Top 100 Cited Papers on Premenstrual Syndrome/Premenstrual Dysphoric Disorder: A Bibliometric Study

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Background: Premenstrual syndrome/premenstrual dysphoric disorder is a serious condition affecting women worldwide, causing clinically significant distress or interference. Therefore, solving these diseases has become the utmost concern worldwide, culminating in numerous studies. In this study, we performed bibliometric analysis on the 100 most cited papers with the aim of identifying research hot spots and trends in this field.

Methods: We screened the Science Citation Index Expanded (SCIE) of Web of Science (WOS) to identify the top 100 cited studies on PMS/PMDD. Next, we analyzed relevant literature from various journals, countries/regions, institutions, authors, and keywords. Finally, we used VOSviewer and Citespace software to generate knowledge maps and identify hot spots and trends.

Results: The top 100 highly cited studies were published in 55 journals, between 1999 and 2017, across 24 countries/regions around the world. Most articles were published in Obstetrics and Gynecology, whereas Psych neuroendocrinology had the largest average number of citations per paper. The United States had the highest number of publications, followed by England, Canada, and Sweden. The top three institutions that published the highly cited literature were the University of Pennsylvania, Yale University, and National Institute of Mental Health (NIMH). Obstetrics, Gynecology, Psychiatry, and Reproductive Biology were the main research directions, whereas the top 10 Co-occurrence of Keywords included double-blind, fluoxetine, efficacy, prevalence, epidemiology, phase sertraline treatment, depression, progesterone, placebo, and placebo-controlled trial. Results from cluster analysis indicated that more comprehensive epidemiology and steroid pathogenesis have gradually become the hot spots and trends.
INTRODUCTION

Premenstrual dysphoric disorder (PMDD), a severe form of premenstrual syndrome (PMS), refers to a condition in which women of childbearing age exhibit periodic symptoms of discomfort, emotion, and physical disorders in the luteal phase, which deeply affect the patients’ ability to study, and work as well as quality of life (1–5). Clinically, PMS/PMDD not only brings a substantial burden on both physical and mental aspects of life (6, 7) but also predisposes affected individuals to depression and bipolar disorders (8–10). Recent studies have demonstrated that some PMDD patients are suicidal, as evidenced by the fact that nearly 40% of PMDD women reported suicidal ideation (11, 12).

Published articles on PMS/PMDD date back to 1950 (13). In the past 60 years, researchers have made significant progress on PMS/PMDD, a phenomenon that is still ongoing (14). However, it is difficult to grasp the development overview and trend of PMS/PMDD research field, and scientific analysis of bibliometrics is urgently needed.

Knowledge on the top 100 cited papers may generate an understanding into the current focus of researchers. Bibliometric analysis, an effective method for analyzing literature, enhances researchers’ understanding of a particular research area (15). In this study, we adopted bibliometric analysis to identify the top 100 cited papers on PMS/PMDD, and determined the trends in research on this topic from a perspective different from the previous research (14), which will promote the development of this research field and promote the basic research to gain new discoveries.

MATERIALS AND METHODS

Data Sources and Search Strategies

Data were obtained from the Science Citation Index Expanded (SCI-E) database in the Web of Science Core Collection (WoSCC) (1). The literature search was framed as follows: (TI = (Premenstrual Syndrome) OR TI = (Premenstrual Dysphoric Disorder) OR TI = (late luteal phase dysphoric disorder) referring to related retrieval strategy (16). The range of article publication dates range was set from inception of the database to April 8th, 2022. No limitations were applied with regards to either the year of publication or language.

Inclusion and Exclusion Criteria

Papers were displayed in descending order, based on the number of citations. Where necessary, two independent researchers identified the 100 most-cited papers after reading the titles, abstracts, and full texts. Conference papers and studies in which PMS/PMDD was not the central topic were excluded. Any disagreement, between the researchers, was resolved through discussion and consensus with a third researcher.

RESULTS

Citation Characteristics of the Included Articles

A total of 1,135 documents were initially retrieved from WoSCC. The list was arranged in descending order of citations, and the top 100 cited papers selected as listed in Table 1. The total number of citations for these 100 papers was 9,675 (median = 96.75) and frequency distribution of citations by year could be seen in Figure 1. The top 100 papers had 3821 references, with an h-index of 68. The most frequently cited articles included “The prevalence, impairment, impact, and burden of premenstrual dysphoric disorder (PMS/PMDD)” (17) by Halbreich, U (431 citations), followed by “Prevalence, incidence, and stability of premenstrual dysphoric disorder in the community” (355 citations) (18), “Cortical gamma-aminobutyric acid levels across the menstrual cycle in healthy women and those with premenstrual dysphoric disorder—A proton magnetic resonance spectroscopy study” (257 citations) (19), “Efficacy of a new low-dose oral contraceptive with drospirenone in premenstrual dysphoric disorder” (226 citations) (20) and “Efficacy of selective serotonin-reuptake inhibitors in premenstrual syndrome: a systematic review” (218 citations) (21). The abovementioned articles have been cited more than 200 times.

