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The prevalence and risk factors of senile pruritus: a systematic review and meta-analysis

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Short Title: The prevalence and risk factors of senile pruritus: meta-analysis

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Abstract

Objectives: To systematically assess the prevalence and risk factors for SP in the elderly (≥ 60 years of age).

Design: A meta-analysis were used to pool the prevalence and risk factors for SP estimated from individual studies. Four subgroup analyses were conducted to explore the prevalence for SP in different age, sex, research sites and region.

Setting, participants and measures: Senile pruritus (SP) reduces quality of life in the elderly, yet the worldwide prevalence is unclear. Moreover, the risk factors for SP are controversial. Data from cross-sectional studies, case-control studies and cohort studies that reported the prevalence or the risk factors for SP were collected by searching nine electronic databases up to October 2020, including Web of Science, PubMed, Embase, Cochrane Library, CINAHL, CBM, CNKI, Wanfang and VIP. Two reviewers independently screened studies according to the inclusion and exclusion criteria, extracted data, and assessed methodological quality. Data analysis was performed using Stata 15.1 software.

Results: Seventeen studies involving 28,666 participants were included. The overall pooled prevalence of SP was 21.04% (95% confidence intervals (CI)*:* 11.37%-32.72%). In addition, the results showed that smoking, excessive drinking, and monophagism were possible risk factors for SP, with pooled odds ratios (ORs) of 1.26 (95% CI: 1.14-1.40), 25.03 (95% CI:18.28-34.25), and 1.22 (95% CI:1.12-1.33), respectively.

Conclusions: The overall prevalence of SP was high. Smoking, excessive drinking and monophagism were possible risk factors for SP.

Keywords: senile pruritus; prevalence; risk factors; systematic review; meta-analysis

Registration: PROSPERO registration number(CRD42019143295).

Strengths and limitations

- To our knowledge, this study is the first systematic review and meta-analysis providing comprehensive assessment on the prevalence of senile pruritus in worldwide.
- This study could potentially inform policy and practice to reduce the prevalence of senile pruritus.
- The definitions of SP differed across the included studies.

Introduction

The geriatric population (≥ 60 years of age) has been growing steadily worldwide in recent decades. It is estimated that the geriatric population will account for 20% of the world's population by the middle of this century[1-3]. Aging results in numerous adverse changes in the structure and function of multiple human organs, including the skin[4]. Senile pruritus (SP) is defined as generalized pruritus in patients without primary skin lesions[5-8]. Pruritus is the most common skin disorder in the geriatric population[9]. It can lead to an unpleasant cutaneous sensation, which provokes the desire to scratch (itchiness) and is accompanied by skin lesions, pain, and infection[10]. Furthermore, it can lead to adverse consequences for patients' psychological health and quality of life, including anxiety, depression, disruption of normal sleep patterns, and poor daytime concentration[10, 11]. Therefore, investigating the prevalence of SP is essential for informing policymakers, clinicians, and the general population.

The prevalence of SP has been reported around the world, ranging from 41% in Thailand[12], 40.6% in America[13], 18.9% in Italy[14], and 14.2% in China[15]. However, these studies were limited by sample size and regional differences, and therefore do not represent the prevalence of SP worldwide. Furthermore, several studies conducted surveys on inpatients or outpatients to report the prevalence of SP [1, 11, 16, 17]. Inpatients or outpatients do not represent the whole elderly population, making the results less representative of the actual prevalence of SP in the community. For these reasons, the precise prevalence and characteristics of the population are unknown worldwide. Furthermore, the risk factors for SP have been reported extensively, but with controversial conclusions[18, 19]. For example, Yang *et al*. indicated that smoking was associated with SP (odds ratio (OR) = 2.23, 95%CI:1.35-17.40) [18]. However, Chen *et al*. reported that smoking was not associated with SP (OR = 1.25, 95%CI: 0.99-1.35) [19].

In this study, we conducted a systematic review and meta-analysis to synthesize the prevalence of SP in different ages, sexes, and regions based on the general population and to evaluate the risk factors for SP.

Materials and Methods

Protocol registration

This study was conducted in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines[20] and has been prospectively registered in PROSPERO (registration number: CRD42019143295).

Search strategy

Nine databases were searched in this study, including Web of Science, PubMed, Embase, Cochrane Library, CINAHL, CBM, CNKI, Wanfang, and VIP. The following strategy was used in the searches: (Pruritus OR Itching) AND (Senile OR Aging OR Aged OR Geriatrics) AND (Incidence OR Epidemiology OR Prevalence OR Risk factors). All of the databases were searched from their inception dates to the 24th of October 2020. Additional relevant literature was included following a manual search of the included studies reference lists.

Inclusion and exclusion criteria

The inclusion criteria were as follows: (1) the study design was either cross-sectional, case-control or cohort; (2) participants were over 60 years of age; (3) exact diagnostic criteria for SP were provided; (4) prevalence or risk factors for SP were reported. The exclusion criteria were as follows: the study populations were inpatients and outpatients; the study had incomplete data; republished literature; or studies published in a language other than Chinese or English.

Quality of the studies

Two independent reviewers assessed the quality of the included studies according to 11 criteria recommended by the American agency for healthcare research and quality (AHRQ). The criteria included assessment of selection bias, performance bias, attrition bias, detection bias, and publication bias. An item would be scored "1" if it was answered "YES", and if it was answered 'NO' or 'UNCLEAR', then the item scored '0' [21], providing a maximum score of 11.

Data extraction

Study selection and data extraction were independently conducted by two reviewers. Any disagreement was resolved by discussion the two reviewers or a third reviewer. The articles were firstly screened by the title and abstract, and then full-text documents were reviewed for inclusion if they reported the prevalence and risk factors for SP. By using a standardized and pilot-tested form, two reviewers independently extracted data from eligible studies, including the title, first author name, publication year, study location, age, sample size, diagnostic criteria, prevalence and risk factors for SP.

Data analysis

Double arcsine transformation was used to convert the prevalence of SP. The ORs with their corresponding 95% CIs were selected to assess the effect size of risk factors for SP. Heterogeneity among studies was tested by Cochrane's *Q* and I^2 statistics. Heterogeneity was recognized as significant when I^2 >50%. A Fixed- effect model (Mantel and Haenszel method) was used if $I^2 \leq 50\%$, otherwise a random-effects model (DerSimonian and Laird method) was used[22]. Forest plots were constructed for a visual display of the pooled results if necessary. Four subgroup analyses were conducted to explore the prevalence for SP in different age, sex, research sites and region. Sensitivity analysis were assessed by excluding single studies. Publication bias was assessed by using Begg's and Egger's tests[23]. Tests of Publication bias and sensitivity analysis were not conducted in the risk factor analysis section due to the limited number of studies included. Statistical analyses were conducted using STATA 15.1 (Stata Corp LP, College Station, TX).

Results

Study Description

A total of 8,518 records were identified from the nine databases, of which 647 were duplicates. After screening titles and abstracts, 7,740 records were excluded. Full-text documents of 131 records were screened, 114 studies were excluded, with the remaining 17 studies included in the meta-analysis (Figure 1).

Characteristics of the included studies

The characteristics of the seventeen studies are summarized in Table 1. Eleven articles were written in Chinese[18, 19, 24-32], and six were written in English [33-38]. Thirteen studies were conducted in Asia[18, 19, 24-32, 34, 36] and four in Europe [33, 35, 37, 38]. Sample sizes ranged from 45[38] to 8,252 [35]. Four of the seventeen studies reported the risk factors for SP [18, 19, 25, 32].

Table 1. Characteristics of included studies.

