

# Prevalence of erectile dysfunction and its associated factors among patients with diabetes in Ethiopia: a systematic review and meta-analysis

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## Abstract

**Objectives:** We aimed to estimate the pooled prevalence of erectile dysfunction (ED) among patients with diabetes mellitus (DM) in Ethiopia and to identify its associated factors.

**Methods:** We performed a systematic search of scientific databases (PubMed, ScienceDirect); the grey literature was also searched (Google, Google Scholar). Data were extracted from primary studies using a data extraction format and exported for statistical analysis.  $I^2$  tests were used to assess the heterogeneity of studies. Owing to heterogeneity among the included studies, we used a random-effects model to determine pooled estimates of ED. Publication bias was assessed using Egger's and Begg's tests.

**Results:** The pooled prevalence of ED among patients with DM in Ethiopia was 54.3% (95% confidence interval [CI]: 28.2–80.5). Older age (OR: 4.42, 95% CI: 2.83–6.00) and duration of DM (OR: 3.2, 95% CI: 1.74–4.66) had statistically significant associations with ED.

**Conclusion:** One in two individuals with DM in Ethiopia also had ED. This finding highlights the need to integrate assessment and management of ED into routine medical care in diabetes follow-up visits. Special attention is recommended for patients with older age and a longer duration of DM.

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**Keywords**

Erectile dysfunction, diabetes mellitus, risk factor, Ethiopia, older patient, diabetes management

Date received: 13 October 2020; accepted: 19 January 2021

**Introduction**

Diabetes mellitus (DM) is a chronic disease that affects nearly every organ in the human body. DM is a major public health problem in both developed and developing countries. Globally, the prevalence of diabetes is increasing at an alarming rate, affecting 463 million people. The World Health Organization has projected that 300 and 700 million people will develop DM by 2025 and 2045, respectively.<sup>1,2</sup> Erectile dysfunction (ED) is one of the most common but underdiagnosed complications of DM.<sup>3</sup>

ED, also called impotence, is a condition characterized by the inability to initiate and maintain an erection firm enough to have satisfying sexual intercourse. ED is common in men who have diabetes, particularly those with type 2 diabetes. The onset of ED also occurs 10 to 15 years earlier in men with diabetes than it does in sex-matched counterparts without diabetes. Studies indicate that the ED prevalence in men with diabetes ranges from 35% to 75% versus 26% in the general population.<sup>3,4</sup>

At least some degree of ED is experienced by 35% to 75% of men with diabetes globally. The prevalence of ED among men with diabetes is over 50% in the United States, 35% to 78% in Mexico, 41% in The Netherlands, and 80% to 90% in Saudi Arabia.<sup>5,6</sup> In Africa, evidence from a systematic review and meta-analysis showed that the ED prevalence ranges from 36% to 95%, with pooled prevalence of 71.45%.<sup>7</sup> In Ethiopia, the prevalence of ED among patients with diabetes ranges from 6.8% to 85.5%.<sup>8,9</sup>

ED can stem from organic causes including hormone-induced, drug-induced, vascular, traumatic or post-surgical, and psychogenic causes including depression, relationship problems, and performance anxiety. ED is also linked to other conditions common in men with diabetes, such as high blood pressure and heart disease. ED has a substantial negative physical, psychological, and social impact on patients with diabetes and can affect their quality of life.<sup>10,11</sup>

Owing to an inability to recognize ED as a common consequence of DM that should be addressed and treated, providers are missing an important opportunity to improve their patients' quality of life.<sup>3</sup> Despite the negative impact of ED on quality of life in patients with diabetes, talking openly about sexually related issues is taboo in Ethiopia. Because of this, most patients fear discussing sexual problems with their doctor or partner. Health care providers often do not ask male patients with diabetes about their sexual function owing to societal norms. This leads to sexual disorders being under-recognized and under-treated in this country.

Although some studies have reported the prevalence and predictors of ED among people with diabetes in Ethiopia, the magnitude of these studies is inconsistent and great variability has been observed.<sup>8,9</sup> Moreover, nonexistence of country-wide data that represent the national ED prevalence and its determinant factors is a considerable research gap. Therefore, in this systematic review and meta-analysis, we

aimed to estimate the pooled prevalence of ED among people with diabetes in Ethiopia. This finding will be helpful for policymakers, health personnel, and other stakeholders, to help reduce the negative consequences of ED by designing appropriate preventive and interventional programs for people with DM.

