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SYSTEMATIC REVIEW

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Survey methods contributing to the difference of dentin hypersensitivity prevalence among publications between 1998 and 2022: a research-on-research study

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Abstract

Background The prevalence of dentin hypersensitivity (DH) differed significantly among previous reports, which may confuse clinicians and public health practitioners. This study aimed to identify which survey methods contributed to the difference in reported DH prevalence.

Methods A systematic search was performed in Medline, Embase, ProQuest, CNKI, and ClinicalTrial.gov databases up to November 2022. Two authors extracted the basic characteristics and survey methods independently. A random-effect meta-analysis was performed to estimate the effects of survey methods on estimated DH prevalence. The Newcastle-Ottawa Scale (NOS) was employed to appraise the methodological quality of the studies included in the analysis.

Results Thirty-nine studies were included. The average estimate of DH prevalence was 32% (95% CIs: 27 − 37%). The statistical heterogeneity was very high among studies ($I^2 = 99.7\%$, $P < 0.001$), especially in the field of survey methods. Variables were observed in sampling approaches, study settings, and inclusion criteria. Besides, clinical examination protocols and reporting of inter-examiner reliability remained inconsistent. Meta-regression analysis showed that the DH prevalence might be underestimated when the clinical examinations were conducted only for participants with positive subjective symptoms ($P = 0.001$). The included studies scored 5.74 ± 1.7 on the NOS, indicating relatively low methodological quality. The lower study quality was primarily attributed to insufficient elaboration on representativeness of the exposed cohort, comparability of cohorts on the basis of the design or analysis controlled for confounders, and follow-up procedures.

Conclusion The included studies demonstrated substantial heterogeneity in survey methods. Conducting clinical examinations for all participants enhanced detection rates. The reliability of our pooled prevalence estimates was substantially compromised due to the studies' low methodological quality and high heterogeneity. It is

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recommended to propose the instructive detailed guideline to standardize the design and improve the quality of studies.

Keywords Dentin hypersensitivity, Epidemiology, Methods, Research design, Evidence-based dentistry

Introduction

Dentin hypersensitivity (DH) is defined as a short, acute dental pain in response to thermal, evaporative, tactile, or osmotic stimuli that cannot be explained by any other dental pathology [1]. The current hydrodynamic theory attributes the pain of DH to pulp exposure to the oral environment through dentin tubules [2]. The diagnosis of DH can be confirmed after excluding dental caries, pulpitis, fractured teeth, fractured restorations, post-restorative sensitivity, marginal leakage, chipped teeth, and gingival inflammation.

Patients with DH report a substantial impairment in oral health-related quality of life. The burden of DH is typically recognized by estimating its prevalence [3]. A meta-analysis showed that the reported prevalence estimates ranged from 1.3 to 92.1% and the I^2 statistic was over 99% [4]. The study suggested that geographic factors may partially explain the extremely high degree of heterogeneity among studies. However, the inconsistency in epidemiological survey methodologies increased the risk of bias in the findings. Notably, the study did not perform meta-regression analyses to assess the method of diagnosis, such as differences between clinical examinations and questionnaire [4]. The scatted estimates confused clinicians and policymakers regarding the disease burden of DH. However, the underlying mechanisms for the extremely unstable estimate remain unclear.

Some researchers have suggested a series of possible reasons for this apparent variation in reported results. DH is a diagnosis of exclusion; thus, an investigation without clinical examination cannot disclose the prevalence of DH, but instead provides an estimate of tooth sensitivity [5]. Many diseases of the tooth present with sensitivity, including caries and pulpitis [6]. Some studies relied on only self-reported questionnaires to diagnose DH, thus overestimating its prevalence [7–9]. Moreover, the investigation setting appears to impact the results. Rees et al. reported a higher prevalence of DH in the periodontal specialty compared to general dental practice [10, 11]. According to the 2021 Global Burden of Diseases, Injuries, and Risk Factors Study (GBD), dental caries in permanent teeth and severe periodontitis were identified as the most prevalent oral health conditions worldwide [12]. Patients visiting a periodontist have a higher possibility of having gingival recession and cervical enamel loss, which can expose the dentine surface causing DH [13]. However, these factors seemed inadequate to completely address the differences among prevalence estimates.