Year and Types of Publication

The distribution of publications by year is illustrated using a histogram in Figure 2. The top 100 cited papers on PMS/PMDD were published between 1999 and 2017, although articles published between 2018 and 2022 were not included in the

Conclusion: These findings demonstrated that bibliometric analysis can intuitively and rapidly reveal the frontiers and hot spots of research in PMS/PMDD. Notably, epidemiology, steroid pathogenesis, GABAA receptor delta subunits, and double-blind placebo-controlled trials are potential areas of focus for future research.

Keywords: bibliometric analysis, citations, premenstrual syndrome, trends, PMDD
TABLE 1: The 100 most cited papers in PMS/PMDD until 2022.

| Rank | Title | First author | Journal | Year | Total citation | Average citation by year |
|------|-------|--------------|---------|------|----------------|--------------------------|
| 1    | The prevalence, impairment, impact, and burden of premenstrual dysphoric disorder (PMS/PMDD) | Halbreich, U | PSYCHONEUROENDOCRINOLOGY | 2003 | 431 | 21.55 |
| 2    | Prevalence, incidence and stability of premenstrual dysphoric disorder in the community | Wittchen, HU | PSYCHOLOGICAL MEDICINE | 2002 | 354 | 16.86 |
| 3    | Premenstrual syndrome | Yonkers | LANCET | 2008 | 257 | 17.13 |
| 4    | Cortical gamma-aminobutyric acid levels across the menstrual cycle in healthy women and those with premenstrual dysphoric disorder—a proton magnetic resonance spectroscopy study | Epperson, CN | ARCHIVES OF GENERAL PSYCHIATRY | 2002 | 257 | 12.24 |
| 5    | Efficacy of a new low-dose oral contraceptive with drospirenone in premenstrual dysphoric disorder | Yonkers, KA | OBSTETRICS AND GYNECOLOGY | 2005 | 226 | 12.56 |
| 6    | Efficacy of selective serotonin-reuptake inhibitors in premenstrual syndrome: a systematic review | Dimmock, PW | LANCET | 2000 | 218 | 9.48 |
| 7    | Allopregnanolone levels and reactivity to mental stress in premenstrual dysphoric disorder | Girdler, SS | BIOLOGICAL PSYCHIATRY | 2001 | 190 | 8.84 |
| 8    | The etiology, biology, and evolving pathology of premenstrual syndromes | Halbreich, U | PSYCHONEUROENDOCRINOLOGY | 2003 | 180 | 9 |
| 9    | Treatment of premenstrual dysphoric disorder with a new drospirenone-containing oral contraceptive formulation | Pearlstein, TB | CONTRACEPTION | 2005 | 177 | 9.83 |
| 10   | Efficacy of vitamin B-6 in the treatment of premenstrual syndrome: systematic review | Wyatt, KM | BMJ-BRITISH MEDICAL JOURNAL | 1999 | 167 | 6.96 |
| 11   | Treatment for the premenstrual syndrome with agnus castus fruit extract: prospective, randomized, placebo controlled study | Schellenberg, R | BRITISH MEDICAL JOURNAL | 2001 | 163 | 7.41 |
| 12   | Premenstrual dysphoric disorder: evidence for a new category for DSM-5 | Epperson, C | AMERICAN JOURNAL OF PSYCHIATRY | 2012 | 161 | 14.64 |
| 13   | Premenstrual syndrome and premenstrual dysphoric disorder: definitions and diagnosis | Freeman, EW | PSYCHONEUROENDOCRINOLOGY | 2003 | 157 | 7.85 |
| 14   | Allopregnanolone concentrations and premenstrual syndrome | Monteleone, P | EUROPEAN JOURNAL OF ENDOCRINOLOGY | 2000 | 153 | 6.65 |
| 15   | Biological, social, and behavioral factors associated with premenstrual syndrome | Deuster, PA | ARCHIVES OF FAMILY MEDICINE | 1999 | 152 | 6.33 |
| 16   | Premenstrual syndrome | Dickerson, LM | AMERICAN FAMILY PHYSICIAN | 2003 | 143 | 7.15 |
| 17   | Differential response to antidepressants in women with premenstrual syndrome/premenstrual dysphoric disorder—A randomized controlled trial | Freeman, EW | ARCHIVES OF GENERAL PSYCHIATRY | 1999 | 130 | 5.42 |
| 18   | A review of treatment of premenstrual syndrome & premenstrual dysphoric disorder | Rapkin, A | PSYCHONEUROENDOCRINOLOGY | 2003 | 129 | 6.45 |
| 19   | Prevalence and predictors of premenstrual dysphoric disorder (PMDD) in older premenopausal women—the harvard study of moods and cycles | Cohen, LS | JOURNAL OF AFFECTIVE DISORDERS | 2002 | 126 | 6 |
| 20   | Is premenstrual dysphoric disorder a distinct clinical entity? | Endicott, J | JOURNAL OF WOMENS HEALTH & GENDER-BASED MEDICINE | 1999 | 119 | 4.96 |
| 21   | Differential menstrual cycle regulation of hypothalamic-pituitary-adrenal axis in women with premenstrual syndrome and controls | Roca, CA | JOURNAL OF CLINICAL ENDOCRINOLOGY & METABOLISM | 2003 | 118 | 5.9 |