Authors	Publication Years	Study area	Diagnostic criteria	Sample size	Prevalence(%)	Risk factors
Dalgard et al.[33]	2004	Norway	①	3876	6.91	NA
Li et al.[24]	2000	China	NA	534	12.36	NA
Xue et al. [26]	2008	China	NA	311	19.29	NA
Ni et al.[27]	2012	China	④	426	5.63	NA
Zhang et al.[28]	2012	China	NA	1283	9.90	NA
Li et al.[29]	2014	China	⑤	500	33.40	NA
Wu et al.[30]	2014	China	⑤	1286	42.38	NA
Yang et al.[31]	2014	China	NA	5000	33.84	NA
Tseng et al.[34]	2014	China	NA	313	7.35	NA
Miller et al.[35]	2016	Denmark	①	8252	6.31	NA
Kara et al.[36]	2017	Turkey	NA	105	19.05	NA
Cowdell et al.[37]	2017	Britain	⑥	1116	9.32	NA
Dyhre et al.[38]	2019	Denmark	⑦	45	28.89	NA
Ge et al.[25]	2006	China	②	1236	66.91	Age; xerosis; Astriction
Yang et al.[18]	2009	China	③	3785	61.98	Less water intake; Bathing with soap; Baths too much; Smoking; Malignant tumor;
Chen et al.[19]	2015	China	④	200	10.50	Bathing with soap; Smoking; Chronic illness; Excessive drinking; Monophagism; Insomnia; Contact with animal
Hou et al.[32]	2016	China	④	398	18.09	Smoking; Chronic illness; Excessive drinking; Monophagism; Insomnia; Contact with animal

NA: not available. Diagnostic criteria: ① Self-reported skin complaints scale ; ② participants ≥60 years, an itch lasting more than 2 weeks, Pruritus of whole body or multiple parts, no primary rash, no other pruritic skin disease, no obvious liver and kidney damage, diabetes and mental disease. ③ Dermatology and Venereology; ④ Clinical Dermatology; ⑤Dermatovenerolog; ⑥ Self-report skin diseases scale[37]; ⑦ Self-report skin diseases scale.

Risk of Bias Assessment

Results of the risk of bias assessment are listed in Table S1. Study quality was found to be moderate in 11 studies and high in the other six studies[39].

Prevalence of SP

Seventeen studies, involving 28,666 participants reported the prevalence of SP, ranging from 5.63% to 66.91%. A random-effects model-based meta-analysis showed that the pooled prevalence of SP was 21.04% (95% *CI:* 11.37%-32.72%). Subgroup analyses indicated that the pooled prevalence of SP for people aged 60-69, 70-79, 80-89, and ≥90 years old were 11.98% (95% *CI :*3.91%- 23.62%), 26.79% (95% *CI :* 8.71%- 50.36%), 51.31% (95% *CI:* 47.20%- 96.33%) and 57.53% (95% *CI :* 8.18%-n98.09%), respectively. The pooled prevalence of SP was 8.26% (95% *CI:* 5.88%-11.00%) in females and 18.65% (95% *CI:* 0.83%- 51.61%) in males. The pooled prevalence of SP in health examination centers, nursing homes and communities was 43.83% (95% *CI:* 19.39%- 69.94%), 16.26% (95% *CI:* (4.55%, 33.29%) and 12.21% (95% *CI:* 3.46%- 25.34%), respectively. The pooled prevalence of SP in Turkey and China was 24.34% (95% *CI:* 14.03%- 36.38%). The pooled prevalence of SP in Norway, Denmark and Britain was 8.23% (95% *CI:* 6.36%- 10.35%). The results of subgroup analyses of age, sex, research site and region are shown in Table 2.

Table 2. Subgroup analyses by age, sex, research sites and region.

Subgroup	Prevalence (%)	*95%CI* (%)	Heterogeneity	
			I^2 (%)	*P* value
Age				
60-69	11.98	3.91-23.62	98.1	0.000
70-79	26.79	8.71-50.36	99.7	0.000
80-89	51.31	47.20-96.33	99.6	0.000
≥90	57.53	8.18-98.09	99.0	0.000
Sex				
Females	8.26	5.88-11.00	87.4	0.000
Males	18.65	0.83-51.61	99.9	0.000
Research sites				
Health examination center	43.83	19.39-69.94	99.8	0.000
Nursing homes	16.26	4.55-33.29	93.2	0.000
Community	12.21	3.46-25.34	99.8	0.000
Region				
Turkey, China	24.34%	14.03-36.38%	99.6%	0.000
Norway, Denmark, Britain	8.23%	6.36-10.35%	90.2%	0.000

Risk factors

Four studies, including 5,619 participants, reported the risk factors for SP [18, 19, 25, 32]. There were three studies[18, 19, 32], including 4,383 participants, that reported the association of smoking and SP. Meta-analyses showed smoking was associated with SP [pooled OR of 1.26 (95% *CI :* 1.14-1.40), I^2=0%]. The results of two studies[19, 32], involving 598 participants, suggested that excessive drinking increased the occurrence of SP [pooled OR of 25.03 (95% CI:18.28- 34.25), I^2=0%]. Two studies[19, 32] involving 589 participants reported the association of Monophagism and SP [pooled OR of 1.22 (95% *CI :* 1.12-1.33), I^2=0%] (Table 3).

Tab.3 Pooled risk factors of senile pruritus.

No.	Risk factors	*OR*	*95%CI*	*P*	Heterogeneity	
					I^2 (%)	*P* value
1	smoking	1.26	1.14 - 1.40	0.000	0%	0.673
2	excessive drinking	25.03	18.28 - 34.25	0.000	0%	0.980
3	monophagism	1.22	1.12 -1.33	0.000	0%	0.926

Sensitivity Analysis

Sensitivity analysis was performed by excluding a single study and showed that the results of the meta-analysis were stable (18.61%- 22.23%). Sensitivity analysis was not conducted for the risk factor analysis due to the limited number of studies.

Publication Bias

Publication bias was assessed by using Begg's and Egger's tests. Begg's (Z=0.70, P=0.484) and Egger's test (t=0.26, P=0.796) results showed that the possibility of publication bias was less in the overall prevalence pooled analysis. Publication bias was not assessed in the risk factor analysis due to the limited number of studies.

Discussion

In this study, 17 studies involving 28,666 participants were included encompassing Norway, China, Denmark, Turkey, and Britain.

Subgroup analyses found that the difference in the prevalence of SP based on epidemiological factors. Subgroup analyses indicated that a steadily increasing prevalence of SP was associated with increasing age. Xerosis is related to aging and is reported as the most common cause of SP[40-42]. One of the skin's most important functions is to retain water. skin surface

lipids and sebum on the skin helps retain water[43]. As skin ages, there is a decrease in lipids and sebum on the skin, leading to suboptimal moisture retention[41]. In addition, immunosenescence occurs with aging and also produces a higher incidence of pruritus[41]. Moreover, decreases in androgen, estrogen and glucocorticoid in aged people can contribute to SP[44, 45].

The results of sub-sex and sub-regional analyses found that individuals who were male or living in Turkey and China were associated with a higher prevalence of SP. Sub-research sites analyses found that the highest prevalence of SP was found in health examination centers. The reasons for these results are unclear based on the current scientific knowledge available on SP prevalence. Further studies would be helpful in further exploring these phenomena. In conclusion, the prevalence of SP varies among different populations. However, the reasons underlying the differences in prevalence observed in the current study remain unclear. It is suggested that further studies of the prevalence of SP in different populations be conducted in the future.