## Methods

### *Protocol and registration*

The results of this systematic review and meta-analysis were reported based on the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement.<sup>12</sup> We used the PRISMA flowchart to depict the selection process, from the initially identified articles to the finally included studies. The protocol for this review is registered on the International Prospective Register of Systematic Reviews (PROSPERO) with reference number CRD42020201825.

Because this review was concerned with published research articles, there was no need to obtain ethical approval or informed consent from participants.

### *Search strategy*

A preliminary search was conducted using scientific databases, including PubMed and ScienceDirect. To identify additional articles, we performed a search of the grey literature using Google and Google Scholar. Endnote X 8.1 reference manager software was used to collect and organize the search results and to remove duplicate articles. The searches were restricted to free full-text articles reporting human studies in English language. All relevant articles available online through 1 August 2020 were considered.

Articles related to the prevalence and/or associated factors of ED among patients

with diabetes were retrieved. We used combinations of the following key terms in the search: “erectile dysfunction”, “sexual function”, “sexual dysfunction”, “impotence”, “diabetes mellitus”, “risk factors”, “determinants”, “predictors” and “Ethiopia”.

### *Eligibility criteria*

**Inclusion criteria.** All observational studies conducted on the prevalence of ED among patients with DM in Ethiopia, published prior to 1 August 2020 that were accessible and written in English were eligible for inclusion in the current systematic review and meta-analysis.

**Exclusion criteria.** We excluded articles that were not fully accessible, duplicate reports possessing a low quality score per the stated criteria, and case series.

### *Data extraction process*

A data extraction template was used to extract the data including author names, year of publication, study design, sample size, sampling technique, prevalence of ED, number of events, and diagnostic criteria used for ED. Data from selected articles were extracted and presented in Microsoft Excel.

### *Outcome measures*

The prevalence of ED and determinant factors were the outcome variables in this systematic review and meta-analysis. Predictors of ED among patients with diabetes were assessed using odds ratios (ORs).

### *Quality assessment*

The quality of primary studies included in this systematic review and meta-analysis were assessed using the Newcastle–Ottawa Scale, adapted for cross-sectional study

quality assessment.<sup>13</sup> This scale is used to assess the methodological quality of each study, the comparability of primary studies, and the quality of original articles with respect to statistical analysis. Two group of authors (BST, SAK) and ABW evaluated the quality of each original article independently using this assessment tool. Inconsistencies between assessors were resolved through discussion, and the average score of different assessment results were used. Articles fulfilling at least 50% of the quality assessment criteria were included in this review.

### *Statistical analysis*

Data analysis was carried out using Stata/SE version 16 (StataCorp LLC, College Station, TX, USA). Heterogeneity among reported prevalence results was assessed by computing p-values for the  $I^2$  statistic.<sup>14</sup> The pooled prevalence of ED was carried out using a random-effects meta-analysis model. To deal with heterogeneity among primary studies, we used a random-effects model. Publication bias was assessed using a funnel plot and the Egger's test with a 5% significance level. Point prevalence with 95% confidence interval (CI) was presented in forest plot format.

## **Results**

### *Search results*

In the first step, 457 articles were retrieved from scientific databases (PubMed = 183, ScienceDirect = 7). An additional 267 articles were also identified from other sources (Google Scholar and Google). After removing duplicates, 412 articles were considered eligible for title and abstract evaluation. Of these, 398 articles were excluded and the remaining 14 articles were considered for further full-text evaluation. A full-text article review resulted in

further exclusion of two articles owing to differences in the outcomes of interest. Finally, 6 papers met the eligibility criteria and were included in the systematic review and meta-analysis (Figure 1).