(Continued)
| Rank | Title                                                                 | First author         | Journal                                      | Year | Total citation | Average citation by year |
|------|------------------------------------------------------------------------|----------------------|----------------------------------------------|------|----------------|--------------------------|
| 22   | Evaluation of a unique oral contraceptive in the treatment of premenstrual dysphoric disorder | Freeman, EW          | JOURNAL OF WOMENS HEALTH & GENDER-BASED MEDICINE | 2001 | 118            | 5.36                     |
| 23   | Clinical diagnostic criteria for premenstrual syndrome and guidelines for their quantification for research studies | Halbreich, Uriel     | GYNECOLOGICAL ENDOCRINOLOGY                  | 2007 | 116            | 7.25                     |
| 24   | The role of hormones and hormonal treatments in premenstrual syndrome | Backstrom, T         | CNS DRUGS                                    | 2003 | 112            | 5.6                      |
| 25   | Calcium and vitamin D intake and risk of incident premenstrual syndrome | Bertone-Johnson, ER  | ARCHIVES OF INTERNAL MEDICINE               | 2005 | 106            | 5.89                     |
| 26   | Changes in mood, cognitive performance and appetite in the late luteal and follicular phases of the menstrual cycle in women with and without PMDD (premenstrual dysphoric disorder) | Reed, Stephanie Collins | HORMONES AND BEHAVIOR                         | 2008 | 104            | 6.93                     |
| 27   | Premenstrual daily fluoxetine for premenstrual dysphoric disorder: a placebo-controlled, clinical trial using computerized diaries | Cohen, LS            | OBSTETRICS AND GYNECOLOGY                    | 2002 | 104            | 4.95                     |
| 28   | Crocus sativus L. (saffron) in the treatment of premenstrual syndrome: a double-blind, randomized and placebo-controlled trial | Agha-Hosseini, M     | BJOG-AN INTERNATIONAL JOURNAL OF OBSTETRICS AND GYNAECOLOGY | 2008 | 102            | 6.8                      |
| 29   | Psychosocial functioning in women with premenstrual dysphoric disorder before and after treatment with sertraline or placebo | Pearlstein, TB       | JOURNAL OF CLINICAL PSYCHIATRY              | 2000 | 101            | 4.39                     |
| 30   | Risk factors for premenstrual dysphoric disorder in a community sample of young women: the role of traumatic events and posttraumatic stress disorder | Perkonigg, A         | JOURNAL OF CLINICAL PSYCHIATRY              | 2004 | 100            | 5.26                     |
| 31   | Selective serotonin reuptake inhibitors for premenstrual syndrome | Marjoribanks, Jane   | COCHRANE DATABASE OF SYSTEMATIC REVIEWS      | 2013 | 99             | 9.9                      |
| 32   | Health and economic impact of the premenstrual syndrome | Borenstein, JE       | JOURNAL OF REPRODUCTIVE MEDICINE            | 2003 | 99             | 4.95                     |
| 33   | Premenstrual syndrome, premenstrual dysphoric disorder, and beyond: a clinical primer for practitioners | Johnson, SR          | OBSTETRICS AND GYNECOLOGY                    | 2004 | 97             | 5.11                     |
| 34   | Oral contraceptives containing drospirenone for premenstrual syndrome | Lopez, Laureen M     | COCHRANE DATABASE OF SYSTEMATIC REVIEWS      | 2012 | 96             | 8.73                     |
| 35   | Risk for premenstrual dysphoric disorder is associated with genetic variation in ESR1, the estrogen receptor alpha gene | Huo, Liang           | BIOLOGICAL PSYCHIATRY                       | 2007 | 93             | 5.81                     |
| 36   | Physiological changes during carbon dioxide inhalation in patients with panic disorder, major depression, and premenstrual dysphoric disorder—evidence for a central fear mechanism | Gorman, JM           | ARCHIVES OF GENERAL PSYCHIATRY              | 2001 | 92             | 4.18                     |
| 37   | Toward a functional neuroanatomy of premenstrual dysphoric disorder | Protopopescu, Xenia   | JOURNAL OF AFFECTIVE DISORDERS              | 2008 | 90             | 6                        |
| 38   | Premenstrual syndrome and premenstrual dysphoric disorder | Braverman, Paula K.  | JOURNAL OF PEDIATRIC AND ADOLESCENT GYNECOLOGY | 2007 | 90             | 5.63                     |
| 39   | The effectiveness of GnRH-a with and without ‘add-back’ therapy in treating premenstrual syndrome: a meta analysis | Wyatt, KM            | BJOG-AN INTERNATIONAL JOURNAL OF OBSTETRICS AND GYNAECOLOGY | 2004 | 90             | 4.74                     |
| 40   | Premenstrual dysphoric disorder: burden of illness and treatment update | Pearlstein, Teri     | JOURNAL OF PSYCHIATRY & NEUROSCIENCE         | 2008 | 89             | 5.93                     |