Previous clinical guidelines provide valuable suggestions for the diagnosis of DH [1, 14]. It may be not instructive and practical enough for a prevalence survey. For example, clinicians may focus on the DH with evident symptoms, whereas the epidemiological survey needs a comprehensive evaluation including the potential or occult lesions. In addition, it seemed that epidemiological methods of prevalence investigation varied among different studies, which was also a potential source of the differences. The inconsistencies in epidemiological surveillance protocols and diagnostic criteria have posed significant challenges to the implementation of effective oral disease prevention strategies and the formulation of evidence-based public health policies. Hence, there is an urgent requirement to normalize and standardize the methods of surveys investigating DH prevalence.

Therefore, this study aimed to investigate variations in survey methods across studies reporting the prevalence of dentin hypersensitivity and explore potential sources affecting survey result of DH prevalence.

Methods

This research-on-research study was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [15].

Study identification

The electronic search was conducted in Medline (via Ovid), Embase (via Ovid), ProQuest, China national knowledge infrastructure (CNKI), and ClinicalTrial.gov databases up to November 2022. Search strategies are provided in Table S1. The inclusion criteria were: (1) surveys investigated the DH prevalence at individual level; (2) diagnosis of DH was confirmed by clinical examinations. The exclusion criteria were: (1) surveys investigated subtypes of DH (e.g. cervical DH); (2) prevalence was calculated in the unit of teeth. Two researchers independently identified the eligible studies and discussed them with an arbitrator. The reference lists of eligible studies were also reviewed for potential inclusion.

Data extraction

Data extraction was conducted independently by two researchers and checked by a third researcher. Basic information included the first author, publication year, country, participants' age and gender, the examination site, and funding. Zeola's research underscores the critical role of standardized epidemiological investigation methods for dentin hypersensitivity, particularly clinical examinations and questionnaire [4]. Building on these insights, we developed "Table 1" by integrating essential components of observational study design, including sampling method, sample size estimation, and survery duration. The table comprises nine methodological domains, each categorized into "Superior" and "Inferior" options based on explicit reporting status in the methods sections of included studies. Then, two reviewers assessed the methods of included studies in detail, to find all the differences in the process of epidemiological survey. The following domains were identified (Table 1). A pilot test was conducted by five excluded studies addressing the cervical DH or buccal cervical DH. The intra-examiner consistency was assessed by Cohen's Kappa, which was over 90% for any pair of examiners. An arbitrator participated in the assessment if any different score was rated for an item.

Quality assessment

The methodological quality of the included studies was assessed using the Newcastle-Ottawa Scale (NOS), which evaluates three core domains: participant selection, study comparability, and outcome assessment [16]. This instrument assigns total scores ranging from 0 to 9 points based on rigorous evaluation of research design and outcome validity. Two researchers conducted the assessments independently with inter-rater reliability quantified using Cohen's Kappa coefficient. Any discrepancies were resolved through consultation with a third investigator.

Data analysis

All statistical analyses were undertaken using the Stata 16 (College Station, TX: StataCorp LLC). The prevalence of DH was pooled using the random-effects model. The heterogeneity of effect size among studies was quantified using I^2. The sensitivity analysis was performed by removing one study at a time to evaluate whether the pool estimates could have been altered by a single study. Subgroup analyses were conducted by continent, age range, survey site, publication date, and funding status. The Egger's test and funnel plots were conducted to assess the existence of publication bias. We incorporated both demographic characteristics and epidemiological survey from the included studies into the analysis. Univariable and multivariable meta-regression analyses were systematically conducted to identify significant determinants associated with the prevalence of dentin hypersensitivity. Variables demonstrating significant associations in univariable meta-regression analyses were selected for multivariable modeling. A $P < 0.05$ was considered statistically significant.

Results

After searching the databases, 7157 unduplicated studies were identified. Five additional studies were identified through websites searching and citation tracking for inclusion. To further evaluate the eligibility, full texts of 90 studies were obtained. After independent assessment and discussion, 39 studies were finally included (Table S2). A flow diagram of this review is presented in Fig. 1. The detailed exclusion reasons were listed in Table S3.