Meta-analyses showed that smoking, excessive drinking, and monophagism were possible risk factors for SP. It has been shown that smoking can cause nutrient and oxygen deprivation in cutaneous tissues, decreases collagen and elastin fibers in the dermis, and increases keratinocyte dysplasia[46]. These changes reduce skin lipids, sebum, and moisture retention, leading to dryness and pruritus of skin[47, 48]. Therefore, smoking is a potential risk factor for SP. The present study also identified drinking alcohol as a potential risk factor for SP. Studies have demonstrated that alcohol consumption could reduce the concentration of carotenoids

in the skin[49]. Carotenoids can neutralize free radicals, delay premature skin aging and skin diseases caused by free radicals[49-51]. It could be proposed that alcohol consumption may lead to skin diseases by affecting the concentration of carotenoids. The human body cannot synthesize carotenoids in sufficient amounts without relying on a nutrient rich diet including fruit and vegetables. Therefore, monophagism could contribute to reducing the concentration of carotenoids and it could be considered a risk factors for skin diseases.

Although the present study indicated smoking, excessive drinking and monophagism were associated with an increased risk of SP, all the studies included in the meta-analysis were cross-sectional. Consequently, It is not possible to infer on the causality between exposure and outcomes. Further studies are needed to confirm these findings. In addition to the three risk factors identified through the meta-analyses, the included studies also showed that the risk factors for SP also include age, xerosis, astriction, less water intake, bathing with soap, bathing too frequently, malignant tumor, chronic illness, excessive drinking, insomnia, and contact with animals.

To the best of our knowledge, this study is the first to provide a systematic review of SP prevalence and risk factors. However, several limitations of this study should be noted. First, The epidemiological data on SP was only from Norway, China, Denmark, Turkey, Britain, and Denmark, which cannot be generalized to the worldwide population. Second, the methods of identifying SP varied among the included studies, and no diagnostic assessment was performed in some studies, making it difficult to analyze the prevalence of SP using a gold

standard method. Considering these limitations, further studies will be needed to better understand the prevalence and risk factors of SP worldwide.

Conclusion

In conclusion, this study found the prevalence of SP was 21.04%. Individuals who were older, male, or living in Turkey and China were associated with a higher prevalence of SP. Additionally, among health examination centers, nursing homes and communities, the highest detection rate of SP was found in the health examination centers. Smoking, excessive drinking and monophagism were possible individual risk factors for SP.

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Footnotes

Author Statement

Contributions: Shi Chen and Fa-quan Zhou contributed equally to this study. Shi Chen conceived and participated in the design of this review. Shi Chen and Fa-quan Zhou performed the literature searches, study selection, data extraction, and assessed the risk of bias. Shi Chen and Fa-quan Zhou drafted the manuscript. Yi-quan Xiong helped in performing the analysis with constructive discussions. Shi Chen revised the final version. All authors read and approved the final manuscript.

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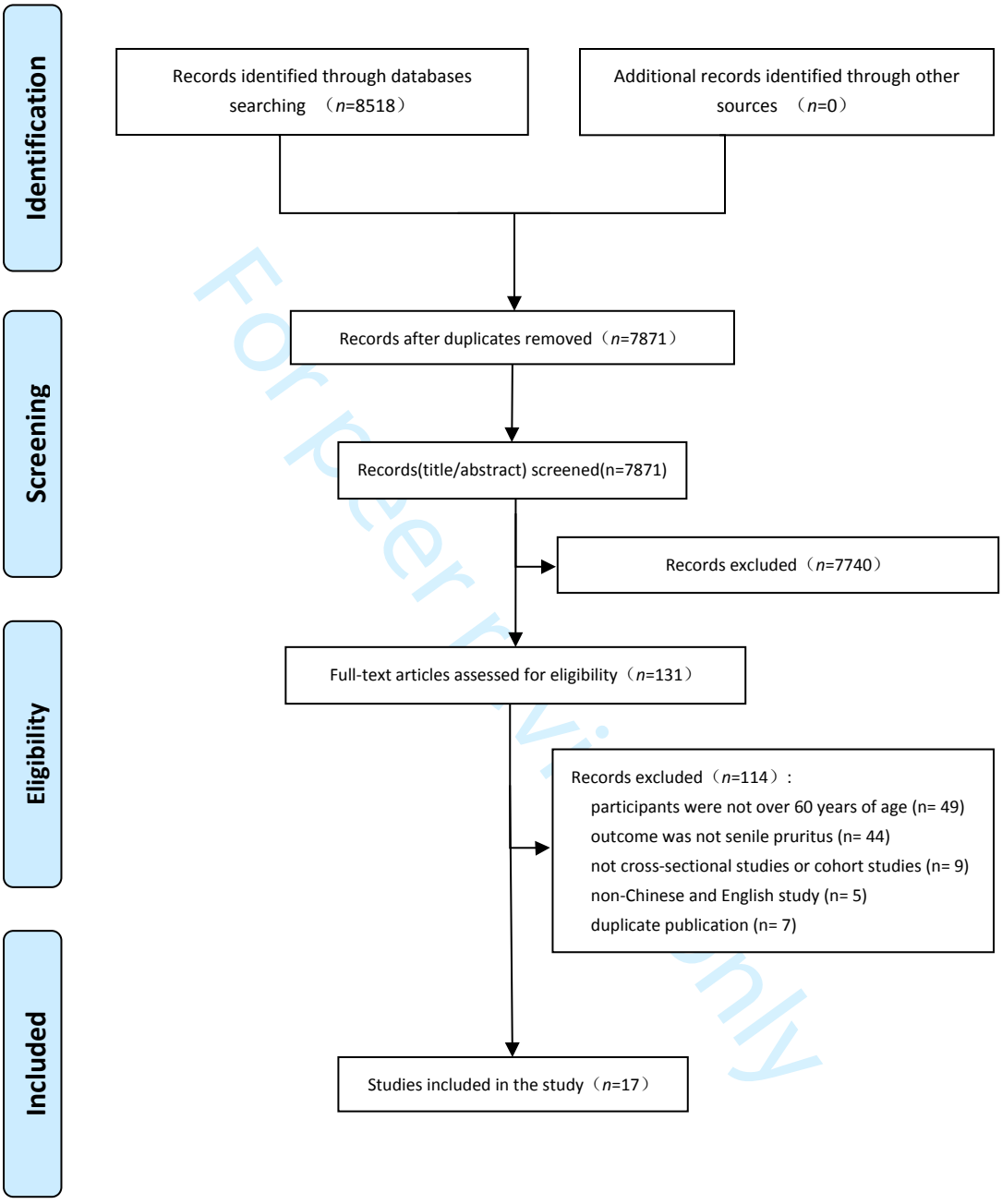
Data availability statement: All data relevant to the study are included in the article or uploaded as supplementary information.

Figure

Figure 1. Flowchart of the study selection process.



Supplementary table caption

Tab.S1 Risk of bias assessment for studies included.