| 41   | Efficacy of intermittent, luteal phase sertraline treatment of premenstrual dysphoric disorder | Halbreich, U         | OBSTETRICS AND GYNECOLOGY                    | 2002 | 89             | 4.24                     |
| Rank | Title                                                                 | First author | Journal                                   | Year | Total citation | Average citation by year |
|------|----------------------------------------------------------------------|--------------|-------------------------------------------|------|----------------|--------------------------|
| 42   | Gonadal steroid regulation of mood: the lessons of premenstrual syndrome | Rubinow, David R. | FRONTIERS IN NEUROENDOCRINOLOGY          | 2006 | 87            | 5.12                     |
| 43   | Prevalence of premenstrual syndrome and premenstrual dysphoric disorder in Japanese women | Takeda, T. | ARCHIVES OF WOMENS MENTAL HEALTH          | 2006 | 87            | 5.12                     |
| 44   | Efficacy of progesterone and progestogens in management of premenstrual syndrome: systematic review | Wyatt, K | BRITISH MEDICAL JOURNAL                   | 2001 | 81            | 3.68                     |
| 45   | Pretreatment pattern of symptom expression in premenstrual dysphoric disorder | Pearlstein, T | JOURNAL OF AFFECTIVE DISORDERS            | 2005 | 80            | 4.44                     |
| 46   | How does premenstrual dysphoric disorder relate to depression and anxiety disorders? | Landen, M | DEPRESSION AND ANXIETY                    | 2003 | 80            | 4.44                     |
| 47   | Prevalence of menstrual cycle symptoms and premenstrual dysphoric disorder in a random sample of women using and not using oral contraceptives | Sveindottir, H | ACTA OBSTETRICIA ET GYNECOLOGICA SCANDINAVICA | 2000 | 80            | 3.48                     |
| 48   | Luteal phase sertraline treatment for premenstrual dysphoric disorder—results of a double-blind, placebo-controlled, crossover study | Jermain, DM | ARCHIVES OF FAMILY MEDICINE               | 1999 | 80            | 3.33                     |
| 49   | Premenstrual dysphoric disorder: epidemiology and treatment          | Hantsoo, Lisa | CURRENT PSYCHIATRY REPORTS                | 2015 | 79            | 9.88                     |
| 50   | Steroid withdrawal in the mouse results in anxiogenic effects of 3 alpha, 5 beta-THP: a possible model of premenstrual dysphoric disorder | Smith, Sherly S | PSYCHOPHARMACOLOGY                       | 2006 | 79            | 4.65                     |
| 51   | Premenstrual syndrome as a predictor of menopausal symptoms          | Freeman, EW  | OBSTETRICS AND GYNECOLOGY                | 2004 | 79            | 4.16                     |
| 52   | The diagnosis of premenstrual syndromes and premenstrual dysphoric disorder—clinical procedures and research perspectives | Halbreich, U | GYNECOLOGICAL ENDOCRINOLOGY              | 2004 | 77            | 4.05                     |
| 53   | Premenstrual syndrome and premenstrual dysphoric disorder          | Biggs, Wendy | AMERICAN FAMILY PHYSICIAN                | 2011 | 76            | 6.33                     |
| 54   | Sleep, hormones, and circadian rhythms throughout the menstrual cycle in healthy women and women with premenstrual dysphoric disorder | Shechter, Ari | INTERNATIONAL JOURNAL OF ENDOCRINOLOGY   | 2010 | 76            | 5.85                     |
| 55   | Premenstrual syndrome and premenstrual dysphoric disorder: guidelines for management | Steiner, M | JOURNAL OF PSYCHIATRY & NEUROSCIENCE      | 2000 | 76            | 3.33                     |
| 56   | Treatment of premenstrual syndrome with gonadotropin-releasing hormone agonist in a low dose regimen | Sundstrom, I | ACTA OBSTETRICIA ET GYNECOLOGICA SCANDINAVICA | 1999 | 76            | 3.17                     |
| 57   | Premenstrual syndrome: a mini review                                   | Ryu, Aeili     | MATURES                                   | 2015 | 75            | 9.38                     |
| 58   | Premenstrual syndrome and associated symptoms in adolescent girls   | Derman, O      | EUROPEAN JOURNAL OF OBSTETRICS & GYNECOLOGY AND REPRODUCTIVE BIOLOGY | 2004 | 75            | 3.95                     |
| 59   | Fluoxetine vs. Vitex agnus castus extract in the treatment of premenstrual dysphoric disorder | Atmaca, M | HUMAN PSYCHOPHARMACOLOGY-CLINICAL AND EXPERIMENTAL | 2003 | 75            | 3.75                     |
| 60   | Prevalence of sexual abuse history in a sample of women seeking treatment for premenstrual syndrome | Golding, JM | JOURNAL OF PSYCHOSOMATIC OBSTETRICS AND GYNECOLOGY | 2000 | 75            | 3.26                     |
| 61   | Selective serotonin reuptake inhibitors for premenstrual syndrome and premenstrual dysphoric disorder—a meta-analysis | Shah, Nirav R | OBSTETRICS AND GYNECOLOGY                | 2008 | 74            | 4.93                     |