Table 1 Judgement and criteria of clinical and survey methods domains in the study

Domain	Judgement	Criteria
Sampling setting	superior	The survey was conducted in the community
	inferior	The survey was conducted in dental clinic, hospitals, or other sites
Sampling method	superior	The survey applied a random, stratified, or consecutive sampling
	inferior	The survey applied a casual sampling
Sample size estimation	superior	The survey estimated the sample size
	inferior	The survey did not estimate the sample size
Participant inclusion	superior	The survey included all or almost all dentulous population
	inferior	The survey excluded individuals with common diseases (e.g. caries)
Survey duration	superior	The survey was completed within one year.
	inferior	The survey was completed in longer or unclear time duration.
Questionnaire	superior	The survey used a questionnaire for assistant diagnosis or data collection
	inferior	The survey did not use a questionnaire
Objects of clinical examination	superior	The survey performed clinical examination for all the participants
	inferior	The survey performed clinical examination only for participants with positive responses in the questionnaire (e.g. tooth sensitivity)
Stimuli	superior	The clinical examination used two or more types of stimuli
	inferior	The clinical examination used only one type of stimuli (e.g. air blast)
Examiner consistency	superior	The consistency of multiple examiners was checked or only one examiner performed the clinical examination
	inferior	The consistency of multiple examiners was not checked

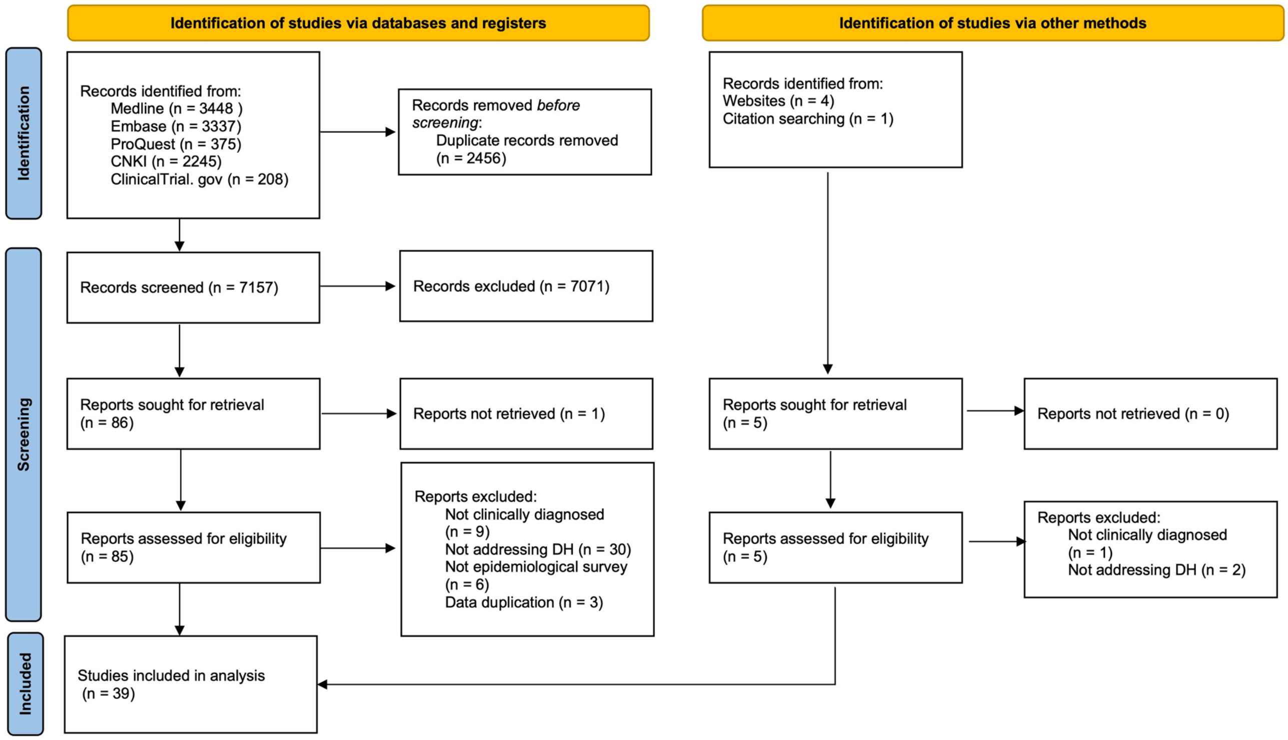

Fig. 1 Flow chart of the research-on-research study

The included studies were published between 1998 and 2022. Most of the studies were conducted in Asia (25/39), specifically in China (9/39) and India (8/39). Five studies were conducted in Europe, six in South America, two in Africa, and one in North America. 11 studies were performed in the community population, 14 in general dental practice, 4 in specialty dental practice, 6 in periodontology clinics, and 4 in schools. Herein, 8 out of 11 community investigations were performed by Chinese researchers. Six studies surveyed both juveniles and adults, in which one study focused on the age range of 12 to 20, and one study focused on university students aged 17 to 23 years old. 28 studies only included adults, of which 4 studies focused on the young population (aged 18 to 35), one focused on the elder population (aged > 35), and one only investigated individuals aged 30 to 49. Four studies did not report the age range of the population. The female/male ratio was balanced in four studies and ranged from 0.59 to 2.45 in all the studies except five studies not reporting. The investigation results of the prevalence rate ranged from 0.038 to 0.887, and the sample size varied between 40 and 7939 among studies.