Study	1	2	3	4	5	6	7	8	9	10	11	Total score
Li et al.[24]	Y	N	Y	Y	U	Y	N	Y	N	N	N	5
Dalgard et al.[33]	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	N	8
Ge et al.[25]	Y	Y	Y	Y	U	Y	Y	Y	N	Y	N	8
Xue et al. [26]	Y	N	N	Y	U	Y	Y	N	N	Y	N	5
Yang et al.[18]	Y	Y	Y	Y	U	Y	Y	Y	N	Y	N	8
Ni et al.[27]	Y	Y	Y	Y	U	Y	N	N	N	Y	N	6
Zhang et al.[28]	Y	Y	Y	Y	U	Y	N	N	N	Y	N	6
Li et al.[29]	Y	Y	N	Y	U	Y	N	N	N	Y	N	5
Wu et al.[30]	Y	Y	Y	Y	U	Y	N	N	N	Y	N	6
Yang et al.[31]	Y	Y	Y	Y	U	Y	Y	Y	N	Y	N	8
Tseng et al.[34]	Y	N	Y	Y	U	Y	Y	Y	N	Y	Y	7
Chen et al.[19]	Y	Y	Y	Y	U	Y	Y	N	N	Y	N	7
Hou et al.[32]	Y	Y	Y	Y	U	Y	Y	N	N	Y	N	7
Miller et al.[35]	Y	Y	Y	Y	U	Y	Y	Y	N	Y	N	8
Kara et al.[36]	Y	Y	Y	Y	U	Y	Y	N	N	Y	N	7
Cowdell et al.[37]	Y	Y	Y	Y	U	Y	Y	N	N	Y	N	7
Dyhre et al.[38]	Y	Y	Y	Y	U	Y	Y	N	Y	Y	N	8

Y=YES; N= NO; U=Unclear; Score of Item (point): 1. Define the source of information (survey, record review); 2. List inclusion and exclusion criteria for exposed and unexposed subjects (cases and controls) or refer to previous publications; 3. Indicate time period used for identifying patients; 4. Indicate whether or not subjects were consecutive if not population-based; 5. Indicate if evaluators of subjective components of study were masked to other aspects of the status of the participants; 6. Describe any assessments undertaken for quality assurance purposes (e.g., test/retest of primary outcome measurements); 7. Explain any patient exclusions from analysis; 8. Describe how confounding was assessed and/or controlled; 9. If applicable, explain how missing data were handled in the analysis; 10. Summarize patient response rates and completeness of data collection; 11. Clarify what follow-up, if any, was expected and the percentage of patients for which incomplete data or follow-up was obtained.

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1-2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3-4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	3-4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	6
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	6

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	6
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	6
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	7-8
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	8
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	9-11
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	9-11
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	11
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	11
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	11-13
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	13-14
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	14
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	19

From: 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(6): e1000097. doi:10.1371/journal.pmed1000097

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The prevalence and risk factors of senile pruritus: a systematic review and meta-analysis

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Short Title: The prevalence and risk factors of senile pruritus: meta-analysis

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Abstract

Objectives: To systematically assess the prevalence and risk factors for Senile pruritus (SP) in the elderly (≥ 60 years of age).

Design: A meta-analysis were used to pool the prevalence and risk factors for SP estimated from individual studies. Four subgroup analyses were conducted to explore the prevalence for SP in different age, sex, research sites and region.

Setting, participants and measures: SP reduces quality of life in the elderly, yet the worldwide prevalence is unclear. Moreover, the risk factors for SP are controversial. Data from cross-sectional studies, case-control studies, longitudinal studies and cohort studies that reported the prevalence or the risk factors for SP were collected by searching nine electronic databases up to October 2020, including Web of Science, PubMed, Embase, Cochrane Library, CINAHL, CBM, CNKI, Wanfang and VIP. Two reviewers independently screened studies according to the inclusion and exclusion criteria, extracted data, and assessed methodological quality. Data analysis was performed using Stata 15.1 software.

Results: Seventeen studies involving 28,666 participants were included. The overall pooled prevalence of SP was 21.04% (95% confidence intervals [CI]*:* 11.37%-32.72%). In addition, the results showed that smoking, excessive drinking, and monophagism were possible risk factors for SP, with pooled odds ratios (ORs) of 1.26 (95% CI: 1.14-1.40), 25.03 (95% CI:18.28-34.25), and 1.22 (95% CI:1.12-1.33), respectively.

Conclusions: The overall prevalence of SP was high. Smoking, excessive drinking and monophagism were possible risk factors for SP.

Keywords: senile pruritus; prevalence; risk factors; systematic review; meta-analysis

Registration: PROSPERO registration number(CRD42019143295).

Strengths and limitations

- To our knowledge, this study is the first systematic review and meta-analysis providing comprehensive assessment on the prevalence of senile pruritus in worldwide.
- The risk factors of senile pruritus are evaluated.
- This systematic review and meta-analysis, covering 5 different countries, was composed of 17 studies, with 28,666 participants were included.
- The definitions of SP differed across the included studies.

Introduction

The geriatric population (≥ 60 years of age) has been growing steadily worldwide in recent decades. It is estimated that the geriatric population will account for 20% of the world's population by the middle of this century[1-3]. Aging results in numerous adverse changes in the structure and function of multiple human organs, including the skin[4]. Senile pruritus (SP) is defined as generalized pruritus in patients without primary skin lesions[5-8]. Pruritus is the most common skin disorder in the geriatric population[9]. It can lead to an unpleasant cutaneous sensation, which provokes the desire to scratch (itchiness) and is accompanied by skin lesions, pain, and infection[10]. Furthermore, it can lead to adverse consequences for patients' psychological health and quality of life, including anxiety, depression, disruption of normal sleep patterns, and poor daytime concentration[10, 11]. Therefore, investigating the prevalence of SP is essential for informing policymakers, clinicians, and the general population.

The prevalence of SP has been reported around the world, ranging from 41% in Thailand[12], 40.6% in America[13], 18.9% in Italy[14], and 14.2% in China[15]. However, these studies were limited by sample size and regional differences, and therefore do not represent the prevalence of SP worldwide. Furthermore, several studies conducted surveys on inpatients or outpatients to report the prevalence of SP [1, 11, 16, 17]. Inpatients or outpatients do not represent the whole elderly population, making the results less representative of the actual prevalence of SP in the community. For these reasons, the precise prevalence and characteristics of the population are unknown worldwide. Furthermore, the risk factors for SP have been reported extensively, but with controversial conclusions[18, 19]. For example, Yang *et al*. indicated that

smoking was associated with SP (odds ratio (OR) = 2.23, 95%CI:1.35-17.40) [18]. However, Chen *et al*. reported that smoking was not associated with SP (OR = 1.25, 95%CI: 0.99-1.35) [19].

In this study, we conducted a systematic review and meta-analysis to synthesize the prevalence of SP in different ages, sexes, and regions based on the general population and to evaluate the risk factors for SP.

Materials and Methods

Protocol registration

This study was reported in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines[20] and has been prospectively registered in PROSPERO (registration number: CRD42019143295).

Search strategy

Nine databases were searched in this study, including Web of Science, PubMed, Embase, Cochrane Library, CINAHL, CBM, CNKI, Wanfang, and VIP. The following strategy was used in the searches: (Pruritus OR Itching) AND (Senile OR Aging OR Aged OR Geriatrics) AND (Incidence OR Epidemiology OR Prevalence OR Risk factors). Complete details of the search strategy are available in supplementary table S1. All of the databases were searched from their inception dates to the 24th of October 2020. Additional relevant literature was included following a manual search of the included studies reference lists.

Inclusion and exclusion criteria

The inclusion criteria were as follows: (1) the study design was either cross-sectional study, case-control study, cohort study or longitudinal study; (2) participants were greater than or

equal to 60 years of age; (3) exact diagnostic criteria for SP were provided; (4) prevalence or risk factors for SP were reported. The exclusion criteria were as follows: (1) the study populations were inpatients and outpatients; (2) the prevalence or risk factor effect value (mainly referred to as OR in this study) of SP wasn't clearly reported in the original study, and the data provided by the original study couldn't calculate the prevalence or risk factor effect value of SP; (3) republished literature; (4) or studies published in a language other than Chinese or English.

Quality of the studies

Two independent reviewers assessed the quality of the included studies according to 11 criteria recommended by the American agency for healthcare research and quality (AHRQ). The criteria included assessment of selection bias, performance bias, attrition bias, detection bias, and publication bias. An item would be scored "1" if it was answered "YES", and if it was answered 'NO' or 'UNCLEAR', then the item scored '0' [21], providing a maximum score of 11.