| Rank | Title                                                                 | First author | Journal                                               | Year | Total citation | Average citation by year |
|------|----------------------------------------------------------------------|--------------|-------------------------------------------------------|------|----------------|--------------------------|
| 62   | Venlafaxine in the treatment of premenstrual dysphoric disorder       | Freeman, EW  | OBSTETRICS AND GYNECOLOGY                            | 2001 | 74             | 3.36                     |
| 63   | Menstrual cycle effects on amygdala reactivity in premenstrual dysphoric disorder | Gingell, Malin | HORMONES AND BEHAVIOR                                | 2012 | 73             | 6.64                     |
| 64   | Randomized controlled trial of the management of premenstrual syndrome and premenstrual mastalgia using luteal phase-only danazol | O’Brien, PMS | AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY        | 1999 | 73             | 3.04                     |
| 65   | Prevalence and predictors of premenstrual syndrome and premenstrual dysphoric disorder in a population-based sample | Tschudin, Sibil | ARCHIVES OF WOMENS MENTAL HEALTH                      | 2010 | 72             | 5.54                     |
| 66   | Sleep quality and the sleep electroencephalogram in women with severe premenstrual syndrome | Baker, Fiona | SLEEP                                                 | 2007 | 70             | 4.38                     |
| 67   | Estimating direct and indirect costs of premenstrual syndrome        | Borenstein, J  | JOURNAL OF OCCUPATIONAL AND ENVIRONMENTAL MEDICINE   | 2005 | 70             | 3.89                     |
| 68   | Diagnosis and treatment of premenstrual dysphoric disorder: an update| Steiner, M    | INTERNATIONAL CLINICAL PSYCHOPHARMACOLOGY            | 2000 | 70             | 3.04                     |
| 69   | Weekly luteal-phase dosing with enteric-coated fluoxetine 90 mg in premenstrual dysphoric disorder: a randomized, double-blind, placebo-controlled clinical trial | Miner, C | CLINICAL THERAPEUTICS                                | 2002 | 68             | 3.24                     |
| 70   | Micronutrients and the premenstrual syndrome: the case for calcium    | Thys-Jacobs, S | JOURNAL OF THE AMERICAN COLLEGE OF NUTRITION        | 2000 | 66             | 2.87                     |
| 71   | The prevalence of premenstrual dysphoric disorder in a randomly selected group of urban and rural women | Gehlert, S | PSYCHOLOGICAL MEDICINE                               | 2009 | 65             | 4.64                     |
| 72   | Allopregnanolone levels and symptom improvement in severe premenstrual syndrome | Freeman, EW | JOURNAL OF CLINICAL PSYCHOPHARMACOLOGY               | 2002 | 64             | 3.05                     |
| 73   | Abnormal luteal phase excitability of the motor cortex in women with premenstrual syndrome | Smith, MJ | BIOLOGICAL PSYCHIATRY                               | 2003 | 62             | 3.1                      |
| 74   | Premenstrual dysphoric disorder                                      | Grady-Welky, TA | NEW ENGLAND JOURNAL OF MEDICINE                    | 2003 | 62             | 3.1                      |
| 75   | Premenstrual dysphoric disorder symptoms following ovarian suppression: triggered by change in ovarian steroid levels but not continuous stable levels | Schmidt, Peter J | AMERICAN JOURNAL OF PSYCHIATRY                   | 2017 | 61             | 10.17                    |
| 76   | Association of inflammation markers with menstrual symptom severity and premenstrual syndrome in young women | Bertone-Johnson, E. R | HUMAN REPRODUCTION                                  | 2014 | 61             | 6.78                     |
| 77   | Obesity as a risk factor for premenstrual syndrome                   | Masho, SW    | JOURNAL OF PSYCHOSOMATIC OBSTETRICS & GYNECOLOGY     | 2005 | 61             | 3.39                     |
| 78   | Continuous or intermittent dosing with sertraline for patients with severe premenstrual syndrome or premenstrual dysphoric disorder | Freeman, EW | AMERICAN JOURNAL OF PSYCHIATRY | 2004 | 61             | 3.21                     |
| 79   | A randomized comparison of psychological (cognitive behavior therapy), medical (fluoxetine) and combined treatment for women with premenstrual dysphoric disorder | Hunter, MS | JOURNAL OF PSYCHOSOMATIC OBSTETRICS & GYNECOLOGY    | 2002 | 61             | 2.9                      |
| 80   | Premenstrual dysphoric disorder—is there an economic burden of illness? | Chawla, A | MEDICAL CARE                                           | 2002 | 60             | 2.86                     |
| 81   | Abnormalities of dorsolateral prefrontal function in women with premenstrual dysphoric disorder: a multimodal neuroimaging study | Baller, Erica B | AMERICAN JOURNAL OF PSYCHIATRY    | 2013 | 59             | 5.9                      |