The included studies varied significantly in their procedure of prevalence survey (Table S4). The survey methods of the 39 included studies were statistically analyzed according to the domains in Table 1, with the results presented in Fig. 2. As mentioned above, only 11 studies were performed in the community, whereas those in dental clinics or schools may have a selection bias. Then, all the community surveys applied the random sampling method. Only 15 surveys in dental clinics or schools performed random or consecutive sampling, while the others that applied casual sampling may have a higher probability of selection bias. 20 studies estimated the sample size referring to previous survey results, while others did not with unclear statistical power. 28 studies examined all the non-edentulous population, while 11 studies excluded some individuals with local diseases (e.g. caries), which decreases the representativeness of the sampling population. Especially when dental caries is prevalent in the general population, the exclusion of personnel with caries determined that this study result could not be generalized. Moreover, 25 studies reported that they accomplished the survey within one year, while others did not report it which could not be recognized as “cross-sectional”. Despite the sampling process, there remain many discrepancies in the diagnosis of DH. 32 studies conducted both questionnaire and clinical examinations to confirm the diagnosis, while 7 studies did not provide a questionnaire. Then, 21 studies conducted clinical examinations for all the participants, while others only performed clinical examinations for individuals reporting positive symptoms in the questionnaire. Only 15 studies applied multiple methods of clinical examinations to confirm the diagnosis of DH, in which cold air plus probing was the most common combination (10/15).