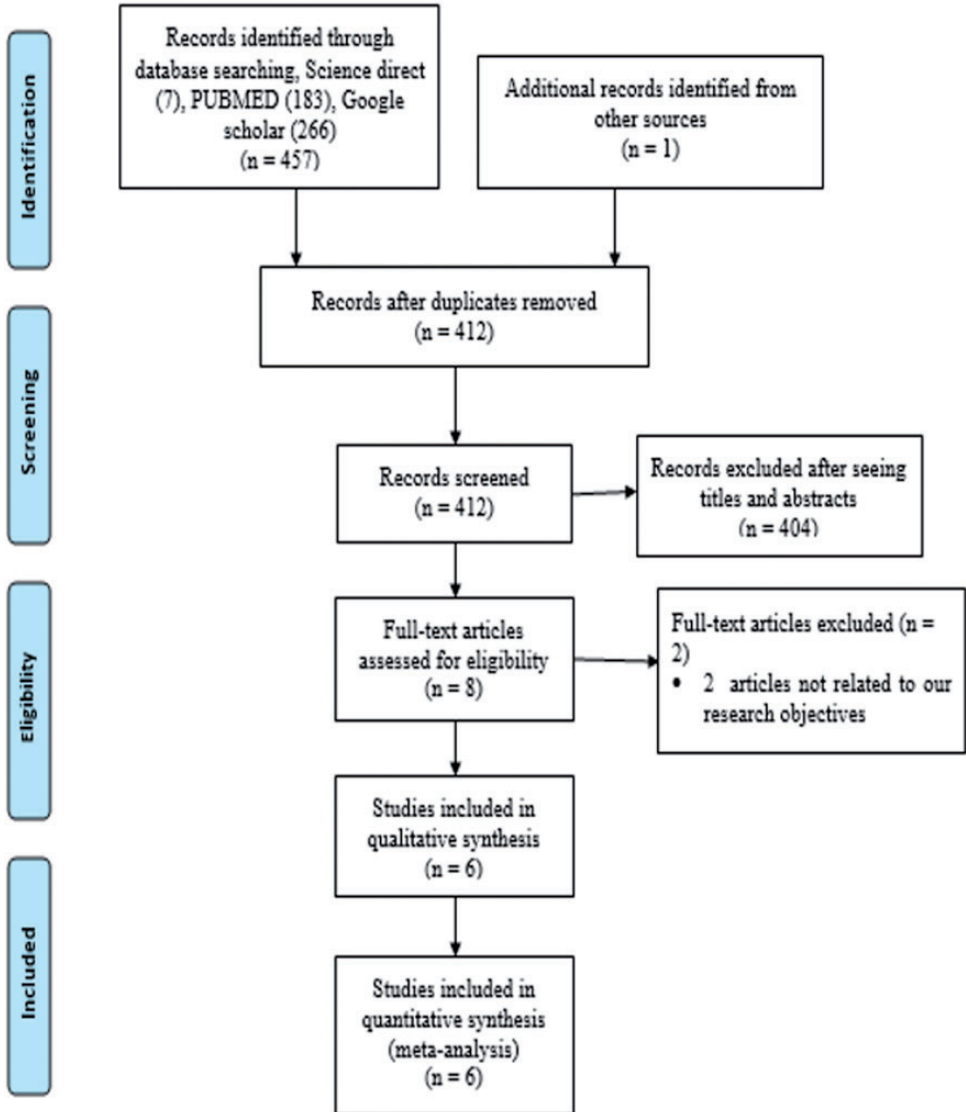
### *Characteristics of included studies*

All studies included in this systematic review and meta-analysis had a cross-sectional study design.<sup>8,9,15-18</sup> The minimum sample size among the included studies was 192 patients from a study in Jimma<sup>8</sup> and the maximum sample size was 423 patients from a study in Mizan-Tepi.<sup>15</sup> Six studies were included, with a total sample size of 2003 participants, to estimate the pooled prevalence of ED among patients with diabetes in Ethiopia. These studies were published between 2010<sup>8</sup> and 2020.<sup>16</sup> Of the included studies, three were conducted in Oromia,<sup>8,15,16</sup> two in the Amhara region<sup>9,18</sup> (one from the grey literature), and one in the Tigray region.<sup>17</sup>

Except for the study from Mizan-Tepi<sup>15</sup> with a response rate of 94%, the response rate of the remaining five studies was 100%.<sup>8,9,16-18</sup> The mean age of patients in the six studies included in this systematic review and meta-analysis ranged from 41.76 ( $\pm 9.00$ ) years<sup>15</sup> to 54.12 ( $\pm 16.51$ ) years. Regarding assessment tools of ED, four studies<sup>9,16-18</sup> (the Gondar study was from the grey literature) used the International Index of Erectile Function (IIEF-5), and one study used the 14-item Sexual Functioning Questionnaire (CSFQ-14).<sup>15</sup> The instrument used was not reported in one study<sup>8</sup> (Table 1).

