity was significantly reduced (OR = 1.57, 95%CI: 1.47–1.66,  $I^2 = 0\%$ ,  $P = 0.0001$ ). Moreover, no change was shown in the

pooled results on depression and anxiety subgroup analysis (OR = 1.62, 95%CI: 1.45–1.81,  $I^2 = 6.1\%$ ,  $P < 0.0001$  and OR = 1.54, 95%CI: 1.43–1.66,  $I^2 = 0\%$ ,  $P < 0.0001$ , respectively).

**Association between UI and depression or anxiety, according to age.** We analyzed the relationship between UI and depression or anxiety by age subgroup among nine studies. The UI group had significantly higher levels of depression and anxiety than the group without UI (OR = 1.78, 95%CI: 1.54–2.05,  $I^2 = 68.1\%$ ,  $P < 0.0001$ ). Furthermore, in subgroup analysis by age, study participants over 60 years of age showed significantly higher depression or anxiety than their counterparts without UI (OR = 1.59, 95%CI: 1.29–1.95,  $I^2 = 59.1\%$ ,  $P < 0.0001$ ). Moreover, the subgroup under 60 years old also had significantly higher depression and anxiety levels than the non-UI subgroup (OR = 1.98, 95%CI: 1.62–2.43,  $I^2 = 75.5\%$ ,  $P < 0.0001$ ) (Figure 3). Owing to high heterogeneity ( $I^2 = 68.1\%$ ), we conducted sensitivity analysis. After removing the studies by Gasconet al. (anxiety),<sup>10</sup> Meade et al.,<sup>13</sup> and Hsu et al.<sup>11</sup> as samples that were “left out”, the pooled results did not change substantially but the heterogeneity was significantly reduced (OR = 1.70, 95%CI: 1.42–2.03,  $I^2 = 6.9\%$ ,  $P < 0.0001$ ). Moreover, no change were seen in the pooled results for age more or less than 60 years in subgroup analysis (OR = 1.81, 95%CI: 1.43–2.29,  $I^2 = 26.5\%$ ,  $P < 0.0001$  and OR = 1.56, 95%CI: 1.20–2.04,  $I^2 = 0\%$ ,  $P = 0.01$ , respectively). There were insufficient studies including subgroup analysis of UI according to sex.

### Sensitivity analysis and publication bias

According to funnel plot analysis, the UI- and depression/anxiety-related funnel plots were basically symmetrical, indicating low publication bias in this meta-analysis.



**Figure 1.** Flowchart of the records selection process in this meta-analysis.

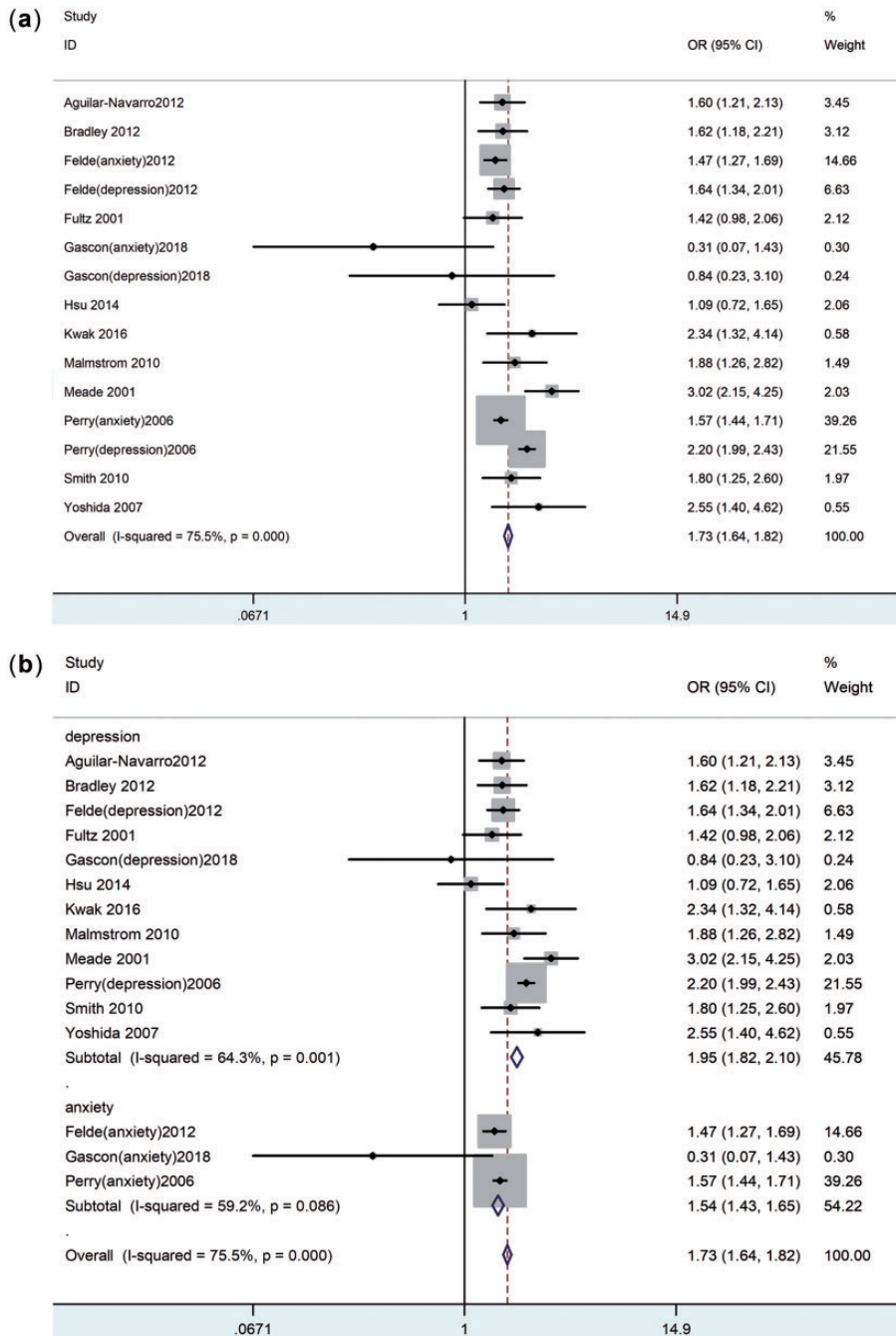
According to PRISMA template: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med* 6(7): e1000097. doi: 10.1371/journal.pmed.1000097.