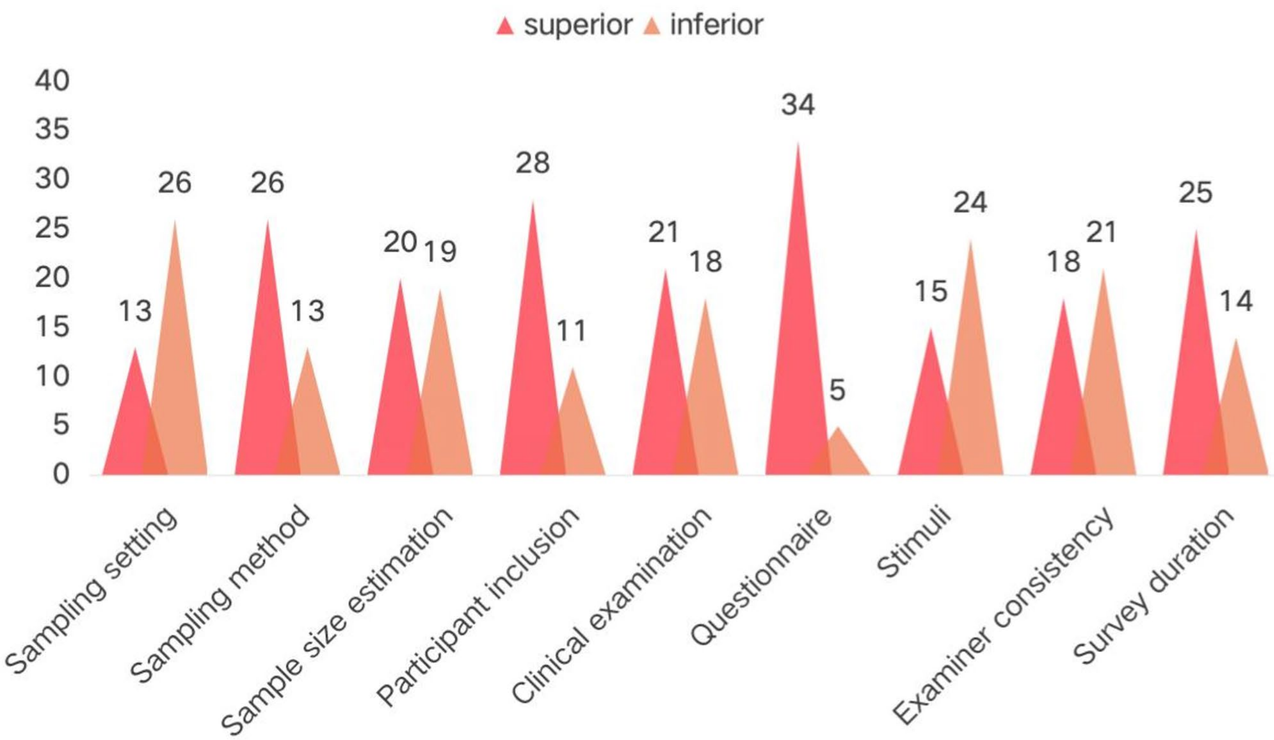

Fig. 2 Differences in epidemiological investigation methods

The remaining 24 studies applied cold air and one applied probing only. Furthermore, 18 studies checked the inter-examiner consistency, which others did not. The meta-analysis showed that the average estimate of DH prevalence was 32% (95% CIs: 27 – 37%) (Fig. 3). The statistical heterogeneity was very high among studies ($I^2 = 99.7\%$, $P < 0.001$). Sensitivity analysis showed that the estimate was highly stable which fluctuated between 30.4% and 32.8% by excluding a study (Figure S1). The Egger's test suggested a high probability of publication bias ($P < 0.001$) (Figure S2, 3).

The subgroup analysis showed that the population in Asia (32.1%, 95%CIs: 28.0-36.3%) and South America (45.8%, 95%CIs: 22.1-69.5%) may have a higher DH prevalence than in Africa (23.6%, 95%CIs: 9.1-38.1%) and Europe (22.2%, 95%CIs: 11.6-32.8%). Although North America (12.3%, 95%CIs: 10.0-14.6%) showed further lower prevalence, only one study was included in the subgroup which decrease the stability of results. Population in the community (28.1%, 95%CIs: 24.5-31.7%) and general dental practice (26.3%, 95%CIs: 19.3-33.3%) may have a lower prevalence of DH than in the periodontal clinic (42.5%, 95%CIs: 22.6-62.4%) or other special dental practice (39.5%, 95%CIs: 24.1-54.9%). The prevalence measured in school or university varied extremely (42.2%, 95% CIs: 1.2 – 83.2%). Additionally, the prevalence of the younger population (22.4%, 95%CIs: 11.6-33.1%) may be lower than the general population (34.0%, 95%CIs: 28.5-39.5%). There was only one study investigating the prevalence of the older population (34.2%, 95%CIs: 31.3-37.1%). The DH prevalence rates reported in studies published between 2001 and 2010 (33.2%, 95%CIs: 17.3-48.8%) were comparable to those from post-2010 publications (32.2%, 95%CIs: 27.5-38.2%). Most studies lacked funding, with non-funded studies (31.1%, 95%CIs: 27.3-35.7%) showing slightly lower DH prevalence than funded ones (36.5%, 95%CIs: 21.3-50.7%) (Table S5).

We incorporated population characteristics (continent, location, age) and nine epidemiological survey indicators into the meta-regression analysis (Table 2). Univariable meta-regression revealed significant effects of location ($P = 0.047$), clinical examination ($P = 0.0001$), and stimuli ($P = 0.008$) on study outcomes. Subsequent multivariable meta-regression identified clinical examination as the most critical factor ($P = 0.001$). The results demonstrated that conducting clinical examinations for all participants, compared to selectively examining only questionnaire-positive respondents, increased the prevalence of dentin hypersensitivity by a factor of 0.163, indicating that relying solely on questionnaires may be insufficient, and clinical examinations across the entire population can detect more dentin hypersensitivity patients.

The methodological quality of 39 studies were assessed through the NOS tool. Results indicated suboptimal overall quality, with an average score of 5.49 ± 1.57 (range: 3–7) (Table S6). Seventeen studies scored above