### *Meta-analysis of erectile dysfunction (ED) in Ethiopia*

The pooled prevalence of ED among patients with diabetes in Ethiopia was 54.3% (95% CI: 28.2, 80.5). Because of significant heterogeneity across the included



**Figure 1.** PRISMA flowchart showing the selection of primary studies.

studies ( $I^2 = 100\%$ ,  $p < 0.001$ ), a random-effects meta-analysis model was used to estimate the pooled prevalence of ED in Ethiopia. In this meta-analysis, the highest prevalence was 85.5% (95% CI: 81.9, 88.6), reported in the study by Walle et al.<sup>9</sup> The lowest prevalence of 6.8% (95% CI: 4.0, 11.2) was reported by Worku et al.<sup>8</sup> (Figure 2).

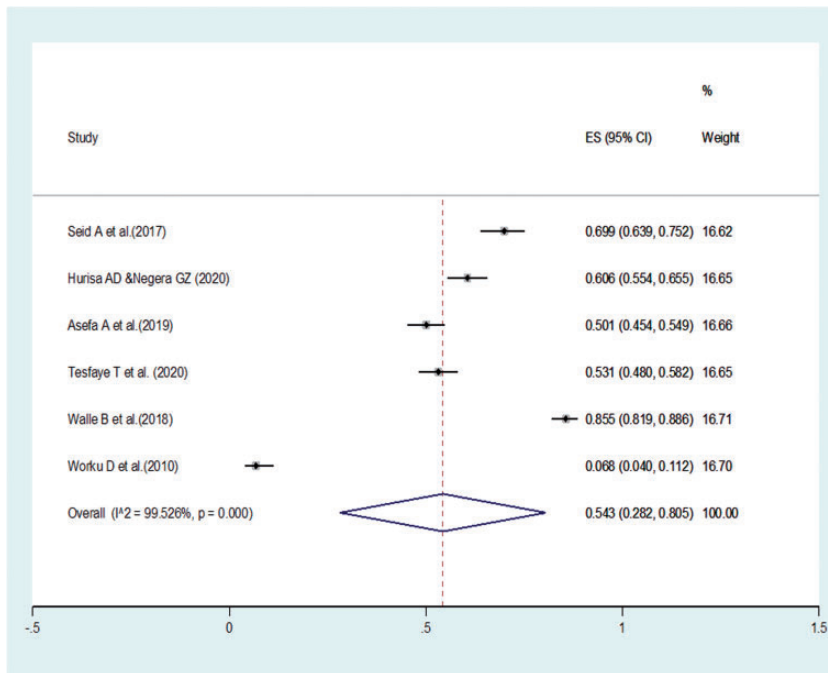
**Factors associated with ED**

Five of the six studies included in this systematic review and meta-analysis reported factors associated with ED among patients with diabetes. In more than one study, these factors were duration of diabetes, type of DM, and age of study participants. The pooled meta-analysis using four studies

**Table 1.** Baseline characteristics of studies included in the systematic review and meta-analysis of erectile dysfunction prevalence among patients with diabetes in Ethiopia, 2020.