(Continued)
TABLE 1 | Continued

| Rank | Title                                                                 | First author   | Journal                              | Year | Total citation | Average citation by year |
|------|-----------------------------------------------------------------------|----------------|--------------------------------------|------|----------------|--------------------------|
| 82   | Biological correlates of abuse in women with premenstrual dysphoric disorder and healthy controls | Girdler, SS    | PSYCHOSOMATIC MEDICINE              | 2003 | 59             | 2.95                     |
| 83   | Premenstrual syndrome prevalence and fluctuation over time: results from a french population-based survey | Potter, Julia  | JOURNAL OF WOMENS HEALTH            | 2009 | 58             | 4.14                     |
| 84   | A controlled study of light therapy in women with late luteal phase dysphoric disorder | Lam, RW        | PSYCHIATRY RESEARCH                 | 1999 | 58             | 2.42                     |
| 85   | Brain-derived neurotrophic factor plasma variation during the different phases of the menstrual cycle in women with premenstrual syndrome | Cubeddu, Alessandra | PSYCHONEUEROENODCRINOLOGY         | 2011 | 56             | 4.67                     |
| 86   | Placebo-controlled trial comparing intermittent and continuous paroxetine in premenstrual dysphoric disorder | Landen, Mikael | NEUROPSYCHOPHARMACOLOGY            | 2007 | 56             | 3.5                      |
| 87   | Are there differential symptom profiles that improve in response to different pharmacological treatments of premenstrual syndrome/premenstrual dysphoric disorder? | Halbreich, Uriel | CNS DRUGS                             | 2006 | 56             | 3.29                     |
| 88   | Specificity of panic response to CO2 inhalation in panic disorder: a comparison with major depression and premenstrual dysphoric disorder | Kent, JM       | AMERICAN JOURNAL OF PSYCHIATRY      | 2001 | 56             | 2.55                     |
| 89   | Characteristics of placebo responses in medical treatment of premenstrual syndrome | Freeman, EW    | AMERICAN JOURNAL OF PSYCHIATRY      | 1999 | 56             | 2.33                     |
| 90   | Premenstrual syndrome and premenstrual dysphoric disorder          | Hofmeister, Sabrina | AMERICAN FAMILY PHYSICIAN         | 2016 | 55             | 7.86                     |
| 91   | Cognitive-behavioral therapy for premenstrual syndrome and premenstrual dysphoric disorder: a systematic review | Lustyk, M. Kathleen B | ARCHIVES OF WOMENS MENTAL HEALTH | 2009 | 54             | 3.86                     |
| 92   | Luteal-phase accentuation of acoustic startle response in women with premenstrual dysphoric disorder | Epperson, Cynthia Neill | NEUROPSYCHOPHARMACOLOGY          | 2007 | 54             | 3.38                     |
| 93   | Hysterectomy and bilateral oophorectomy for severe premenstrual syndrome | Cronje, WH     | HUMAN REPRODUCTION                  | 2004 | 54             | 2.84                     |
| 94   | 5 alpha-reductase inhibition prevents the luteal phase increase in plasma allopregnanolone levels and mitigates symptoms in women with premenstrual dysphoric disorder | Martinez, Pedro E | NEUROPSYCHOPHARMACOLOGY          | 2016 | 53             | 7.57                     |
| 95   | Premenstrual syndrome—advances in diagnosis and treatment | Kessel, B      | OBSTETRICS AND GYNECOLOGY CLINICS OF NORTH AMERICA | 2000 | 53             | 2.3                      |
| 96   | Proton magnetic resonance spectroscopy measurement of brain glutamate levels in premenstrual dysphoric disorder | Batra, Neha Arun | BIOLOGICAL PSYCHIATRY              | 2008 | 52             | 3.47                     |
| 97   | The treatment of severe premenstrual syndrome with goserelin with and without ‘add-back’ estrogen therapy: a placebo-controlled study | Leather, AT    | GYNECOLOGICAL ENDOCRINOLOGY        | 1999 | 51             | 2.13                     |
| 98   | Prevalence, impacts and medical managements of premenstrual syndrome among female students: cross-sectional study in college of health sciences, mekelle university, mekelle, northern ethiopia | Tolossa, Fikru Waikira | BMC WOMENS HEALTH               | 2014 | 50             | 5.56                     |
| 99   | Full- or half-cycle treatment of severe premenstrual syndrome with a serotonergic antidepressant | Freeman, EW    | JOURNAL OF CLINICAL PSYCHOPHARMACOLOGY | 1999 | 50             | 2.08                     |
| 100  | Factors associated with premenstrual syndrome-A survey of new female university students | Cheng, Shu-Hu  | KAOHSIUNG JOURNAL OF MEDICAL SCIENCES | 2013 | 49             | 4.9                      |
list. Additionally, 13 papers published in 2007 had the most significant impact on research in this field. Among the selected papers, 67 and 33 were original research articles and reviews, respectively. Furthermore, the 23 papers published in 2003 had the most significant impact on research in this field (Figure 2).