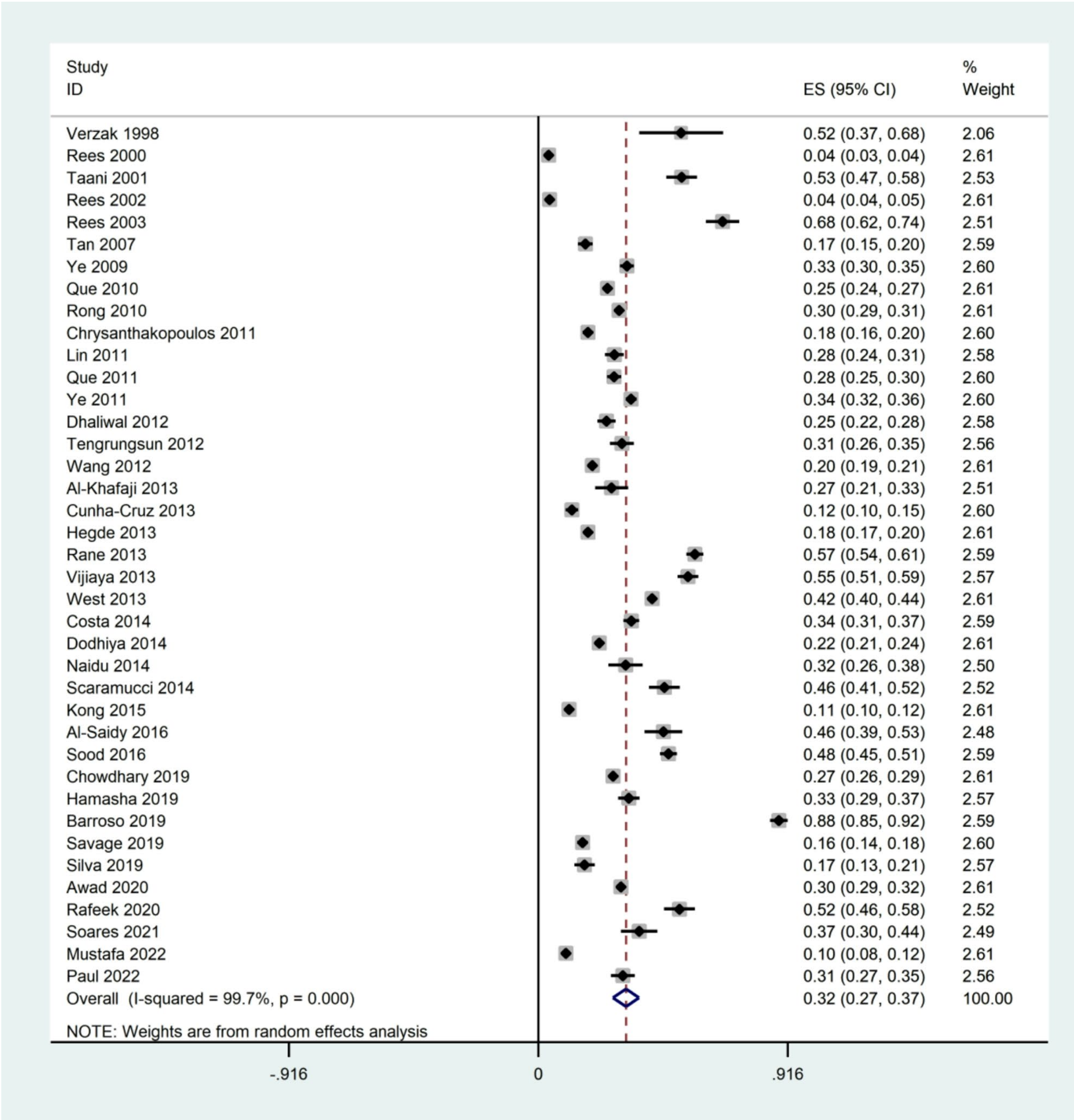

Fig. 3 Forest plot of updated meta-analysis of prevalence of dentin hypersensitivity

5 points, while 22 scored 5 points or below. Key limitations included: 13 studies failed to specify random sampling methods, compromising the representativeness of exposed cohort; 17 studies lacked designs controlling for confounding factors, resulting in high risk of bias. Notably, approximately 90% of the studies did not report follow-up details. The prevalence of dentin hypersensitivity reported in high-quality studies (score > 5) ranged from 3.8 to 34.2%. Among these, one study documented a DH prevalence of 3.8%, four studies reported rates around 20%, and the remaining twelve studies clustered near our final calculated prevalence of 32%. This demonstrates that while high-quality studies constituted a relatively small proportion, they predominantly influenced the final pooled estimate of DH prevalence.