Data extraction

Study selection and data extraction were independently conducted by two reviewers. Any disagreement was resolved by discussion the two reviewers or a third reviewer. The articles were firstly screened by the title and abstract, and then full-text documents were reviewed for inclusion if they reported the prevalence and risk factors for SP. By using a standardized and pilot-tested form, two reviewers independently extracted data from eligible studies, including the title, first author name, publication year, study location, age, sample size, diagnostic criteria, prevalence and risk factors for SP.

Data analysis

Double arcsine transformation was used to convert the prevalence of SP so that the data can follow an approximately normal distribution[22]. The ORs with their corresponding 95% CIs were selected to assess the effect size of risk factors for SP. Heterogeneity among studies was tested by Cochrane's *Q* and I^2 statistics. Heterogeneity was recognized as significant when I^2 >50%. A Fixed- effect model (Mantel and Haenszel method) was used if $I^2 \leq 50\%$, otherwise a random-effects model (DerSimonian and Laird method) was used[23]. Forest plots were constructed for a visual display of the pooled results if necessary. Four subgroup analyses were conducted to explore the prevalence for SP in different age, sex, research sites and region. Sensitivity analysis were assessed by excluding single studies. Publication bias was assessed by using Begg's and Egger's tests[24]. Tests of Publication bias and sensitivity analysis were not conducted in the risk factor analysis section due to the limited number of studies included. Statistical analyses were conducted using STATA 15.1 (Stata Corp LP, College Station, TX).

Results

Study Description

A total of 8,518 records were identified from the nine databases, of which 647 were duplicates. After screening titles and abstracts, 7,740 records were excluded with reasons of age, outcome, study design. Full-text documents of 131 records were screened, and 114 studies were excluded with reasons listed as follows: participants were not ≥ 60 years of age (n= 49), outcome was not senile pruritus (n= 44), not cross-sectional, case-control, cohort or

longitudinal study (n= 9), non-Chinese and English study (n= 5), duplicate publication (n= 7). In summary, 17 studies were eligible and included in the meta-analysis finally (Figure 1).

Characteristics of the included studies

The characteristics of the seventeen studies are summarized in Table 1. Eleven articles were written in Chinese[18, 19, 25-33], and six were written in English [34-39]. Thirteen studies were conducted in Asia[18, 19, 25-33, 35, 37] and four in Europe [34, 36, 38, 39]. Sample sizes ranged from 45[39] to 8,252 [36]. Four of the seventeen studies reported the risk factors for SP [18, 19, 26, 33].

Table 1. Characteristics of included studies.

Authors	Publication Years	Study area	Diagnostic criteria	Sample size	Prevalence(%)	Risk factors
Dalgard et al.[34]	2004	Norway	①	3876	6.91	NA
Li et al.[25]	2000	China	NA	534	12.36	NA
Xue et al. [27]	2008	China	NA	311	19.29	NA
Ni et al.[28]	2012	China	④	426	5.63	NA
Zhang et al.[29]	2012	China	NA	1283	9.90	NA
Li et al.[30]	2014	China	⑤	500	33.40	NA
Wu et al.[31]	2014	China	⑤	1286	42.38	NA
Yang et al.[32]	2014	China	NA	5000	33.84	NA
Tseng et al.[35]	2014	China	NA	313	7.35	NA
Miller et al.[36]	2016	Denmark	①	8252	6.31	NA
Kara et al.[37]	2017	Turkey	NA	105	19.05	NA
Cowdell et al.[38]	2017	Britain	⑥	1116	9.32	NA
Dyhre et al.[39]	2019	Denmark	⑦	45	28.89	NA
Ge et al.[26]	2006	China	②	1236	66.91	Age; xerosis; Astriction
Yang et al.[18]	2009	China	③	3785	61.98	Less water intake; Bathing with soap; Baths too much; Smoking; Malignant tumor;
Chen et al.[19]	2015	China	④	200	10.50	Bathing with soap; Smoking; Chronic illness; Excessive drinking; Monophagism; Insomnia; Contact with animal
Hou et al.[33]	2016	China	④	398	18.09	Smoking; Chronic illness; Excessive drinking; Monophagism; Insomnia; Contact with animal

NA: not available. Diagnostic criteria: ① Self-reported skin complaints scale ; ② participants ≥60 years, an itch lasting more than 2 weeks, Pruritus of whole body or multiple parts, no primary rash, no other pruritic skin disease, no obvious liver and kidney damage, diabetes and mental disease. ③ Dermatology and Venereology; ④ Clinical Dermatology; ⑤Dermatovenerolog; ⑥ Self-report skin diseases scale[38]; ⑦ Self-report skin diseases scale.

Risk of Bias Assessment

Results of the risk of bias assessment are listed in supplementary table S2. Higher scores indicative of less bias and more quality. Article quality was assessed as follows: 0 to 3 indicates a low quality, 4 to 7 indicates a moderate quality, and 8 to 11 indicates a high quality[40]. Study quality was found to be moderate in 11 studies and high in the other six studies.

Prevalence of SP

Seventeen studies, involving 28,666 participants reported the prevalence of SP, ranging from 5.63% to 66.91%. A random-effects model-based meta-analysis showed that the pooled prevalence of SP was 21.04% (95% *CI:* 11.37%-32.72%). Subgroup analyses indicated that the pooled prevalence of SP for people aged 60-69, 70-79, 80-89, and ≥90 years old were 11.98% (95% *CI :*3.91%- 23.62%), 26.79% (95% *CI:* 8.71%- 50.36%), 51.31% (95% *CI:* 47.20%- 96.33%) and 57.53% (95% *CI:* 8.18%-n98.09%), respectively. The pooled prevalence of SP was 8.26% (95% *CI:* 5.88%-11.00%) in females and 18.65% (95% *CI:* 0.83%- 51.61%) in males. The pooled prevalence of SP in health examination centers, nursing homes and communities was 43.83% (95% *CI:* 19.39%- 69.94%), 16.26% (95% *CI:* (4.55%, 33.29%) and 12.21% (95% *CI:* 3.46%- 25.34%), respectively. The pooled prevalence of SP in Turkey and China was 24.34% (95% *CI:* 14.03%- 36.38%). The pooled prevalence of SP in Norway, Denmark and Britain was 8.23% (95% *CI:* 6.36%- 10.35%). The results of subgroup analyses of age, sex, research site and region are shown in Table 2.

Table 2. Subgroup analyses by age, sex, research sites and region.

Subgroup	Prevalence (%)	*95%CI* (%)	Heterogeneity	
			I^2 (%)	*P* value
Age				
60-69	11.98	3.91-23.62	98.1	0.000
70-79	26.79	8.71-50.36	99.7	0.000
80-89	51.31	47.20-96.33	99.6	0.000
≥90	57.53	8.18-98.09	99.0	0.000
Sex				
Females	8.26	5.88-11.00	87.4	0.000
Males	18.65	0.83-51.61	99.9	0.000
Research sites				
Health examination center	43.83	19.39-69.94	99.8	0.000
Nursing homes	16.26	4.55-33.29	93.2	0.000
Community	12.21	3.46-25.34	99.8	0.000
Region				
Turkey, China	24.34%	14.03-36.38%	99.6%	0.000
Norway, Denmark, Britain	8.23%	6.36-10.35%	90.2%	0.000

Risk factors

Four studies, including 5,619 participants, reported the risk factors for SP [18, 19, 26, 33]. There were three studies[18, 19, 33], including 4,383 participants, that reported the association of smoking and SP. Meta-analyses showed smoking was associated with SP [pooled OR of 1.26 (95% *CI:* 1.14-1.40), I^2=0%]. The results of two studies[19, 33], involving 598 participants, suggested that excessive drinking increased the occurrence of SP [pooled OR of 25.03 (95% CI:18.28- 34.25), I^2=0%]. Two studies[19, 33] involving 589 participants reported the association of Monophagism and SP [pooled OR of 1.22 (95% *CI:* 1.12-1.33), I^2=0%] (Table 3).