**Distribution Per Journal**

We generated a citation network of journals, based on the average published year, to depict interaction among the top 100 cited articles published in 55 journals (Figure 3). Notably, Obstetrics and Gynecology published the largest number of
papers (7 papers), followed by the American journal of psychiatry (6 papers). On the other hand, Psychoneuroendocrinology had the largest average number of citations per paper (1 paper, 917 citations).

**Contributing Authors**
A total of 360 authors contributed to the top 100 cited papers, although some of the 386 items in the network were not connected. The largest set of connected items comprised 83 items. Notably, Freeman EW was at the core of this network, although Halbreich U and Yonkers KA emerged as new authors in recent years. Freeman EW had the highest number of papers (11, with 956 citations), followed by Halbreich U and Yonkers KA who had 645 and 894 citations, respectively (Figure 4).

**Contributing Countries/Regions and Institutions**
The selected top 100 cited papers were published across 24 countries or regions (Figure 5). Among them, the United States had the highest contribution (68 articles), followed by England...
(13 papers). Among the 24 countries, the United States formed the largest national cooperation network, covering 17 countries. In terms of research institutions, the 100 most cited papers were published by 153 institutions, with the largest set of connected items comprising 107 institutions. Specifically, the University of Pennsylvania contributed the most papers (15 papers), followed...
by Yale University and NiMH which accounted for 13 and 10 papers, respectively (Figure 6).

Research Direction
The top 100 cited papers on PMS/PMDD were stratified into various study directions based on WOS categories as shown in Table 2. Among them, “Obstetrics Gynecology” (98 papers) was the topmost research direction, followed by “Psychiatry” (63 papers), and “Reproductive Biology” (61 papers), among others (Table 2).

Co-occurrence of Keywords
A total of 477 keywords were identified across the top 100 cited papers. We excluded 10 keywords, such as women, menstrual cycle, premenstrual dysphoric disorder, and premenstrual syndrome, among others. Further analysis revealed cooccurring keywords, with the following forming the top 10: double-blind, fluoxetine, efficacy, prevalence, epidemiology, phase sertraline treatment, depression, progesterone, placebo, and placebo-controlled trial (Table 3). These keywords were further classified into 11 clusters as follows: cluster 1 (epidemiology), cluster 2 (placebo-controlled trial), cluster 3 (steroid), cluster 4 (late luteal phase), cluster 5 (premenstrual syndrome), cluster 6 (emotional perception), cluster 7 (dysmenorrhea), cluster 8 (therapeutic use), cluster 9 (brain-derived neurotrophic factor), cluster 10 (delta) and cluster 11 (Japanese women) (Figure 7, Table 4).

DISCUSSION
Women’s menstrual cycle-related disorders, such as premenstrual syndrome and dysmenorrhea, predispose many women to various diseases which subsequently adversely affect their health (22).

General Information From the Top 100 Most-Cited Papers on Top 100 Most-Cited Papers
The top 100 cited papers were selected from papers titled “Premenstrual Syndrome,” “Premenstrual Dysphoric Disorder,” or “late luteal phase dysphoric disorder” referring to its citations, which represent the concerns of researchers. Analysis of the selected top 100 cited articles resulted in a total of 9,676 citations, with an average of 96.76 citations per article. Among them, the earliest paper entitled “Randomized controlled trial of the management of premenstrual syndrome and premenstrual mastalgia using luteal phase-only danazol,” was published in 1999 (23), whereas the most recent one was “Premenstrual Dysphoric Disorder Symptoms Following Ovarian Suppression: Triggered by Change in Ovarian Steroid Levels but Not Continuous Stable Levels” published in 2017 (24). Moreover, “The prevalence, impairment, impact, and burden of premenstrual dysphoric disorder (PMS/PMDD)” (17) by Halbreich was the most cited article.