Discussion

The prevalence of dentin hypersensitivity varies across regions, mainly due to differences in lifestyle habits such as diet, oral hygiene practices. Additionally, the risk of

Table 2 Meta-regression of prevalence rate by demographic and survey methods domains

Category	Domin	Univariable		Multivariable	
		Coef. (95%CIs)	*P* value	Coef. (95%CIs)	*P* value
Population characteristics	Continent	0.035 (-0.013, 0.083)	0.148		
	Location	0.043 (0.000, 0.085)	0.047	0.020 (-0.020, 0.060)	0.324
	Age	-0.055 (-0.130, 0.020)	0.151		
Epidemiological survey indicators	Sampling setting	-0.091 (-0.207, 0.025)	0.122		
	Sampling method	0.028 (-0.091, 0.148)	0.640		
	Sample size estimation	-0.053 (-0.164, 0.059)	0.356		
	Participant inclusion	-0.015 (-0.140, 0.110)	0.818		
	Clinical examination	0.185 (0.089, 0.281)	0.0001	0.163 (0.070, 0.256)	0.001
	Questionnaire	-0.023 (-0.191, 0.145)	0.787		
	Stimuli	0.143 (0.037, 0.250)	0.008	0.086 (-0.021, 0.193)	0.116
	Examiner consistency	-0.031 (-0.144, 0.181)	0.587		
	Survery duration	-0.008 (-0.125, 0.110)	0.896		

developing DH increases with age as tooth wear progressively advances. These factors naturally contribute to variability in reported DH rates among studies. However, we observed that substantial heterogeneity in survey methods-beyond these objective factors-has significantly amplified this discrepancy. Notably, prevalence differences between studies exceeded 90%, which distorts the true prevalence of DH and undermines evidence-based health policy decisions. In addition, our study has shown that the current observational studies on DH generally have low methodological quality. This study evaluated the differences in survey methods used to investigate dentin hypersensitivity and the research-on-research study provided a support for the necessity to unify and standardize the methods of the epidemiological survey of DH.

Among the included 39 surveys of DH prevalence, a variety of clinical and survey methods differences have been identified, which may influence the sampling and diagnosis procedures, leading to the unclear comparability of different survey results. Notably, we found that performing clinical examinations (using multiple diagnostic stimuli such as air blast, probing, or ice water) alongside the survey questionnaire responses may reduce the misdiagnosis rate. This combined approach addresses potential discrepancies between self-reported data and objective clinical assessments. Although the study did not identify factors in the sampling as significant, we could not interpret the results as that difference in sampling will not affect the prevalence estimate. Instead, it is possible that these factors will affect the estimate in a complex or unclear pattern, not simply underestimate or overestimate.

In the 2019 updated version of guideline for diagnosis, prevention, and treatment of dentin hypersensitivity by Chinese Stomatological Association, the expert committee emphasized that the diagnosis should be established on history collection and patients' subjective feelings [17]. Our results seemed to provide a viewpoint opposite to the Chinese guideline. Although questionnaires may be helpful and convenient for the discovery of positive symptoms, clinical examinations should be the only standard of DH diagnosis as some of them are occult and asymptomatic in most daily activities. Overreliance on self-reported questionnaires may fail to capture subclinical cases of dentin hypersensitivity, particularly among individuals unaware of their dental condition. Barroso et al. found that 41.7% of volunteers self-reported the presence of DH, while 88.7% of the participants were clinically diagnosed in a university population, which was consistent with our findings [18]. Additionally, it was also possible that examiners ignored some lesions on specific sites. Questionnaire-based preliminary screening can supplement targeted clinical examinations to improve the diagnosis in clinical examinations but should not be adopted as the primary exclusion criterion. We recommend performing clinical examinations and auxiliary questionnaires for all the participants, to identify DH with or without evident symptoms.

The exposed dentin may respond to a varied assortment of stimuli, for example, ice-cold beverages, atmospheric air on a cold winter's day, or friction with hard food [19]. Variable methods have been developed to identify DH sensitive to different stimuli, including cold air blasts, cold water, and probing. However, it seemed that each method could not confirm the diagnosis of DH exclusively [6]. Tactile (probe) and thermal/evaporative (cold air blast) evaluation together with a subjective response from the patient may be recommended [6]. West et al. systematically reviewed randomized controlled trials of DH treatment agents and found about half of 105 trials used both cold air blast and tactile test, the others used only cold stimulus except one applying thermal stimulus [20]. Our results suggested that the cross-sectional study inclined to conclude a higher prevalence rate if multiple stimuli were used in the diagnosis process. In adult and elderly populations in Porto Alegre, Brazil, the overall prevalence of dentin hypersensitivity diagnosed using air blast and tactile probe was 33.4% and 34.2%, respectively. These differential detection rates suggest that individual responses to diagnostic stimuli may vary [21]. Therefore, multiple stimuli should be routinely applied to reduce the ignorance of DH symptomatic to other types of stimuli. Air blast combined with probing test may be preferable. Incorporating diverse stimuli during clinical assessments enhances the detection of subclinical dentin hypersensitivity cases, thereby improving the accuracy of prevalence estimates.