Tab.3 Pooled risk factors of senile pruritus.

No.	Risk factors	*OR*	*95%CI*	*P*	Heterogeneity	
					I^2 (%)	*P* value
1	smoking	1.26	1.14 - 1.40	0.000	0%	0.673
2	excessive drinking	25.03	18.28 - 34.25	0.000	0%	0.980
3	monophagism	1.22	1.12 -1.33	0.000	0%	0.926

Sensitivity Analysis

Sensitivity analysis was performed by excluding a single study and showed that the results of the meta-analysis were stable (18.61%- 22.23%). Sensitivity analysis was not conducted for the risk factor analysis due to the limited number of studies.

Publication Bias

Publication bias was assessed by using Begg's and Egger's tests. Begg's (Z=0.70, P=0.484) and Egger's test (t=0.26, P=0.796) results showed that the possibility of publication bias was less in the overall prevalence pooled analysis. Publication bias was not assessed in the risk factor analysis due to the limited number of studies.

Discussion

In this study, 17 studies involving 28,666 participants were included encompassing Norway, China, Denmark, Turkey, and Britain. Subgroup analyses found that the difference in the prevalence of SP based on epidemiological factors. Subgroup analyses indicated that a steadily increasing prevalence of SP was associated with increasing age. Xerosis is related to aging and is reported as the most common cause of SP[41-43]. One of the skin's most important functions is to retain water. skin surface lipids and sebum on the skin helps retain water[44]. As skin ages,

there is a decrease in lipids and sebum on the skin, leading to suboptimal moisture retention[42]. It was reported that pruritus can also be secondary to diabetes, kidney disease, liver disease, etc[44, 45]. Furthermore, pruritus is commonly listed as a medication complication[46], including angiotensin-converting enzyme inhibitors, salicylates, chloro-quine, and calcium channel blockers[44]. However, elderly people have more basic diseases and complex medication, which also contributed to the higher incidence of pruritus. Another view is that SP is probably a subclinical neuropathy, degenerative change in peripheral nerve endings may be attributable to age. This age alteration can cause pruritus without specific stimuli[7]. In addition, immunosenescence occurs with aging and also produces a higher incidence of pruritus[42]. Moreover, decreases in androgen, estrogen and glucocorticoid in aged people can contribute to SP[47, 48]. All these factors will increase the prevalence of SP with age.

The results of sub-regional analyses found that individuals who were living in Turkey and China were associated with a higher prevalence of SP. Pruritus is influenced by multiple factors, such as genetic, biological, psychological, social, environmental and cultural factors[49]. Different countries vary in society, culture, and environment, genetic, biological, and psychological factors also differ among populations in different countries. Therefore, the different prevalence among countries is related to the above factors.

The results of sub-sex found that the prevalence of male is higher. Sub-research sites analyses found that the highest prevalence of SP was found in health examination centers. The reasons for these results are unclear based on the current scientific knowledge available on SP

prevalence. Further studies would be helpful in further exploring these phenomena. In conclusion, the prevalence of SP varies among different populations. However, the reasons underlying the differences in prevalence observed in the current study remain unclear. It is suggested that further studies of the prevalence of SP in different populations be conducted in the future.

Meta-analyses showed that smoking, excessive drinking, and monophagism were possible risk factors for SP. It has been shown that smoking can cause nutrient and oxygen deprivation in cutaneous tissues, decreases collagen and elastin fibers in the dermis, and increases keratinocyte dysplasia[50]. These changes reduce skin lipids, sebum, and moisture retention, leading to dryness and pruritus of skin[51, 52]. Therefore, smoking is a potential risk factor for SP. The present study also identified drinking alcohol as a potential risk factor for SP. Studies have demonstrated that alcohol consumption could reduce the concentration of carotenoids in the skin[53]. Carotenoids can neutralize free radicals, delay premature skin aging and skin diseases caused by free radicals[53-55]. It could be proposed that alcohol consumption may lead to skin diseases by affecting the concentration of carotenoids. The human body cannot synthesize carotenoids in sufficient amounts without relying on a nutrient rich diet including fruit and vegetables. Therefore, monophagism could contribute to reducing the concentration of carotenoids and it could be considered a risk factors for skin diseases. Regrettably, the specific types of monophagism wasn't pointed out in the included study, which prevented further analysis and discussion. We expect that follow-up studies will explore and investigate

this. In addition, point out the participants' dietary structure and specific types of monophagism.

Although the present study indicated smoking, excessive drinking and monophagism were associated with an increased risk of SP, all the studies included in the meta-analysis were cross-sectional. Consequently, It is not possible to infer on the causality between exposure and outcomes. Further studies are needed to confirm these findings. In addition to the three risk factors identified through the meta-analyses, the included studies also showed that the risk factors for SP also include age, xerosis, astriction, less water intake, bathing with soap, bathing too frequently, malignant tumor, chronic illness, excessive drinking, insomnia, and contact with animals.

To the best of our knowledge, this study is the first to provide a systematic review of SP prevalence and risk factors. However, several limitations of this study should be noted. First, The epidemiological data on SP was only from Norway, China, Turkey, Britain, and Denmark, which cannot be generalized to the worldwide population. Second, the methods of identifying SP varied among the included studies, the definitions of SP may not be uniform among investigators and researchers in different countries, the study of different countries may not be unified in assessing the prevalence of SP, making it difficult to analyze the prevalence of SP using a gold standard method. These limitations make we less confident that the final estimate is close to a "true" estimate. Considering these limitations, further studies will be needed to better understand the prevalence and risk factors of SP worldwide.

Conclusion

In conclusion, this study found the prevalence of SP was 21.04%. Individuals who were older, male, or living in Turkey and China were associated with a higher prevalence of SP. Additionally, among health examination centers, nursing homes and communities, the highest detection rate of SP was found in the health examination centers. Smoking, excessive drinking and monophagism were possible individual risk factors for SP.

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Footnotes

Author Statement

Contributions: Shi Chen and Fa-quan Zhou contributed equally to this study. Shi Chen conceived and participated in the design of this review. Shi Chen and Fa-quan Zhou performed the literature searches, study selection, data extraction, and assessed the risk of bias. Shi Chen and Fa-quan Zhou drafted the manuscript. Yi-quan Xiong helped in performing the analysis with constructive discussions. Shi Chen revised the final version. All authors read and approved the final manuscript.

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Patient consent for publication: Not required.

Patient and public involvement: Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

Data availability statement: All data relevant to the study are included in the article or uploaded as supplementary information.

Figure

Fig. 1. Flowchart of the study selection process.