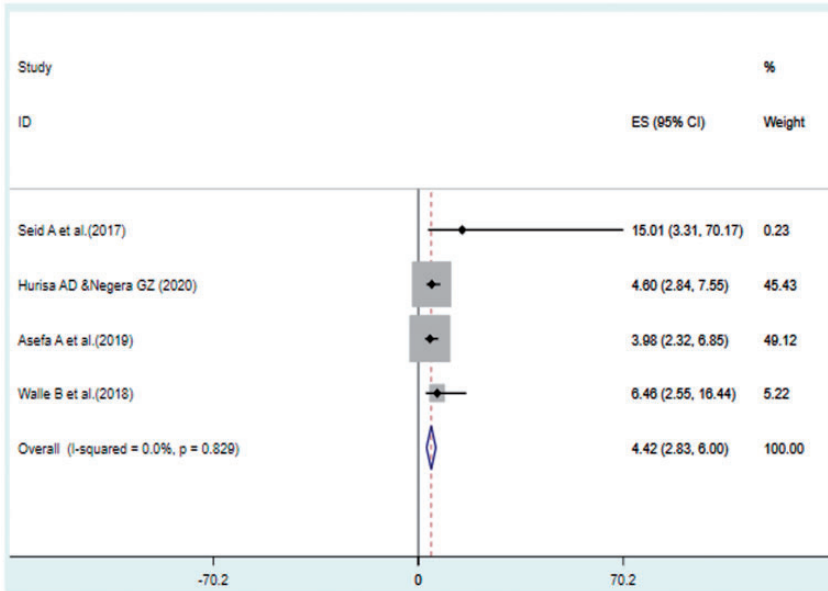
Authors (Reference)	Publication year	Study area/ region	Study design	Sample size	Instrument	Response rate	Age, y (mean $\pm$ SD)	Prevalence
Seid A et al. <sup>17</sup>	2017	Tigray	Cross-sectional	249	IIEF-5	100%	43.39 $\pm$ 14.7	69.90%
Hurisa AD & Negera GZ <sup>16</sup>	2020	Oromia	Cross-sectional	350	IIEF-5	100%	47.90 $\pm$ 12.2	60.40%
Asefa A et al. <sup>15</sup>	2019	Oromia	Cross-sectional	423	CSFQ-14	94%	41.76 $\pm$ 9.00	53.30%
Tesfaye T et al. <sup>18</sup>	2020	Amhara	Cross-sectional	367	IIEF-5	100%	54.12 $\pm$ 16.51	53.10%
Walle B et al. <sup>9</sup>	2018	Amhara	Cross-sectional	422	IIEF-5	100%	45.70 $\pm$ NR	86%
Worku D et al. <sup>8</sup>	2010	Oromia	Cross-sectional	192	NR	100%	44.40 $\pm$ 15.6	6.8%

IIEF-5: International Index of Erectile Function; NR: not reported; CSFQ-14: 14-item Changes in Sexual Functioning Questionnaire; SD: standard deviation.

**Figure 2.** Pooled estimated prevalence of erectile dysfunction among patients with diabetes in Ethiopia, 2020.

revealed that being over the age of 40 years was significantly associated with ED among patients with diabetes. Patients aged over 40 years were 4.42 times more likely to develop ED than those aged less than 40 years (pooled OR: 4.42, 95% CI: 2.83, 6.00) (Figure 3).

In the study, the duration of DM was significantly associated with ED. An aggregated meta-analysis using two studies indicated that patients with a longer duration of DM (more than 5 years) had a 3.2-times higher odds of developing ED than those with DM for less than 5 years



**Figure 3.** Forest plot of pooled odds ratios between age and erectile dysfunction among patients with diabetes in Ethiopia.

(pooled OR: 3.2, 95% CI: 1.74, 4.66) (Figure 4).

### Publication bias

Small-study effects were assessed using Egger's and Begg's tests and the results showed no evidence of publication bias among the included studies ( $p = 0.612$  and  $0.848$ , respectively). However, it should be noted that the funnel plot and Egger's test are less reliable when the number of studies is less than 10.

