

Prevalence of Female Sexual Dysfunction Among Premenopausal Women: A Systematic Review and Meta-Analysis of Observational Studies



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ABSTRACT

Introduction: Epidemiologic research in female sexual dysfunction (FSD) has gained momentum in recent years, particularly in clinical populations and in menopausal women. However, sexual dysfunction also affects premenopausal women in general populations. Previous literature reviews have been unable to quantify the burden of FSD in general populations. This has been due in part to different definitions of dysfunction, heterogeneous study design, and the wide variety of measurement tools used.

Aim: To provide a meta-analytical estimate of the prevalence of FSD in premenopausal women.

Methods: Observational studies that assessed the prevalence of FSD in premenopausal women were systematically sought in relevant databases (January 2000 through July 2014). Publications that reported the prevalence rate for at least one domain of FSD were included. A meta-analysis of prevalence rates was performed and a meta-regression was used to analyze factors of study design.

Main Outcome Measures: Estimated prevalence rates of FSD and its domains (hypoactive sexual desire disorder, sexual aversion disorder, female sexual arousal disorder, lubrication difficulties, female orgasmic disorder, and pain disorders).

Results: After screening 9,292 results, 440 publications were retrieved for full-text review. Of these, 135 studies were included in the systematic review. Ninety-five of these studies were assessed further in a meta-analysis. There was substantial heterogeneity among studies. The prevalence of FSD in premenopausal women was estimated to be 40.9% (95% CI = 37.1–44.7, $I^2 = 99.0\%$). Prevalence rates of individual sexual disorders ranged from 20.6% (lubrication difficulties) to 28.2% (hypoactive sexual desire disorder). Further analyses showed significantly higher rates of FSD in studies in Africa, studies that used non-validated assessment tools, and studies without pharmaceutical funding.

Conclusion: Prevalence estimates of FSD vary substantially. Nonetheless, results show that FSD is a significant public health problem that affects 41% of premenopausal women around the globe. More research and improved standardization are needed in this field.

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Key Words: Epidemiology; Female Sexual Dysfunction; Female Sexual Difficulties; Meta-Analysis; Prevalence; Systematic Review

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INTRODUCTION

Sexual function is an essential component of life. For this reason, sexual dysfunction can have a negative impact on the well-being of an individual. Sexual dysfunctions are a heterogeneous group of disorders that are typically characterized by a clinically significant disturbance in a person's ability to respond sexually or to experience sexual pleasure, according to the *Diagnostic and Statistical Manual of Mental Disease, Fourth Edition, Text Revision (DSM-IV-TR)*.¹ Sexual dysfunction in women includes hypoactive sexual desire disorder, sexual aversion disorder, female sexual arousal disorder, female orgasmic disorder,

and pain disorders.¹ Female sexual dysfunction (FSD) is related to age, progressive, and highly prevalent, affecting 30% to 50% of women.²

Although still far behind research on male sexual dysfunction, research on FSD has attracted more interest in the past few decades.^{3,4} Several studies have examined the prevalence of sexual dysfunction in women with cancer,⁵ diabetes,⁶ and depression.⁷ Older women also have been a major focus of research owing to increased interest in therapies that might decrease menopausal symptoms.⁸ However, sexual dysfunction is not limited to clinical settings or to women going through menopause. It is an important health issue that affects younger women in general populations.

Several literature reviews have been performed in the past 30 years, yet none has been able to quantify the overall number of premenopausal women who report sexual dysfunction.^{9–11} In 1986 Nathan⁹ performed an epidemiologic analysis of 22 studies (1929–1981) that assessed sexual dysfunction in men and women in the general population. In the 19 studies that included women, prevalence rates for inhibited desire (in women) ranged from 1% to 35% and from 5% to 15% for inhibited female orgasm. No estimate could be given for inhibited sexual excitement (or arousal) because none of the studies inquired about adequate stimulation and the presence of lubrication problems. The sexual pain disorders, vaginismus and dyspareunia, had not been assessed in general populations until that point. In her analysis, Nathan struggled not only with limited epidemiologic data but also with a wide variety of tools that used heterogeneous definitions for sexual dysfunction.

The 1990 critical review from Spector and Carey¹⁰ (1948–1990) identified 20 studies that measured FSD in various populations of women (minimum age = 11 years, maximum age = 85 years). Community samples indicated a prevalence of 5% to 10% for inhibited female orgasm, yet no stable estimates could be determined for female sexual arousal disorder, vaginismus, or dyspareunia. Spector and Carey encountered similar problems as Nathan did and encouraged future researchers to use a common classification system for sexual dysfunction “so that professionals can better compare and evaluate the literature using a common argot. (pg 406)”

In 2004, West et al¹¹ performed a systematic literature review (1966–2004) and identified 40 studies focusing on FSD (minimum age = 18 years, maximum age = 75 years). They found rates of sexual dysfunction that ranged from 1% to 50% for desire disorders, 4% to 48% for arousal disorders, 3% to 50% for anorgasmia, and 1% to 75% for dyspareunia. Like Nathan⁹ and Spector and Carey,¹⁰ West et al were unable to provide an overall prevalence estimate for FSD owing to the different definitions of dysfunction and the lack of standardized, valid assessment tools.

Currently, there is no global estimate of the prevalence of FSD in general populations of premenopausal women. Currently, the most frequently cited statistic for the prevalence of FSD stems

from a 1999 study published in the *Journal of the American Medical Association*.¹² The prevalence rate of generalized FSD was estimated to be 43% in a U.S. population 18 to 59 years old.¹³ However, to have a valid estimate of the global prevalence of a particular disease or disorder, a single study of a single population is not sufficient.

A robust epidemiologic analysis of prevalence rates of FSD is valuable not only for statistical purposes but also, more importantly, for its clinical relevance. Quantifying an illness is the first step in finding a possible cure for that illness, and this is true for FSD.⁹ Establishing the prevalence of sexual dysfunction in premenopausal and menopausal women allows practitioners and administrators to use these data to determine the resources (eg, more research, improved training, etc) needed to alleviate a given disorder.¹⁰ Thus, the aim of this systematic review was to provide a meta-analytical estimate of the prevalence of FSD in general populations of premenopausal women and to examine the factors that might affect these prevalence rates.