However, because individual studies deviated from the confidence interval of the funnel plot, we further tested the funnel plot symmetry using Begg's test and Egger's test. The results showed that the correlation between UI and depression or anxiety was  $t = -0.41$ , and that for UI and depression or anxiety with age was  $t = -0.94$ . There was no significant

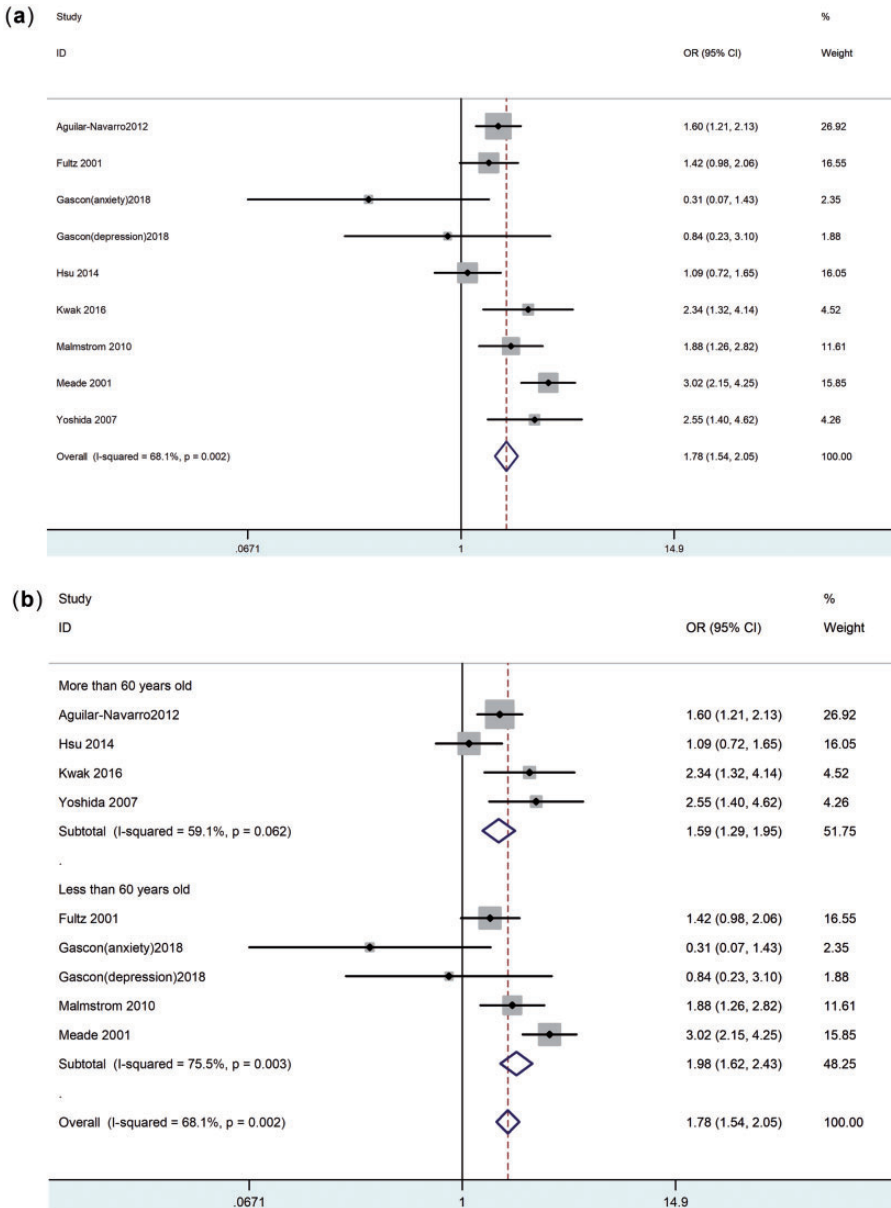
publication bias in each study, and the selected studies were well represented.