Influential Authors and Cooperative Network
Analysis of the 100 most cited papers revealed contribution by 386 authors. Among them, Freeman EW, Halbreich U, and Yonkers KA were the highest contributors to the most influential articles, suggesting that their researches are a potential hotspot in this field. Particularly, Freeman EW’s newest paper, entitled “Are there differential symptom profiles that improve in response to different pharmacological treatments of premenstrual syndrome/premenstrual dysphoric disorder?” revealed possible well-defined subgroups of PMDD. It is evident that overall treatment response rates may improve if treatments are targeted at subtypes (25). On the other hand, Yonkers KA’s paper, entitled “Premenstrual Dysphoric Disorder: Evidence for a New Category for DSM-5,” discussed DSM-5 for premenstrual dysphoric disorder (26), whereas Halbreich U’s article “Clinical diagnostic criteria for premenstrual syndrome and guidelines for their quantification for research studies,” revealed updated diagnostic criteria for PMS/PMDD and guidelines for clinical and research applications (27). A total of 83 items showed an interaction, of which Freeman EW was at the core of this network, although new scholars, such as Halbreich U and Yonkers KA have emerged in recent years. These authors are distributed across 24 countries or regions and 153 institutions. Among them, the University of Pennsylvania and the United States contributed the highest number of publications. This indicated that American institutions and authors play a leading role in research on PMDD, this may guide future research activities.

Future Perspectives
Epidemiology for Prevalence and Risk Factors
Epidemiological research is the primary and critical approach for exploring development and progression of PMS/PMDD. Notably, 11 out of the 100 most cited articles described prevalence of PMS/PMDD between 2000 and 2014 (17, 18, 28–35), while 29 focused on epidemiology. Collectively, these articles provide reliable data sources to better our understanding of PMS/PMDD, including incidence rate. In recent years, numerous studies have evaluated childhood body size and premenstrual disorders in young adulthood (36), comorbid bipolar disorder (37), prevalence, and associated factors among different groups (38). For instance, studies showed that the prevalence of PMS among Academics at a University in Midwest Brazil was 46.9% (38), and 21.1% for university students (39), which are higher than ever before. Moreover, risk factors for PMS/PMDD include childhood abuse and neglect (40), childhood maltreatment (41), and perinatal depression (42), among others.

Steroid Pathogenesis
At present, the pathogenesis of PMDD remains unclear. However, steroid pathogenesis such as progesterone and allopregnanolone in PMS/PMDD has always been research hotspots. New findings have suggested that progesterone exerts a different effect on the metabolic profiles of women with PMDD compared to controls (43). In addition, a change in estradiol/progesterone levels from low to high, and not the
steady-state level, was associated with onset of PMDD symptoms (24). Gradually, researchers have found that allopregnanolone is the provoking factor behind the negative mood symptoms in PMDD, a disease whose pathophysiology is significantly correlated with impaired GABAA-R response to dynamic ALLO fluctuations across the menstrual cycle, manifesting in affective symptoms (44–46). It is possible that GABAA-R response to allopregnanolone, alpha4 and delta subunits of GABAA-R may be playing an essential role in mood swings (47). Recent studies have also associated copy number variations in GABRB2 with PMDD (48, 49). Future studies are expected to elucidate GABAA-Rs susceptibility to ALLO.
Placebo-Controlled Trials for Treatment of PMS/PMDD
Treatment is a crucial step in management of PMS/PMDD. The clusters of co-occurrent keywords suggest that prospecting for effective treatment therapies for PMS/PMDD, such as use of fluoxetine (50), and vitex agnus castus (51), is a promising research hotspot. However, placebo-controlled trials are needed to generate more reliable data.

LIMITATIONS
This study had several limitations. After consulting numerous literature, we used the Web of Science to identify relevant datasets. Although this is the most commonly used database for literature searches, some early publications may be missing. For an accurate econometric analysis, we referred to previous studies (16) and adopted a Title keyword rather than Topic keyword retrieval approach. Although our search results were accurate, they may not be extensive enough.

CONCLUSION
To the best of our knowledge, this is the first bibliometric analysis of the most frequently cited papers on PMS/PMDD. Our results indicate that most essential studies on PMS/PMDD have been published in the Journal of Obstetrics and Gynecology. American authors and institutions have played a leading role in research on PMDD, thus represent a future research direction. Moreover, epidemiology for prevalence and risk factors, steroid pathogenesis, such as progesterone, allopregnanolone, and placebo-controlled trial for the treatment represent future trends in this field of research.

AUTHOR CONTRIBUTIONS
MG designed the study and wrote and revised the draft manuscript. MG, HZ, CW, and XM performed literature search, retrieval, and data collection. MG and HZ carried out data visualization and graphical interpretation. QZ, DG, and JW provided critical assistance or funding. All authors contributed to and approved the final draft of the manuscript before submission.

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Gao et al.
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