METHODS

Protocol and Registration

The methods for this systematic review and meta-analysis were developed according to recommendations from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statements.¹⁴ This protocol has been registered with the International Prospective Register of Systematic Reviews (PROSPERO; CRD42014009526) and is available in published form.¹⁵

Search Strategy and Selection Criteria

Data for this review were identified by searches of Medline, Embase, PsycINFO, Web of Science, and other relevant databases using the terms *sexual dysfunction*, *female*, and *epidemiology*. Searches were limited to studies of humans, to the English language, and from January 1, 2000 until July 10, 2014. The search was performed by an experienced medical research librarian (H.K.). A list of search terms that were used can be requested from the corresponding author. All titles and abstracts were screened for their relevance (M.E.M.). If there was any uncertainty about an abstract's relevance at this stage, the article remained included until the full text was reviewed. Articles identified through hand searches were considered for inclusion based on their titles.

A standard form was designed and used to evaluate the full-text publications for inclusion (see [Supplementary Material](#)). Two investigators (M.E.M. and A.Z.) independently assessed each publication for eligibility and compared their results. If there was a discrepancy in their assessment, a final decision was taken based on discussions with a third reviewer (C.A.). For multiple publications based on a single study, the most current and/or inclusive study was selected. A second hand search was

performed (A.Z.) using the reference lists of all included articles.

Cross-sectional, cohort, and case-control studies were eligible for this systematic review. Validation studies, reviews, reports, and commentaries were not included. Clinical populations or populations of women who were surveyed for a particular disease or illness were excluded. Studies that addressed FSD in infertile women or couples and studies that examined spouses and partners of men with erectile disorder also were excluded.

To be included, the study needed to report the prevalence of FSD or at least one domain of FSD according to the *DSM-IV-TR* (hypoactive sexual desire disorder, sexual aversion disorder, female sexual arousal disorder, female orgasmic disorder, or pain disorders), because this would have been the relevant diagnostic manual at the time of the studies (2000–2014).¹ In the *DSM-IV-TR*, female sexual arousal disorder was described entirely in terms of genital indices of a sexual response, namely the lubrication-swelling response.^{1,16} However, since its publication in 2000, further evidence has been shown for differentiating central or subjective arousal from peripheral or genital arousal (ie, lubrication).^{17,18} In their validated assessment tool, the Female Sexual Function Index (FSFI; 2000), Rosen et al¹⁹ distinguished between measurements of subjective arousal and measurements of lubrication and assessed these aspects separately. Contrary to the *DSM-IV-TR*, the FSFI, which is widely used in population studies around the world,²⁰ used the term *sexual arousal* to refer to a woman's subjective arousal and the term *lubrication* to refer to the genital indices of a sexual response.¹⁹ Owing to variation in classification and in measurement tools across studies, the authors chose to include any study that reported on *sexual arousal* and/or *lubrication*.

The research question focused on premenopausal women in the general population (ie, women beyond menarche and before menopause who were not pregnant or lactating). Any studies that focused primarily on menopausal, postmenopausal, pregnant, or lactating women were excluded. Because several epidemiologic studies covered a broad age range of women, a numeric cutoff was used for the studies that did not specify which women were premenopausal. Based on a recent systematic review, the age at onset of natural menopause (the time at which a woman's reproductive capacity ceases)²¹ is estimated at 48.7 years.²² Thus, studies were included if (i) all women surveyed were premenopausal, (ii) the age range of the participants was between menarche and 49 years, or (iii) data on women no older than 49 years could be extracted from the entire population.

Data Collection

Data were extracted from the included studies using an electronic data extraction form created in Access (Microsoft Corp, Redmond, WA, USA). The extraction form was predesigned and pilot tested (M.E.M. and M.A.T.). A pilot test was performed with 20 randomly selected publications on the prevalence of FSD. Based on the results of the pilot test, the form was revised

by the investigators. If information necessary for the meta-analysis was not contained within the article, the corresponding author and/or coauthors were contacted personally. All authors were contacted in September 2014 and were reminded, if necessary. Where no reply was received or data were no longer accessible, the investigators listed the article in the summary table but did not include the study in the meta-analysis. After all data were extracted from the included publications (M.E.M., A.Z., and M.A.T.), the data were examined and verified by a second author (M.E.M., A.Z., and M.A.T.). Discrepancies in data entry were documented, discussed, and revised accordingly.

Classification of Sexual Disorders

For the data collection process, prevalence rates were extracted for FSD in general (eg, fulfilling a cutoff in the respective study) and any of its domains: hypoactive sexual desire disorder, sexual aversion disorder, female sexual arousal disorder, lubrication difficulties, female orgasmic disorder, and pain disorders.¹ Authors of previous systematic analyses were confronted with differences in terminology across studies and, in the end, used the term *female sexual dysfunction* to describe any self-reported sexual difficulty, regardless of duration, persistence, or level of personal distress.^{9–11} Although the inclusion of personal distress has been shown to yield lower prevalence rates of FSD in population studies,^{23–25} very few previous studies included the criterion of personal distress in their assessment of the prevalence of sexual dysfunction.²⁶ To provide a full scope of international prevalence rates, the authors of this systematic literature review considered all studies for inclusion, regardless of the duration of sexual difficulties or the assessment of persistence or of personal distress. Furthermore, solely for consistency purposes with the literature in the observed timeframe, the authors used the term *sexual dysfunction* for this systematic review.

Methodologic Quality Assessment

Methodologic quality was assessed for all studies included in the meta-analysis using a checklist from Prins et al.²⁷ Using the quality criteria, risk of bias was assessed for setting and dates of study, eligibility criteria, sampling methods, participation rate, description of participants, description of classification of sexual dysfunction, validation of assessment tool, and sources of funding for each study. Each study was assessed independently by two investigators (M.E.M. and A.Z.). In case of disagreement, consensus was reached through discussions with the senior researcher of this study (C.A.).