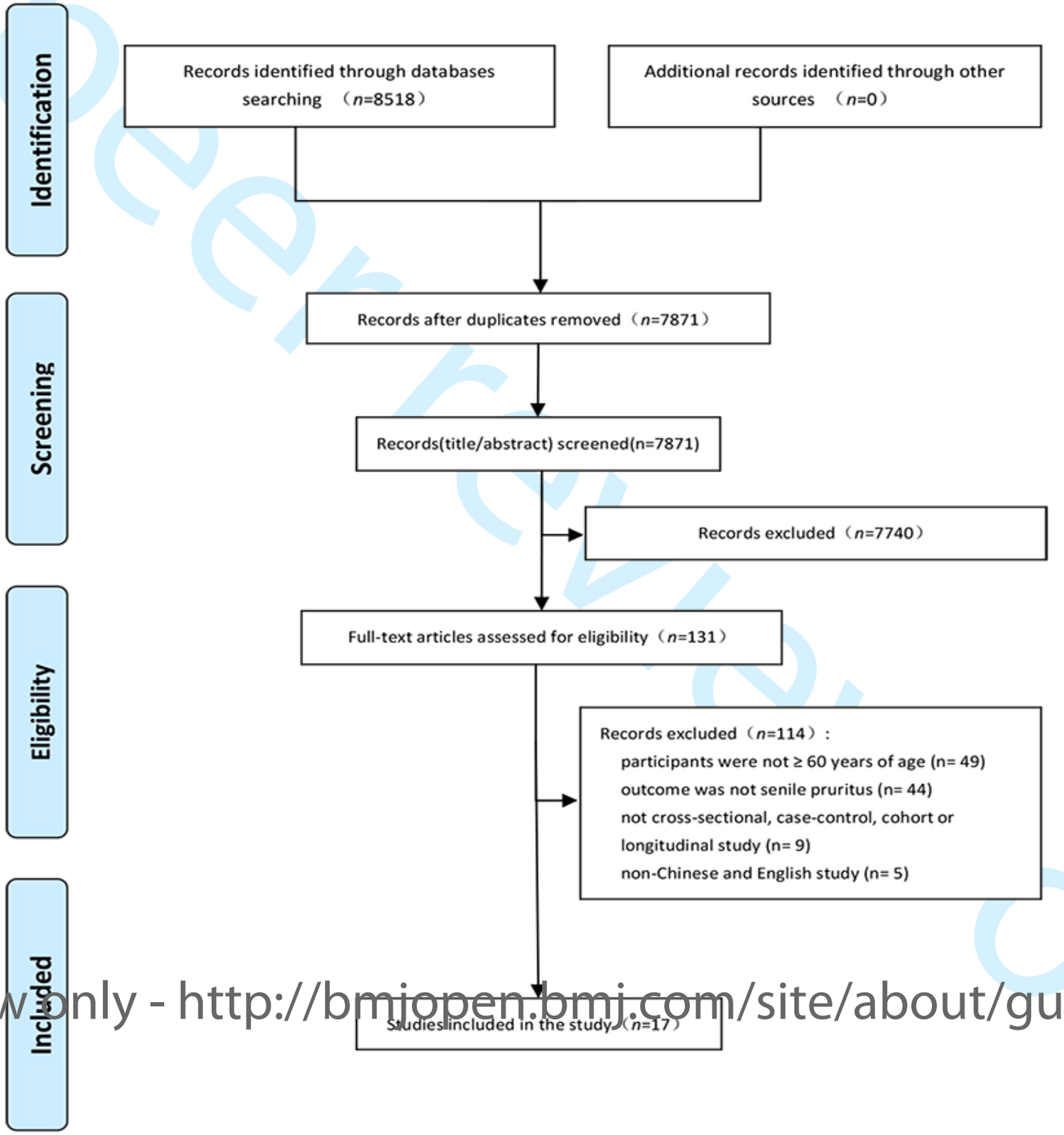
Supplementary

supplementary table S1. Complete search strategy.

supplementary table S2. Risk of bias assessment for the included studies.

Figure

Figure 1. Flowchart of the study selection process.



Supplementary table S1.

Tab.S1 Risk of bias assessment for studies included.

Study	1	2	3	4	5	6	7	8	9	10	11	Total score
Li et al.[25]	Y	N	Y	Y	U	Y	N	Y	N	N	N	5
Dalgard et al.[34]	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	N	8
Ge et al.[26]	Y	Y	Y	Y	U	Y	Y	Y	N	Y	N	8
Xue et al. [27]	Y	N	N	Y	U	Y	Y	N	N	Y	N	5
Yang et al.[18]	Y	Y	Y	Y	U	Y	Y	Y	N	Y	N	8
Ni et al.[28]	Y	Y	Y	Y	U	Y	N	N	N	Y	N	6
Zhang et al.[29]	Y	Y	Y	Y	U	Y	N	N	N	Y	N	6
Li et al.[30]	Y	Y	N	Y	U	Y	N	N	N	Y	N	5
Wu et al.[31]	Y	Y	Y	Y	U	Y	N	N	N	Y	N	6
Yang et al.[32]	Y	Y	Y	Y	U	Y	Y	Y	N	Y	N	8
Tseng et al.[35]	Y	N	Y	Y	U	Y	Y	Y	N	Y	Y	7
Chen et al.[19]	Y	Y	Y	Y	U	Y	Y	N	N	Y	N	7
Hou et al.[33]	Y	Y	Y	Y	U	Y	Y	N	N	Y	N	7
Miller et al.[36]	Y	Y	Y	Y	U	Y	Y	Y	N	Y	N	8
Kara et al.[37]	Y	Y	Y	Y	U	Y	Y	N	N	Y	N	7
Cowdell et al.[38]	Y	Y	Y	Y	U	Y	Y	N	N	Y	N	7
Dyhre et al.[39]	Y	Y	Y	Y	U	Y	Y	N	Y	Y	N	8

Y=YES; N= NO; U=Unclear; Score of Item (point): 1. Define the source of information (survey, record review); 2. List inclusion and exclusion criteria for exposed and unexposed subjects (cases and controls) or refer to previous publications; 3. Indicate time period used for identifying patients; 4. Indicate whether or not subjects were consecutive if not population-based; 5. Indicate if evaluators of subjective components of study were masked to other aspects of the status of the participants; 6. Describe any assessments undertaken for quality assurance purposes (e.g., test/retest of primary outcome measurements); 7. Explain any patient exclusions from analysis; 8. Describe how confounding was assessed and/or controlled; 9. If applicable, explain how missing data were handled in the analysis; 10. Summarize patient response rates and completeness of data collection; 11. Clarify what follow-up, if any, was expected and the percentage of patients for which incomplete data or follow-up was obtained.

Pubmed

1、"Aged"[Mesh]

2、"Aging"[Mesh]

3、 "geriatrics"[Mesh]

4、 ((((((((((((((Aging[Title/Abstract]) OR aged[Title/Abstract]) OR senior old[Title/Abstract]) OR geriatric[Title/Abstract]) OR elder[Title/Abstract]) OR old age[Title/Abstract]) OR pensioner[Title/Abstract]) OR veteran older adult*[Title/Abstract]) OR older people[Title/Abstract]) OR older person*[Title/Abstract]) OR older patient*[Title/Abstract]) OR older women[Title/Abstract]) OR older men[Title/Abstract]) OR geriatrics[Title/Abstract]) OR senile[Title/Abstract]) OR senility[Title/Abstract]

5、#1 or #2 or #3 or #4

6、 "Pruritus"[Mesh]

7、 (((((((Pruritus[Title/Abstract]) OR Pruritis[Title/Abstract]) OR skin pruritus[Title/Abstract]) OR Itching[Title/Abstract]) OR Skin disorders[Title/Abstract]) OR Dermatological problems[Title/Abstract]) OR skin diseases[Title/Abstract]) OR Senile Pruritus[Title/Abstract]) OR chronic pruritus[Title/Abstract]

8、#6 or #7

9、 "Incidence"[Mesh]

10、 "Prevalence"[Mesh]

11、 "Epidemiology"[Mesh]

12、(((((((Epidemiology[Title/Abstract]) OR Prevalence[Title/Abstract]) OR Incidence[Title/Abstract]) OR Incidences[Title/Abstract]) OR Incidence Studies[Title/Abstract]) OR Prevalences[Title/Abstract]) OR Prevalence Studies[Title/Abstract]) OR Epidemiologic Studies[Title/Abstract]

13、#9 or #10 or #11 or #12

14、 "Risk Factors"[Mesh]

15、"Risk"[Mesh]

16、"Root Cause Analysis"[Mesh]

17、((Risk Factors[Title/Abstract]) OR Risk[Title/Abstract]) OR Root Cause Analysis[Title/Abstract]

18、#14 or #15 or #16 or #17

19、#13 or #18

20、#5 AND #8 AND #19

Web of Science

1、TI=(aged or aging or older adult* or older people or older person* or older patient* or older women or older men)

2、TI= (geriatric or geriatrics or elder* or senile or senility or senior or old age or old or elder or pensioner or veteran).tw.