## Discussion

According to the definition of the International Continence Society (ICS), urinary incontinence (UI) refers to a condition in which urine involuntarily flows out of the



**Figure 2.** (a) Pooled estimate of the association of UI with risk of depression/anxiety (b) Pooled estimates of subgroup analysis on the association of UI with risk of depression/anxiety, according to depression or anxiety.



**Figure 3.** (a) Pooled estimate of the association of UI with risk of depression/anxiety, by age (b) Pooled estimates of subgroup analysis on the association of UI with risk of depression/anxiety, according to age.

urethra. This is usually owing to bladder sphincter injury or neurological dysfunction and loss of urinary control function.<sup>17</sup> According to the ICS, UI can be divided into three types: stress, urgency and

mixed.<sup>18</sup> UI was previously considered a physiological condition; UI was formally defined as a disease in 1998 and subsequently added to the International Classification of Diseases by the World Health



Organization.<sup>19</sup> Although it is a non-fatal disease, UI is accompanied by high levels of stress and embarrassment owing to smell and discomfort arising from urine leakage. Moreover, UI can occur rapidly and in large volumes, which seriously affects normal social interaction and leisure activities among affected individuals. This effect is not only physiological, it also has a great impact on the patient's psychological health.<sup>20</sup> For a long time, the lack of knowledge about UI has resulted in a low medical treatment rate, low patient compliance with behavioral training, and poor psychological status among those with UI.<sup>21,22</sup>

Melville et al.<sup>23</sup> studied an Italian population and found that the incidence of depression was 11% in people with UI and 7% in those without UI. Among patients who have not received hospital medical care for UI, the prevalence of depression and anxiety is higher than that reported in the general population.<sup>24</sup> In European and North American countries, UI has a high incidence among older adults, with one-third of older men and one-half of older women among those with this disease.<sup>17</sup> A study by Cagnacci et al.<sup>25</sup> confirmed that UI was positively associated with depression or anxiety in people age 50 to 60 years. A study of people with average age 65 years or older also found that UI is associated with depression and anxiety.<sup>26</sup> Shin et al.<sup>27</sup> conducted a survey regarding the relationship between UI and depression among people in their 70s in South Korea and found that UI was positively correlated with depression. However, the result of our meta-analysis showed that both depression and anxiety are higher in people with UI than in those without UI, regardless of age. The possible reason for this is that although 60 years was the cutoff to classify the two age subgroups, the median age of participants less than 60 years old was over age

50 years. When the sensitivity was removed, the P-value of the subgroup over 60 years old was much smaller than that of the subgroup under 60 years old (both  $P < 0.05$ ). This result still showed that depression and anxiety increase with age.

The quality of the included studies was evaluated with reference to the Newcastle–Ottawa scale (NOS), and the 12 selected studies were of high overall quality. Egger's regression and Begg's rank correlation tests both showed  $P > 0.05$ , suggesting no publication bias.

The meta-analysis has several limitations. First, the data review in this article was limited to English language. Second, the cohort studies included in the meta-analysis were small-scale studies, which may affect accuracy of the results. Third, to reduce or explain the high heterogeneity of the results, sensitivity and subgroup analysis were performed. Despite the subgroup analysis according to age for depression or anxiety, the number of articles included in some subgroups was very small. Because the number of articles included in this systematic review was limited, future studies including a larger number of articles is needed to verify our results. There is currently insufficient literature to perform subgroup analysis of depression and anxiety according to sex.

## Conclusion

In the present meta-analysis, individuals with UI showed significantly higher levels of depression and anxiety than those without UI. This held true regardless of age group (more or less than age 60 years). However, more high-quality studies that include larger sample sizes are needed to further validate our findings.

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### Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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