Statistical Analyses

A meta-analysis of the prevalence rates of FSD was performed for overall FSD and for each domain using a quality effects model (M.E.M.) and a random effects model (C.R.).^{28,29} Further statistical analyses were performed by an experienced epidemiologist (C.R.). Cochran Q and I² statistics were used to test for heterogeneity of the studies.³⁰ Publication bias was examined using

the Begg rank correlation test³¹ and the Egger correlation test.³² Sensitivity analyses were performed by dropping one study at a time. A univariate meta-regression analysis³³ was performed for all six outcomes (FSD and five domains) and the following factors: region of the world, type of sexual regime,³⁴ method of data collection, sampling method, validation of assessment tool, reporting period of assessment tool, inclusion criteria on sexual activity, and pharmaceutical funding. Furthermore, the prevalence rates were correlated with the Gender Inequality Index to determine whether there was a relation between the prevalence of FSD and the level of gender inequality in a country.³⁵ Statistical analyses were performed using MetaXL. Meta-regressions were performed using STATA 12.0 (StataCorp, College Station, TX, USA).

RESULTS

Characteristics of Studies

Of the 19,442 citations retrieved through electronic and other references searches, 10,150 duplicates were excluded, leaving 9,292 titles and abstracts to be screened. Based on the title and/or abstract, 8,852 citations were excluded. The full texts of 440 publications were evaluated. In the end, 135 publications fulfilled all inclusion criteria.^{23-26,36-166} Figure 1 presents a PRISMA flowchart with reasons for exclusion. Sixty-seven researchers were contacted for additional information for the meta-analysis; 37 of 67 responded (55%) and/or supplied additional data. The smallest population was 100 and the largest was 84,644. The mean study size was 2,420 participants and the median was 853 participants.

Table 1 lists the general characteristics of the included studies. Nearly all publications described cross-sectional studies. The number of premenopausal women in these studies was generally smaller than 2,000, with only three very large studies with more than 10,000 premenopausal women. A third of studies took place in European countries, followed by regions in the non-European West¹⁶⁷ (United States, Canada, South Africa, New Zealand, and Australia) and Asia. Seventy studies (51.9%) used paper questionnaires to collect data on reported sexual dysfunction. The FSFI from Rosen et al¹⁹ was the most frequently used measurement tool (43 of 135, 31.9%). Thirty-six percent of studies used measurement tools with unclear validation or no validation.

Supplementary Table 1 lists specific characteristics of all studies in the systematic review (N = 135). Forty studies could not be included in the quantitative analyses owing to insufficient data on participants and/or prevalence rates. Therefore, the meta-analysis entailed 95 studies, comprising 215,740 participants. The prevalence of FSD was reported in 53 studies. In terms of the domains, the prevalence of hypoactive sexual desire disorder was reported in 62 studies, sexual aversion disorder in 5 studies, female sexual arousal disorder in 39 studies, lubrication difficulties in 36 studies, female orgasmic disorder in 53 studies, and

pain disorders in 65 studies. Because the vast majority of studies did not include personal distress in their assessment of prevalence (90%, n = 85), the authors used the prevalence rates of sexual dysfunction without personal distress.

Study Risk of Bias

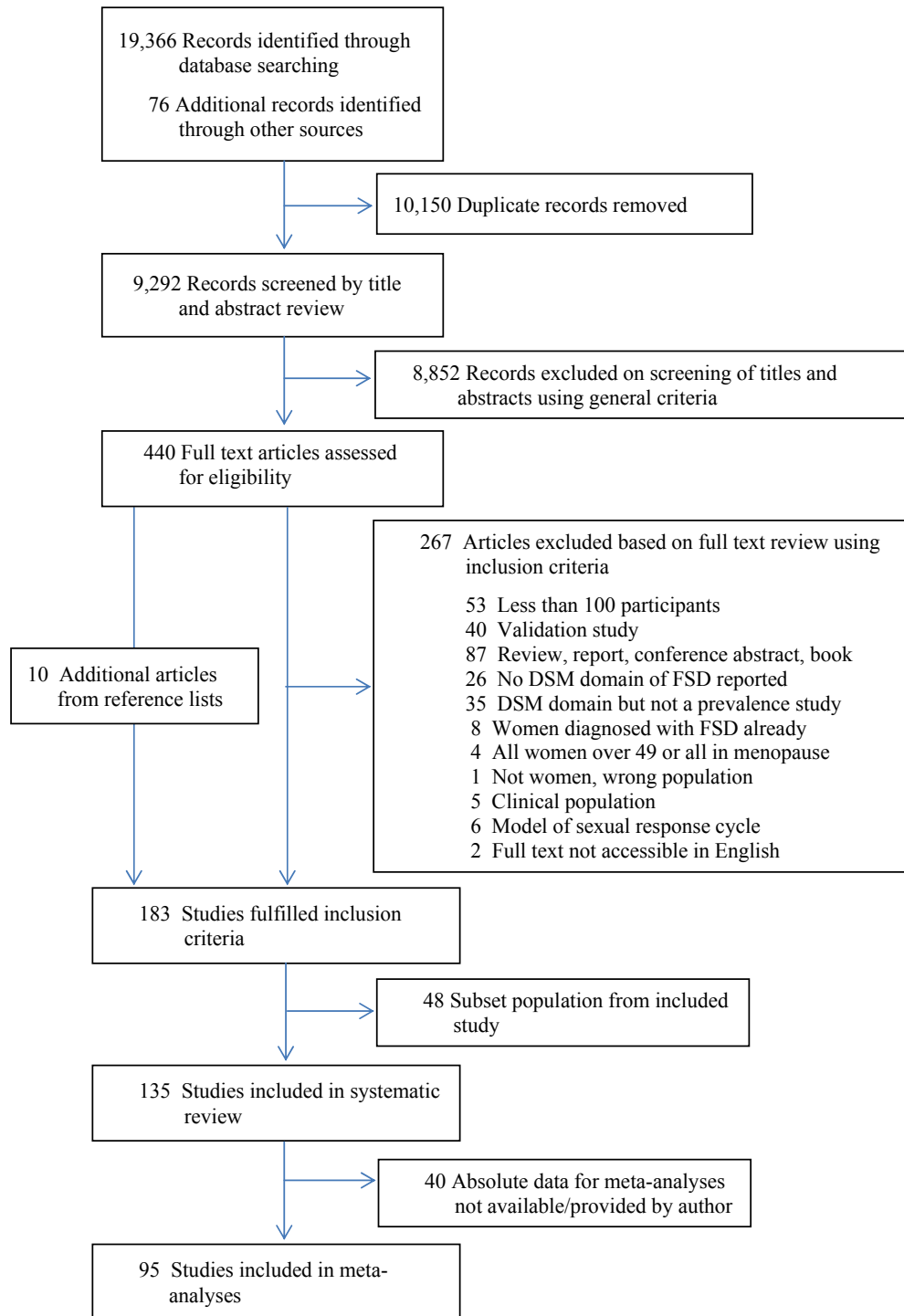
All studies included in the meta-analysis (n = 95) were assessed for their methodologic quality. The risk of bias for these studies is presented in Figure 2. Of the 95 studies, only 2 (1%) were judged as “low risk” on all risks of bias considered. The prevalence rates were judged as reproducible in 77% of the studies. In 37 studies (39%), the population observed was randomly selected or considered representative of the larger population. Fifty-nine studies (62%) used validated measurement tools, and 63 studies (66%) specified the reporting period of the measurement tool. However, 65 studies had a low response rate or did not provide sufficient information about the population of non-responders.