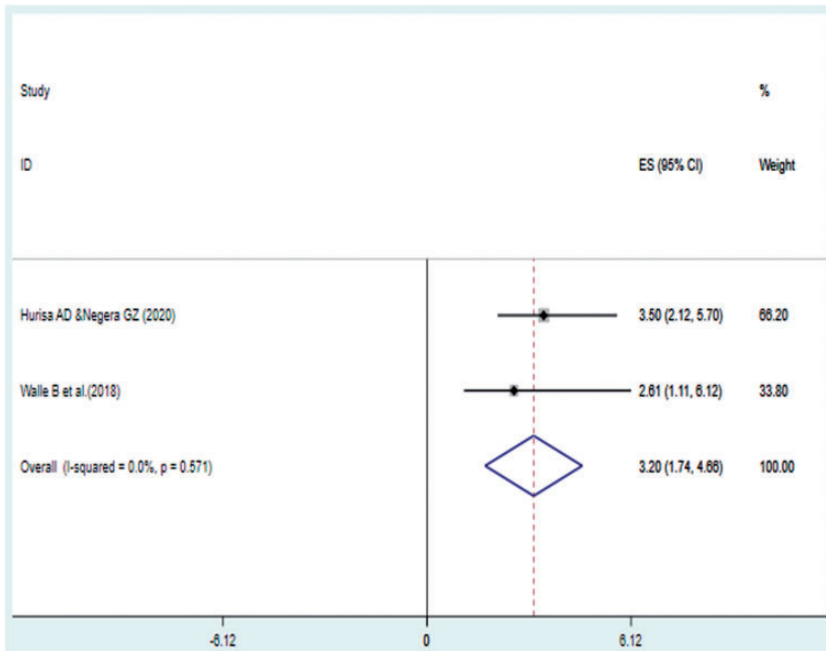
### Discussion

There are several studies regarding the magnitude and associated factors of ED among patients with diabetes in Ethiopia. This is the first systematic review and meta-analysis to assess the prevalence and associated factors of ED among patients with diabetes in the country. However, we observed large variation and inconsistencies in the reported results across these primary

studies. For example, the highest (85.5%) and the lowest (6.80%) prevalence were reported in the Amhara<sup>9</sup> and Oromia region,<sup>8</sup> respectively.

This systematic review and meta-analysis showed that the pooled prevalence of ED among patients with DM in Ethiopia was 54.3% (95% CI: 28.2, 80.5). The magnitude of ED in this systematic review and meta-analysis was lower than the findings from a systematic review and meta-analysis done globally (59.1%)<sup>19</sup> and in Africa (71.45%).<sup>7</sup> This disparity might be owing to differences in the number of study participants. The number of patients in the current systematic review and meta-analysis was low compared with those previous two reviews, which might contribute to the lower prevalence of ED in the current study. Cultural norms in Ethiopia might also be a contributing factor; ED is under-recognized because of societal norms.

Subgroup analysis was also performed based on the geographical area in which



**Figure 4.** Forest plot of pooled odds ratios between duration of diabetes mellitus and erectile dysfunction among patients with diabetes in Ethiopia.

each study was conducted. Accordingly, a higher pooled prevalence of ED (69.50%) was observed among studies in the northern part of the country and lower ED prevalence (40.17%) was found among studies in the southern part of Ethiopia. This could be explained by most included patients with DM from the north of the country being older, which makes the occurrence of ED more likely.

In this study, factors associated with ED were also identified among people with DM. The meta-analysis results showed that the type of DM, patient age, and duration of DM had statistically significant associations with ED among participants with DM. Patients with diabetes aged more than 40 years were 4.42 times more likely to develop ED than those aged less than 40 years. This finding is in line with a previous meta-analysis.<sup>20</sup> This significant

association can possibly be explained by age-related physiological changes in the testicles and declining sex hormones in older men.<sup>21</sup>

The duration of DM was also significantly associated with ED among patients with diabetes, which is in agreement with previous studies.<sup>20,22,23</sup> Patients with a long duration of DM (more than 5 years) had a 3.2-times greater odds of developing ED than those patients who had DM for less than 5 years. A possible explanation for this is that patients living with DM for a longer time have an increased risk of DM-related complications and other comorbidities, as well as poor glycemic control, which can affect sexual function. Moreover, the risk of micro- and macrovascular complications increases over time, giving rise to diabetes-related ED that is mostly neurogenic and vasculogenic in etiology.<sup>20</sup>



### Strengths and limitations of the study

This review was conducted with rigorous adherence to the PRISMA statement. The main limitation of this meta-analysis is the difficulty in determining whether the results are nationally representative of Ethiopia as the included primary studies were only from three administrative regions of the country. The other limitation is that this was a hospital-based study and patients presenting for medical care may differ from the general population in unpredictable ways.

### Conclusions

In this study, we found that one in every two individuals with diabetes in Ethiopia also had ED. This finding highlights the need to integrate assessment and management of ED into routine medical care provided in follow-up clinics for patients with DM. Special attention by health care providers is recommended for older patients and those with a longer duration of DM.

### Authors' contributions

ABW had a primary role in conceptualization, data review, data extraction, data analysis, and writing and editing of this manuscript. BST and SAK had a role in data review, data extraction, and writing and editing of this manuscript. All the authors approved the final version of the manuscript.


### Declaration of conflicting interest

The authors declare that there is no conflict of interest.

### Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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