Though many survey methods domains were not significant in the study, they remained to be important for the precise estimation and sampling representativeness. Bias in the sampling process may make the measured prevalence deviate from the truth to an unclear extent. The DH prevalence could be either overestimated or underestimated, or just hitting. The insignificant results in the study exactly accorded with the unclear bias. We noticed that all the studies from China mainland had a representative sample in the community, resulting in a comparatively stable estimate range, from 17.3 to 34.1% in different populations [22–29]. For survey results from other countries or regions, it was impossible to ensure whether the prevalence difference was attributed to regional differences or survey methods differences. For the results' comparability and generalizability, we recommended the cross-sectional survey of DH prevalence should strictly comply with the epidemiological principle and report the studies in compliance with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement [30]. We expect that future surveys could draw a representative sample, estimate the suitable sample size before the sampling, train the examiners and examine the inter-examiner consistency, and restrict the survey duration.

In addition, the periodontal clinic has a higher DH prevalence in the subgroup analysis. This result was somewhat predictable as patients in the periodontal clinic may have a higher probability of exposed dentin. However, it was not reflected in the study. We suspected that it was because the study number in the periodontal clinic was limited. Despite the results, we recommend regarding patients with periodontal diseases as an independent population to community dwellers. Severe periodontal disease, currently the most prevalent oral condition, leads to dentin exposure through disease progression. As dentin hypersensitivity cases are expected to rise correspondingly, prioritizing periodontal therapy and maintenance emerges as a critical strategy for DH prevention [12].

This study still has some limitations. First, this study is based on the reporting of original studies, which could not address the effects of some potential mistakes. For example, we are unclear whether authors exclude all the differential diagnoses according to current recommendations before the confirmation of DH diagnosis. Second, the number of included studies was limited, which possibly decreased the statistical power. However, to address DH rather than tooth sensitivity, strict eligibility criteria were applied to exclude the surveys not truly investigating DH prevalence as the authors declared, which may be helpful to understand the true burden of DH. Compared to the systematic review by Zeola et al., over half of their included studies were excluded in our study [4]. Therefore, the overall estimate of DH prevalence was 32% in the global population. However, the reported prevalence varied among studies extremely. The differences in the sampling and diagnosis procedures may impact the precise estimate of DH prevalence. It may reduce the ignorance of some DH cases by performing clinical examinations for all the individuals however they have subjective symptoms and by using multiple stimuli. Additionally, the overall methodological quality of the included studies was suboptimal, primarily attributed to unrepresentative exposure cohorts and inadequate follow-up protocols. In the future, we may investigate the diagnostic methods in clinical studies of DH. From this study, we could speculate that unified standardization may be not only exist in epidemiological studies but also clinical studies. The DH diagnosis criteria with operable details may still have a long way to go.

Conclusions

Current epidemiological investigations on dentin hypersensitivity (DH) prevalence exhibit marked variability across key methodological domains, including sampling methodologies, questionnaire implementation, diagnostic criteria, and inter-examiner consistency. Notably, the decision to conduct clinical examinations for all enrolled participants demonstrated a statistically significant impact on outcome measures. Although our meta-analysis yielded an overall DH prevalence estimate of 32%, substantial heterogeneity and suboptimal methodological quality substantially diminish the certainty of this pooled estimate, highlighting the need for cautious interpretation in subsequent research contexts. The cross-sectional studies of DH prevalence may need an instructive detailed guideline to standardize the design and improve the quality of studies.

Abbreviations

CNKI	China national knowledge infrastructure
DH	Dentin hypersensitivity
GBD	Global Burden of Diseases, Injuries, and Risk Factors Study
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
NOS	Newcastle-Ottawa Scale

Supplementary Information

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Supplementary Material 1

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Author contributions

Chunjie Li contributed to the conception, design, and funding support. Guanru Wang and Cheng Miao contributed to the acquisition, analysis, interpretation, and drafted the manuscript. Honglin Li and Guile Zhao contributed to interpretation and polishing of the language of the manuscript. All authors gave their final approval and agreed to be accountable for all aspects of the work. All authors have read and agreed to the published version of the manuscript.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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