Meta-Analysis and Meta-Regression

Prevalence rates of FSD varied considerably among studies in the quantitative analyses. Wide ranges of prevalence were present in each domain of sexual dysfunction (hypoactive desire disorder, 6%–70%; sexual aversion disorder, 5%–24%; sexual arousal disorder, 1%–60%; lubrication difficulties, 1%–53%; female orgasmic disorder, 8%–72%; pain disorders, 1%–72%). A meta-analysis was performed for FSD and for each domain of FSD except for sexual aversion disorder, because there were not sufficient data for performing further stratification.

Table 2 presents the meta-analytical prevalence rates for FSD and its domains. The prevalence of FSD in premenopausal women was estimated to be 40.9% (95% CI = 37.1–44.7, I² = 99.0%). The quality effects model yielded a similar estimate of 40.4% (95% CI = 33.3–47.0, I² = 99.1%). Prevalence estimates varied in the specific domains of FSD (random effects model): 28.2% reported hypoactive sexual desire disorder (95% CI = 24.1–32.5, I² = 99.5%), 22.6% reported sexual arousal disorder (95% CI = 18.8–26.8, I² = 99.2%), 20.6% reported lubrication difficulties (95% CI = 16.9–24.6, I² = 99.2%), 25.7% reported female orgasmic disorder (95% CI = 22.6–29.0, I² = 99.1%), and 20.8% reported pain disorders (95% CI = 18.3–23.5, I² = 99.2%). Heterogeneity was high (I² < 95%) in all estimates; none of the factors analyzed could decrease heterogeneity substantially (I² ≤ 50%) for any outcome.

Further subgroup analyses showed significantly higher prevalence rates of FSD in Africa and the lowest rates in the non-European West. Studies performed in countries with gender-equal sexual regimes had significantly lower rates of lubrication difficulties, female orgasmic disorder, and pain disorders. This was supported by the correlation of prevalence rates with the Gender Inequality Index (Table 2). In all domains, there was a positive correlation, but a significant, positive correlation was



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Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart showing the number of citations retrieved from a systematic literature search in multiple databases. DSM = *Diagnostic and Statistical Manual and Mental Disorders*; FSD = female sexual dysfunction. Figure 1 is available in color online at www.smr.jsexmed.org.

established in FSD, particularly female orgasmic disorder and pain disorders. Higher rates of sexual dysfunction were reported in studies that used interviews and questionnaires together to collect data. Random sampling and sampling from convenience populations in outpatient settings (convenience clinical) showed prevalence rates of 41%, but populations in the subgroup

“convenience clinical” generally reported higher rates of sexual dysfunction in the individual domains. The validity of the assessment tool was examined, resulting in significantly higher prevalence rates in studies using non-validated tools and significantly lower rates in studies using validated tools. A further subgroup analysis tested the hypothesis that the widely used,

Table 1. Characteristics of included studies (N = 135)

| Categorical variable | n (%) |
|---|------------|
| Study design | |
| Cross-sectional | 134 (99.3) |
| Cohort | 1 (0.07) |
| Sizes of population: premenopausal women* | |
| 00–499 | 55 (47.4) |
| 500–1,999 | 44 (37.9) |
| 2,000–9,999 | 14 (12.1) |
| 10,000–84,644 | 3 (2.6) |
| Region | |
| Europe | 45 (33.3) |
| Non-European West† | 31 (23.0) |
| Asia | 23 (17.0) |
| Central and South America | 12 (8.9) |
| Africa | 11 (8.1) |
| Middle East | 10 (7.4) |
| Global | 3 (2.2) |
| Method of data collection | |
| Paper questionnaire | 70 (51.9) |
| Interview and questionnaire | 23 (17.0) |
| Face-to-face interview | 17 (12.6) |
| Online survey | 14 (10.4) |
| Telephone interview | 9 (6.7) |
| Computer-assisted interview | 2 (1.5) |
| Validation of assessment tool | |
| Yes | 86 (63.7) |
| No or unclear | 49 (36.3) |
| Sampling method | |
| Convenience clinical‡ | 52 (38.5) |
| Random | 50 (37.0) |
| Convenience community | 32 (23.7) |
| Not clearly described | 1 (0.7) |
| Pharmaceutical funding | |
| No | 88 (65.2) |
| Yes | 18 (13.3) |
| Funding not reported | 29 (21.5) |

*N = 116 studies; absolute numbers were missing for 19 studies.