3、1 or 2

4、TS=(Pruritus or Pruritis or skin pruritus or Itching or Skin disorders or Dermatological problems or skin diseases or Senile Pruritus or f chronic pruritus)

5、TS=(Prevalence Prevalences or Prevalence Studies or Risk Factors or Root Cause Analysis)

6、 3 and 4 and 5

Embase

1、exp Aged/

2、exp Aging/

3、exp Geriatrics/

4、(aged or aging or older adult* or older people or older person* or older patient* or older women or older men).tw.

5、(geriatric or geriatrics or elder* or senile or senility or senior or old age or old or elder or pensioner or veteran).tw.

6、1 or 2 or 3 or 4 or 5

7、exp Pruritus/

8、(Pruritus or Pruritis or skin pruritus or Itching or Skin disorders or Dermatological problems or skin diseases or Senile Pruritus or f chronic pruritus).tw.

9、7 or 8

10、exp Prevalence/

11、exp Risk Factor/

12、exp Root Cause Analysis/

13、(Prevalence Prevalences or Prevalence Studies).tw.

14、(Risk Factors or Root Cause Analysis).tw.

15、10 or 11 or 12 or 13 or 14

16、6 and 9 and 15

CINAHL

1、 (MH "Aged+") OR (MH "Aging+") OR (MH "geriatrics+")

2、 AB aged or aging or geriatrics or senior or old or geriatric or elder or old age or pensioner or veteran or older adult* or older people or older person* or older patient* or older women or older men or senile or senility

3、 S1 OR S2

4、 (MH "Pruritus+")

5、 AB Pruritus or Pruritis or skin pruritus or Itching or Skin disorders or Dermatological problems or skin diseases or Senile Pruritus or chronic pruritus

6、 S4 OR S5

7、 (MH "Prevalence+") OR (MH "Risk Factors+") OR (MH "Root Cause Analysis+")

8、 AB Prevalence or Prevalences or Prevalence Studies or Risk Factor or Root Cause Analysis

9、 S7 OR S8

10、S3 AND S6 AND S9

Cochrane Library

1、 MeSH descriptor: [Aged] in all MeSH products

2、 MeSH descriptor: [Aging] explode all trees

3、 MeSH descriptor: [Geriatrics] explode all trees

4、 (Aging):ti,ab,kw OR (aged):ti,ab,kw OR (Geriatrics):ti,ab,kw OR (senior):ti,ab,kw OR (old):ti,ab,kw

5、 (geriatric):ti,ab,kw OR (elder):ti,ab,kw OR (old age):ti,ab,kw OR (pensioner):ti,ab,kw OR (veteran):ti,ab,kw

6、 (older adult*):ti,ab,kw OR (older people):ti,ab,kw OR (older person*):ti,ab,kw OR (older patient*):ti,ab,kw OR (older women):ti,ab,kw

7、 (older men):ti,ab,kw OR (senile):ti,ab,kw OR (senility):ti,ab,kw

8、 #1 or #2 #3 or #4 or #5 or #6 or #7

9、 MeSH descriptor: [Pruritus] explode all trees

10、 (pruritus):ti,ab,kw OR (pruritis):ti,ab,kw OR (skin pruritus):ti,ab,kw OR (Itching):ti,ab,kw OR (Skin disorders):ti,ab,kw

11、 (Dermatological problems):ti,ab,kw OR (skin diseases):ti,ab,kw OR (Senile Pruritus):ti,ab,kw OR (chronic pruritus):ti,ab,kw

12、 #9 or #10 or #11

13、 MeSH descriptor: [Prevalence] explode all trees

14、 MeSH descriptor: [Risk Factors] explode all trees

15、 MeSH descriptor: [Root Cause Analysis] explode all trees

16、 (Prevalence):ti,ab,kw OR (Prevalences):ti,ab,kw

17、 (Risk Factors):ti,ab,kw OR (Root Cause Analysis):ti,ab,kw

18、 #13 or #14 #15 or #16 or #17

19、 #8 and #12 and #18

CNKI

AB = ('老人'+ '老年'+ '老年人') AND AB = ('瘙痒性皮肤病'+ '瘙痒症'+'老年性皮肤瘙痒'+ '老年性皮肤瘙痒症'+'搔痒'+'瘙痒') AND AB = ('发病率'+ '发病率研究'+ '患病率'+ '现患调查' + '流行病学研究'+ '流行病学'+ '风险关系' + '危险因素'+ '危险' + '影响因素'+ '影响因素分析'+ '相关因素'+ '现况调查' + '相关性研究'+ '相关因素分析'+ '影响')

Wanfang

（老年+老人+老年人） * （瘙痒性皮肤病+瘙痒+瘙痒症+老年性皮肤瘙痒+老年性皮肤瘙痒症+搔痒） * （发病率+发病率研究+患病率+现患调查+流行病学研究+流行病学+风险关系+危险因素+危险+影响因素+相关因素+现况调查+相关性研究+相关因素分析+影响）

VIP

(U=老人 OR U=老年 OR U=老年人) AND (U=瘙痒性皮肤病 OR U=瘙痒 OR U=瘙痒症 OR U=老年性皮肤瘙痒 OR U=老年性皮肤瘙痒症 OR U=搔痒) AND (U=发病率 OR U=发病率研究 OR U=患病率 OR U=现患调查 OR U=流行病学研究 OR U=流行病学 OR U=风险关系 OR U=危险因素 OR U=危险 OR U=影响因素 OR U=影响因素分析 OR U=相关因素 OR U=现况调查 OR U=相关性研究 OR U=相关因素分析 OR U=影响)

CBM

1、"老年人"[不加权:扩展]

2、"老年人"[常用字段:智能] OR "老人"[常用字段:智能] OR "老年"[常用字段:智能]

3、(#1) OR (#2)

4、"瘙痒症"[不加权:扩展]

5、"瘙痒性皮肤病"[摘要:智能] OR "瘙痒"[摘要:智能] OR "瘙痒症"[摘要:智能] OR "老年性皮肤瘙痒"[摘要:智能] OR "老年性皮肤瘙痒症"[摘要:智能] OR "搔痒"[摘要:智能]

6、(#4) OR (#5)

7、"患病率"[不加权:扩展]

8、"横断面研究"[不加权:扩展]

9、"队列研究"[不加权:扩展]

10、"流行病学研究"[不加权:扩展]

11、"流行病学"[不加权:扩展]

12、"影响因素分析"[不加权:扩展]

13、"危险因素"[不加权:扩展]

14、"危险"[不加权:扩展]

15、"发病率"[常用字段:智能] OR "发病率研究"[常用字段:智能] OR "患病率"[常用字段:智能] OR "现患调查"[常用字段:智能] OR "流行病学研究"[常用字段:智能] OR "流行病学"[常用字段:智能] OR "现况调查"[常用字段:智能] OR "相关性研究"[常用字段:智能] OR "相关因素分析"[常用字段:智能]

16、"影响"[常用字段:智能] OR "风险关系"[常用字段:智能] OR "危险因素"[常用字段:智能] OR "危险"[常用字段:智能] OR "影响因素"[常用字段:智能] OR "影响因素分析"[常用字段:智能] OR "相关因素"[常用字段:智能]

17、(#7-16)

18、(#3) AND (#6) AND (#17)

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1-2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3-4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	3-4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	6
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	6

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	6
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	6
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	7-8
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	8
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	9-11
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	9-11
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	11
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	11
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	11-13
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	13-14
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	14
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	19

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