†United States, Canada, South Africa, New Zealand, and Australia.

‡Women who were recruited in non-emergency clinical settings such as obstetric and gynecologic waiting rooms.

validated FSFI might yield different results from other validated assessment tools and non-validated assessment tools. No clear trend was apparent through this analysis. For reporting period, assessment tools that inquired about symptoms in the past month showed significantly lower prevalence rates, whereas studies with reporting periods of 2 to 12 months showed significantly higher rates. Studies that permitted only sexually active women to participate showed generally higher prevalence rates of sexual dysfunction compared with studies that did not exclude women based on their current sexual activity. Prevalence rates in studies with pharmaceutical funding were lower in all domains—in some cases, significantly lower.

No evidence for publication bias could be indicated through the Begg rank correlation test and Egger correlation test. Results from the sensitivity analysis showed no effect by a single study.

DISCUSSION

Prevalence Rates and Heterogeneity of Studies

In light of previous systematic reviews, it is clear that epidemiologic research in FSD has increased substantially during the past few years.^{9–11,168} The systematic literature review (2000–2014) entailed 135 international studies, 95 of which were included in the meta-analysis. This review far exceeds the previous systematic review from West et al¹¹ (1966–2004), which entailed 40 studies in general populations of women. Considering that peer-reviewed publications on FSD only began to increase in approximately 2001,⁴ previous systematic reviews could not provide the breadth and quantity of studies that this review has been able to achieve.

Furthermore, this is the first systematic review to provide an estimate for FSD and the individual domains, because previous systematic reviews could only provide broad ranges for the prevalence of FSD. The meta-analytical estimate of international prevalence studies indicates that 41% of premenopausal women report sexual dysfunction. The prevalence of the individual disorders of sexual dysfunction in premenopausal women ranges from 21% to 28% (hypoactive sexual desire disorder, 28%; female sexual arousal disorder, 23%; lubrication difficulties, 21%; female orgasmic disorder, 26%; pain disorders, 21%). These results are in line with those of Laumann et al's¹³ frequently cited study, which estimated that 43% of women 18 to 59 years old report sexual dysfunction. The estimated prevalence rates for the various sexual disorders also were close to the ranges determined by Laumann et al for women 18 to 49 years old: 30% to 32% lacked interest in sex, 18% to 21% had lubrication difficulties, 22% to 28% could not achieve orgasm, and 13% to 21% experienced pain during intercourse.

Substantial heterogeneity in population studies (eg, study design, classifications of disorder, assessment tools, reporting period, cutoffs, funding, etc) hindered authors of previous systematic reviews on FSD from establishing a prevalence estimate.^{9–11} Meta-analyses provide a tool by which prevalence rates can be quantified, yet heterogeneity is the main challenge in these types of analyses.²⁸ An I^2 greater than 95% is not uncommon in meta-analytical estimates of prevalence rates.²⁸ Subgroup analyses can provide possible explanations for the heterogeneous results, as can weighing the studies according to their quality (quality effects model). Thus, in addition to using stratification by subgroups, quality effects, and random effects methods, the authors performed multiple tests for biases including a risk of bias evaluation, correlation tests for publication bias, and sensitivity analyses. The methodologic assessment indicates that a risk of bias might be present in several studies owing to the non-representativeness of the populations. This

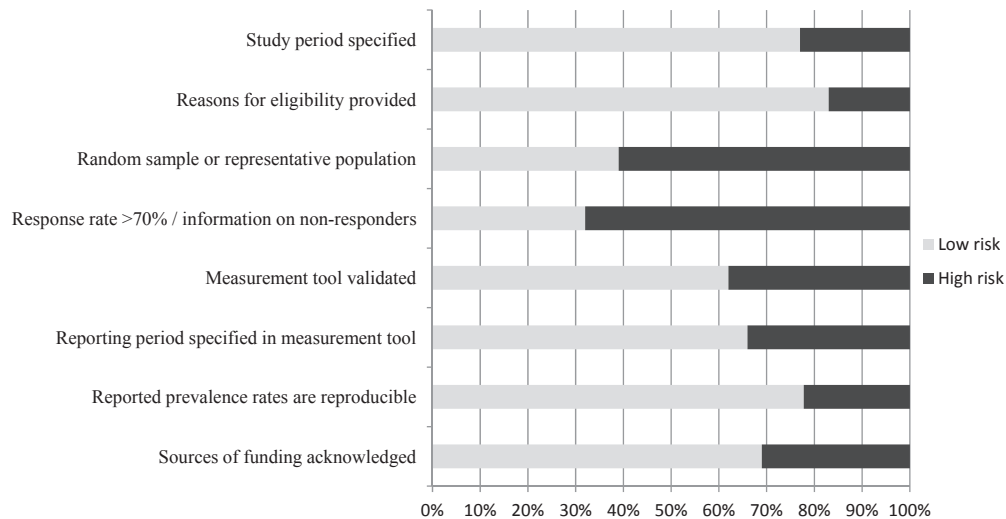


Figure 2. Risk of bias of included studies ($n = 95$) Studies identified as “low risk” provided the necessary information to fulfill a specific quality criterion. Studies identified as “high risk” did not provide sufficient information to make a conclusion or did not fulfill the specific quality criterion.

underlines the need for improved population sampling to avoid non-response biases and to compensate for the probability of selection biases among subgroups.

Analysis of Factors

Worldwide, African studies reported significantly higher rates of FSD, whereas lower rates of sexual dysfunction were found in Europe and the non-European West. Several countries in these regions are considered to have gender-equal sexual regimes: Austria, Belgium, France, Germany, Spain, Sweden, the United Kingdom, Mexico, Australia, Canada, New Zealand, South Africa, and the United States. In gender-equal sexual regimes, prevalence estimates often were significantly lower than in Asian countries (China, Japan, and Thailand) and countries with male-centered sexual regimes (Egypt, Italy, Morocco, Brazil, Malaysia, and Turkey).³⁴ Particularly in male-dominated cultures, where sex might be viewed only as a method for procreation, women’s sexual needs and pleasure are suppressed.¹⁰⁰ Extreme cases of this can be seen in African studies in which factors such as female genital mutilation, polygamy, and rape by the partner were significant risk factors for FSD.^{69,75,121} High rates of FSD also were found in Asian countries, as seen in subgroups “region” and “sexual regime.” In these cultures, a different mechanism is at work. Women who do not conform to traditional female roles can experience greater difficulties.¹⁰⁰ Higher education leads to increased awareness of sexual needs and rights; thus, highly educated women in Asia tend to feel more disappointment with sexual relationships, which can lead to poor sexual functioning.^{63,142} A correlation could be seen between the Gender Inequality Index and prevalence rates (Table 2). For FSD, female orgasmic disorder and pain disorders, a significant positive correlation was found between increasing gender inequality scores (country scores of 0–1, with 1 being the greatest inequality) and

increasing prevalence rates in a country. However, this correlation was not evident with hypoactive sexual desire disorder; in fact, prevalence rates of desire disorder were comparatively high in gender-equal sexual regimes and in Europe and the non-European West. In egalitarian societies such as these, correlates such as full-time employment and housework imbalance with a partner have been shown to be predictors of low sexual interest or decreased sexual desire in women.^{137,152} Although it is not possible to draw conclusions about the causal association of gender (in)equality with sexual dysfunction, global studies have found that sexual functioning, emotional pleasure, and physical pleasure are rated higher in countries with greater gender equality; this holds true for women’s and for men’s sexual well-being.³⁴

Study design was another major focus of this systematic review. Similarly to previous systematic reviews, many assessment tools were used to measure FSD; 49 of 135 (36%) had unclear validity. The validated FSFI from Rosen et al¹⁹ was the most frequently used assessment tool, yet even studies using the FSFI applied various and/or non-validated cutoffs such as median values or lowest quartile. Subgroup analyses did not show clear differences between validated and non-validated instruments or greater precision with the use of the FSFI, as seen in the wide CIs. Thus, the large span in prevalence rates across studies might not reflect real differences, but might be due to the different tools and cutoffs that were used.¹⁶⁹ Furthermore, there was great variation in the reporting period. The FSFI asked about any symptoms in the past month, whereas other studies queried about symptoms in the past 3 months, 6 months, 12 months, or ever. Hayes et al¹⁷⁰ documented that even very minor differences in the reporting period have an impact on prevalence rates. Higher rates of sexual dysfunction were reported in studies that used interviews and questionnaires together to collect data.

Table 2. Prevalence estimates of FSD by factors of study design (n = 95)

| Factors | Studies, n | FSD, % (95% CI) | Desire, % (95% CI) | Arousal, % (95% CI) | Lubrication, % (95% CI) | Orgasm, % (95% CI) | Pain, % (95% CI) |
|---------------------------------------|------------|-------------------------------|--------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Total (QE) | 95* | 40.4 (33.9–47.0) | 26.4 (20.0–33.3) | 15.4 (9.9–21.8) | 16.3 (11.6–21.6) | 20.9 (16.1–26.1) | 14.4 (7.3–23.4) |
| Total (RE) | 95* | 40.9 (37.1–44.7) | 28.2 (24.1–32.5) | 22.6 (18.8–26.8) | 20.6 (16.9–24.6) | 25.7 (22.6–29.0) | 20.8 (18.3–23.5) |
| Meta-regression Gill score slope (SE) | 93 | 1.56 (0.65) | 0.40 (0.71) | 1.55 (0.910) | 0.96 (0.95) | 1.42 (0.55) | 1.93 (0.59) |
| <i>P</i> value | | .020 | .577 | .094 | .320 | .0012 | .002 |
| Region | | | | | | | |
| Europe | 36 | 39.1 (28.8–49.8) | 27.0 (20.2–34.5) | 16.3 (12.8–20.0) [†] | 21.4 (17.5–25.5) | 16.9 (12.8–21.4) | 39.1 (28.8–49.8) |
| Non-European West | 18 | 32.1 (21.1–44.2) | 27.9 (18.9–37.9) | 15.5 (8.8–23.6) | 16.5 (8.4–26.7) | 17.1 (10.1–25.5) | 13.1 (8.6–18.3) |
| Asia | 17 | 40.2 (31.4–49.4) | 26.1 (20.6–32.1) | 32.7 (25.8–40.0) | 26.5 (17.9–36.0) | 27.5 (19.5–36.3) | 22.1 (16.7–28.0) |
| Central and South America | 10 | 45.5 (30.2–61.2) | 28.6 (14.8–44.7) | 34.6 (11.8–61.3) | 45.5 (30.2–61.2) | 27.1 (12.9–43.9) | 26.6 (18.0–36.2) |
| Africa | 6 | 61.7 (48.6–74.0) [†] | 26.2 (01.2–62.9) | 21.2 (01.2–51.9) | - | 52.6 (39.1–65.9) [†] | 31.6 (16.5–48.8) |
| Middle East | 8 | 47.0 (36.5–57.7) | 38.8 (16.2–63.9) | 32.5 (16.8–50.3) | 25.4 (13.6–39.4) | 29.9 (23.3–36.9) | 35.3 (23.9–47.6) [†] |
| Type of sexual regime | | | | | | | |
| Gender equal | 37 | 34.7 (28.1–41.7) | 24.8 (18.6–31.4) | 11.0 (08.1–14.3) | 13.5 (09.1–18.6) [†] | 16.8 (13.5–20.5) [†] | 12.1 (08.6–16.1) [†] |
| Asian | 9 | 49.8 (37.0–62.7) | 22.1 (16.8–27.9) | 27.4 (23.3–31.7) [†] | 25.4 (14.8–37.6) | 25.4 (15.1–37.4) | 16.8 (09.2–26.0) |
| Male centered | 15 | 34.6 (26.3–43.3) | 36.0 (21.4–51.9) | 39.3 (32.2–46.7) [†] | 37.2 (29.7–45.1) [†] | 31.6 (22.7–41.3) | 35.0 (30.0–40.2) [†] |
| Method of data collection | | | | | | | |
| Paper questionnaire | 51 | 37.3 (30.7–44.1) | 26.2 (20.5–32.2) | 24.0 (18.5–30.0) | 21.7 (15.1–29.0) | 24.6 (19.1–30.6) | 22.0 (17.2–27.2) |
| Interview and questionnaire | 16 | 53.2 (46.1–60.3) [†] | 38.0 (31.4–44.8) | 24.2 (13.5–36.7) | 23.7 (12.9–36.5) | 36.0 (27.3–45.2) [†] | 26.0 (18.9–33.9) |
| Face-to-face interview | 9 | 43.5 (37.3–49.8) | 25.1 (16.5–34.8) | 22.9 (09.4–39.8) | 17.1 (11.1–24.2) | 24.8 (17.7–32.7) | 22.6 (17.2–28.4) |
| Online survey | 10 | 37.3 (31.6–43.2) | 25.5 (16.1–36.3) | 16.5 (07.4–28.2) | 16.3 (00.0–43.9) | 21.0 (16.1–26.5) | 12.7 (04.8–23.5) |
| Telephone interview | 7 | 26.0 (03.4–57.2) | 33.9 (12.1–59.6) | 10.6 (8.5–13.1) | 18.5 (9.5–29.5) | 14.5 (5.2–27.1) | 8.2 (1.5–18.6) |
| Computer-assisted interview | 2 | - | - | - | - | 18.7 (1.0–46.7) | - |
| Sampling method | | | | | | | |
| Random | 33 | 41.3 (33.8–48.9) | 27.7 (20.8–35.1) | 14.0 (10.2–18.4) | 16.9 (12.3–22.0) | 21.7 (17.0–26.8) | 15.5 (12.5–18.7) [†] |
| Convenience clinical | 37 | 41.2 (34.9–47.6) | 32.2 (24.4–40.6) | 29.5 (23.5–35.9) | 23.0 (17.7–28.7) | 29.6 (25.4–33.9) | 27.0 (22.5–31.6) [†] |
| Convenience community | 25 | 39.6 (31.8–47.7) | 23.1 (18.4–28.2) | 19.2 (11.1–29.0) | 21.1 (05.5–42.1) | 23.9 (18.2–30.2) | 17.2 (09.6–26.2) |
| Validation of assessment tool | | | | | | | |
| Yes | 62 | 37.3 (33.3–41.3) [†] | 26.6 (21.9–31.5) | 22.7 (18.3–27.4) | 22.1 (17.2–27.4) | 23.8 (20.1–27.6) | 21.3 (16.9–26.0) |
| No or unclear | 33 | 54.7 (46.6–62.7) [†] | 31.3 (23.4–39.7) | 22.3 (13.9–31.9) | 16.3 (11.0–22.3) | 29.9 (25.0–35.0) | 20.1 (16.8–23.7) |
| Assessment tool | | | | | | | |

(continued)

Table 2. Continued

| Factors | Studies, n | FSD, % (95% CI) | Desire, % (95% CI) | Arousal, % (95% CI) | Lubrication, % (95% CI) | Orgasm, % (95% CI) | Pain, % (95% CI) |
|---------------------------------------|------------|-------------------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|-------------------------------|
| FSFI | 31 | 36.3 (30.7–42.2) | 31.3 (20.8–42.9) | 27.0 (19.1–35.6) | 26.5 (18.2–35.6) [†] | 28.3 (21.5–35.7) | 24.9 (17.5–33.2) |
| Other validated tool | 31 | 38.9 (32.4–45.6) | 21.8 (17.5–26.4) | 14.6 (11.6–17.9) | 14.3 (10.3–18.7) | 18.4 (15.1–22.0) | 18.0 (13.0–23.7) |
| Non-validated tool | 33 | 54.7 (46.6–62.7) [†] | 31.3 (23.4–39.7) | 22.3 (13.9–31.9) | 16.3 (11.0–22.3) | 29.9 (25.0–35.0) | 20.1 (16.8–23.7) |
| Reporting period | | | | | | | |
| Past month | 40 | 34.9 (29.4–40.6) [†] | 29.9 (20.7–39.9) | 25.7 (18.7–33.3) | 25.4 (18.1–33.3) | 26.9 (20.7–33.6) | 23.2 (16.6–30.5) |
| Past 2–12 mo | 26 | 50.0 (46.1–53.9) [†] | 28.8 (21.8–36.4) | 18.4 (09.5–29.3) | 16.2 (12.2–20.5) | 23.3 (19.4–27.4) | 17.3 (13.8–21.2) |
| Not specified | 29 | 46.9 (37.6–56.3) | 24.7 (19.3–30.5) | 19.3 (14.2–25.1) | 13.1 (09.4–17.2) | 27.1 (19.8–35.0) | 22.0 (17.0–27.5) |
| Inclusion criteria | | | | | | | |
| Current sexual activity not specified | 34 | 36.6 (30.3–43.1) | 23.5 (17.6–30.0) | 15.7 (11.8–19.9) | 18.9 (13.4–25.0) | 21.9 (17.3–26.8) | 15.3 (11.3–19.9) [†] |
| Sexually active or only married women | 61 | 41.5 (36.9–46.2) | 31.2 (26.1–36.6) | 25.9 (20.1–32.3) | 21.5 (16.2–27.3) | 27.6 (23.5–31.9) | 23.7 (20.2–27.3) [†] |
| Pharmaceutical funding | | | | | | | |
| No | 58 | 43.2 (38.5–48.0) | 33.6 (26.7–40.8) [†] | 25.1 (19.1–31.6) | 21.0 (16.4–25.9) | 27.9 (23.5–32.5) | 43.2 (38.5–48.0) |
| Yes | 17 | 32.4 (22.1–43.7) | 18.0 (12.6–24.2) [†] | 10.1 (9.6–10.6) | 18.7 (10.5–28.6) | 16.2 (10.8–22.3) [†] | 14.8 (8.3–22.6) |
| Not reported | 20 | 40.3 (33.2–47.6) | 25.7 (20.0–31.9) | 20.8 (13.3–29.4) | 20.1 (14.2–26.7) | 26.0 (20.4–31.9) | 18.6 (12.1–26.1) |

FSD = female sexual dysfunction; FSFI = Female Sexual Function Index; GII = Gender Inequality Index; QE = quality effects; RE = random effects; SE = standard error.

*Number of studies included in analysis for each domain: FSD, n = 53; desire, n = 62; arousal, n = 39; lubrication, n = 36; orgasm, n = 53; pain, n = 65.

[†] $p < .05$.

However, the 9 of 16 studies in this subset were performed in the Middle East and Africa and had prevalence rates as high as 76.2%.

Approximately two-thirds of studies in the meta-analysis required women to have been sexually active in the past year. Excluding women based on sexual activity could create a bias in that these non-sexually active women might not engage in intercourse because of their sexual disorder.¹¹⁰ Furthermore, some studies in Middle Eastern and African countries and India only allowed married women to participate. However, recent studies in these countries have shown that the restrictions surrounding marriage are loosening and women's sexual freedom is increasing.¹⁷¹⁻¹⁷³ Thus, studies including only married women might not clearly represent women's sexual health in the general population.

The final factor that was assessed in this meta-analysis was the impact of pharmaceutical funding on prevalence rates, because it has been shown that industry-sponsored research tends to yield pro-industry conclusions.¹⁷⁴ In 2003, as research on women's sexual health was beginning to gain momentum, the article "The making of a disease: female sexual dysfunction" by Moynihan¹² accused pharmaceutical companies and clinicians and researchers of fabricating an illness. However, this analysis clearly showed that studies with pharmaceutical funding had consistently lower prevalence rates than those not funded by pharmaceutical companies or those studies that did not report funding sources. The studies in this subset were primarily from Europe and the non-European West, which generally had lower—but not necessarily significantly lower—prevalence rates. Studies funded by pharmaceutical companies used validated questionnaires 70% of the time, as did those not funded by pharmaceutical companies (funding not reported 45% of the time). Pharmaceutically funded studies used random sampling methods more often than did those without funding or without reported funding (53% vs 36% and 15%, respectively). At closer examination of prevalence rates of hypoactive sexual desire disorder and orgasmic disorder, which were significantly lower, studies funded by pharmaceutical companies achieved larger numbers of participants per study. Furthermore, these studies had higher study quality and fewer biases compared with studies without pharmaceutical funding or without reported funding. Thus, the results of this analysis suggest that the prevalence rates provided through studies with pharmaceutical funding might be more robust than those without pharmaceutical funding.

Limitations of Included Studies

Although Spector and Carey¹⁰ urged researchers to find a common classification system for sexual dysfunction, classification of FSD remains problematic.^{12,175,176} Basic terminology proved to be inconsistent across publications. The terms *sexual difficulties*, *sexual problems*, *sexual health issues*, *FSD symptoms*, and *sexual disability* were used interchangeably with *sexual*

dysfunction. Thus, it is clear that more standardization is needed "so that professionals can better compare and evaluate the literature using a common argot."¹⁰

Few publications in the present study assessed distress over sexual problems (10 of 95 studies in the meta-analysis, 11 of 135 in the literature review). Experts have argued that sexually related personal distress is a fundamental component of sexual disorders.^{26,176} Indeed, several studies have shown that the inclusion of personal distress yields lower prevalence rates of FSD in population studies.²³⁻²⁵ Owing to the scarcity of studies in this systematic review that assessed personal distress, the authors could not account for this variable. Once again, this illustrates the need for greater consistency and standardization in the assessment of sexual function in general populations.

A potential reporting bias within the studies should be mentioned. Several researchers indicated that the women in their studies (particularly in conservative cultures) might have been too shy to speak about sexual matters.^{63,105,125} This could have resulted in an under-reporting of symptoms. Conversely, over-reporting might have occurred in populations in which women are more open and more interested in talking about their sexuality.¹⁴⁸ Social acceptability also can affect responses. For example, in some Asian cultures, desiring sex as a woman is associated with infidelity.¹⁰⁵ In contrast, in Western cultures, sexual impulses are welcomed and the lack thereof is perceived as a dysfunction.¹⁷⁷

Limitations of Systematic Review

The present systematic review provides an analysis of factors that, based on previous systematic reviews, appeared to be pertinent to prevalence rates. Further factor analyses and subgroup classifications are certainly possible, yet these would exceed the scope of this particular review.

There were three limitations of the present systematic review. The literature search was limited to publications in English, decreasing the number of studies that might have been included. The present review also focused on women no older than 49 years; a review that included older women could have yielded different results, because sexual dysfunction has been shown to be related to age.² Because nearly all studies were cross-sectional studies, it is not possible to draw conclusions as to the causal associations of the investigated factors with sexual dysfunction.

CONCLUSIONS

This systematic review of the literature (2000–2014) and meta-analysis of 95 international studies showed that 41% of premenopausal women report FSD. These findings coincide with previous findings yet provide a far more robust estimate of the prevalence of FSD and the individual sexual disorders, while taking key factors of study design into account.

Considering that two of five of premenopausal women report some form of sexual dysfunction, all medical professionals need to take an active role in addressing sexual dysfunction with each patient across medical subspecialties. To corroborate these findings, future research should focus on conducting longitudinal studies with representative populations, comprehensive assessment of relevant cofactors, and validated assessment tools and cutoffs. Further studies are needed to understand better sexual dysfunction in women living in conservative cultures, women with bisexual and homosexual preferences, and adolescents.

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SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.sxmr.2016.03.002>.