

Top-cited articles in the Journal: a bibliometric analysis



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BACKGROUND: The Journal has had a profound influence in nearly 150 years of publishing. A bibliometric analysis, which uses citation analyses to evaluate the impact of articles, can be used to identify the most impactful papers in the Journal's history.

OBJECTIVE: The objective was to identify and characterize the top-cited articles published in the Journal since 1920.

STUDY DESIGN: We used the Web of Science and Scopus databases to identify the most frequently cited articles of the Journal from 1920 through 2018. The top 100 articles from each database were included in our analysis. Articles were evaluated for several characteristics including year of publication, article type, topic, open access, and country of origin. Using the Scopus data, we performed an unadjusted categorical analysis to characterize the articles and a 2 time point analysis to compare articles before and after 1995, the median year of publication from each database list.

RESULTS: The top 100 articles from each database were included in the analysis. This included 120 total articles: 80 articles listed in both and 20 unique in each database. More than half (52%) were observational studies, 9% were RCTs, and 75% were from US authors. When the post-1995 studies were compared with the articles published before 1995, articles were more frequently cited (median 27 vs 13 citations per year, $P < .001$), more likely to be randomized (14.0% vs 4.8%, $P = .009$), and more likely to originate from international authors (33.3% vs 17.5%, $P = .045$).

CONCLUSION: Slightly more than half of the top-cited papers in the Journal since 1920 were observational studies and three quarters of all papers were from US authors. Compared with top-cited papers before 1995, the Journal's top-cited papers after 1995 were more likely to be randomized and to originate from international authors.

Key words: bibliometrics, case report, citation analysis, citation classic, observational study, obstetrics and gynecology, randomized controlled trial, top cited

Evaluative bibliometrics is a field of quantitative science that uses methodologies like citation analysis to evaluate research performance.¹ Citation analysis utilizes citation data to quantify the impact of research as a reflection of the number of references that an article

receives over time. An article that is highly cited has been critically read, deemed of value, and used to promote and defend research. This type of bibliometric analysis is especially important in the modern context with the existence of predatory journals and variations in

the peer review process.² Using citation analysis and other quantitative methodologies, bibliometrics can identify the most impactful papers in a journal's history.

Published bibliometric studies have evaluated frequently cited papers in obstetrics and gynecology and other fields of medicine.^{3–5} These studies provide insight into the important topics of each field and highlight the contributions of individual researchers and institutions. These studies can also focus on individual journals, identifying some of the most influential papers in a journal's history.⁶

The Journal has published scientific articles for close to 150 years. During this time, the Journal published landmark papers that shaped the scope and practice of obstetrician-gynecologists.^{3,7} In its current form, the Journal's influence extends across continents, reaching more than 43,000 readers in print and online each year.⁸ The Journal is now one of the most impactful obstetrics and gynecology journals, ranked second to *Human Reproduction Update* and is the top-ranked publisher of original research in the field.⁷

To date, there has not been a bibliometric study of top-cited papers in the Journal. On the 150th anniversary of the Journal, we performed this study to identify the top-cited papers from the Journal and to see how characteristics of these publications changed over time. We hypothesized that the present analysis would identify a representative list of the Journal's most influential papers while also providing insight into the Journal's history and illuminating its impact on the field of obstetrics and gynecology.

Materials and Methods

We performed a bibliometric study looking at the top-cited articles in the Journal. We used Web of Science (of Thomas Reuters) and Scopus to identify the 100 most frequently cited articles in each database.

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AJOG at a Glance

Why was this study conducted?

Citation analysis is a bibliometric tool that quantifies the impact of research as a reflection of the number of references that an article receives over time. As the Journal approaches its 150th anniversary, we wanted to characterize the top-cited papers in the Journal.

Key findings

We characterized the top-cited articles by year of publication, article type, topic, and country of origin. We found that most top-cited papers were observational studies from US authors. However, randomized trials and articles from international authors were more frequently cited after 1995 compared with articles before 1995.

What does this add to what is known?

This study identified some of the Journal's most impactful papers.

Web of Science includes articles from 1980 to the present. Scopus includes articles from 1920 to the present. Although Web of Science covers the modern history of the Journal, Scopus' data cover a greater proportion of the Journal's publication history. We elected to use both databases to identify the most frequently cited articles because both databases have been used in other bibliometric studies.^{9–12}

Articles were queried on Feb. 15, 2018 from Web of Science and Scopus. We identified the Journal's publications in each database and sorted the results by number of citations. The top 100 articles in each database were independently assessed and characterized by two reviewers (S.M.Y. and H.S.P.).

Each of the top-cited articles was evaluated for specific characteristics including the subject matter, study design, open access, and countries and institutions of origin. Subject matter was divided into 2 categories, obstetrics and gynecology, and each category was further subdivided into subspecialties including maternal-fetal medicine, benign gynecology, gynecological oncology, reproductive endocrinology and infertility, and urogynecology.

Studies were characterized by study design. Observational studies included cohort studies, case-control studies, and case series. Studies were also characterized as basic science, review, consensus, systematic review/meta-analysis, randomized controlled trial, new procedure/assay, and other.

Statistical analyses were performed using Stata version 10.1 (StataCorp LP, College Station, TX). The various analyses were performed using the Scopus data. We performed a descriptive analysis using a χ^2 test and Fisher exact test for categorical variables and a Wilcoxon rank-sum test for nonparametric continuous variables. We evaluated median citation rates by decade of publication using the Kruskal-Wallis test. An analysis was also performed to compare articles published before and after 1995. This year was selected because it was the median year of publication in both databases.

Results

A total of 47,892 articles were identified in Scopus, and 41,571 articles were identified in Web of Science. Of those, 23,464 articles were cited at least once and 1292 were cited 100 or more times in Web of Science. This information could not be obtained through the Scopus database.

Table 1 lists the top-cited articles from both databases in descending order according to the number of citations each received in Scopus. There were 120 articles in total; 80 articles were listed in both databases, whereas each contained 20 unique articles. The top-cited articles were published from 1946 to 2011. The most frequently cited article, which received 2582 citations, was published by Bump et al in 1996.¹³

The median number of citations per article was 448 (interquartile range [IQR], 382–571) with a median of 19 citations per year (IQR, 13–28) (Table 2). The number of citations per year increased each decade of the study period, from a median of 9 (IQR, 7–10) citations per year for publications from the 1940s to 32 (IQR, 26–38) citations per year for publications from the 2000s ($P < .001$) (Figure).

Most of the top-cited papers were observational studies (52%) and from US authors (75%). Randomized controlled trials (RCTs) accounted for less than 10% of all articles. Obstetric publications were the most common article category, accounting for 79 of the top-cited papers (66%). There was only 1 open access article, which was published by Lancaster et al in 2010.¹²⁰

Information about affiliation and authors was analyzed. Most of the papers originated from academic institutions within the United States. Yale University, University of Michigan, University of Tennessee, and the Eunice Kennedy Shriver National Institute of Child Health and Human Development each contributed 5 articles. Seoul National University, which is located in South Korea, contributed 4 articles, the most from an international institution. The author with the most publications was Dr Roberto Romero with 10. Dr Baha Sibai and Dr Bo Hyun were the next biggest contributors, with 7 and 6 articles respectively.

We performed a 2 time point analysis comparing articles before and after 1995 (Table 3). As the Journal's impact factor increased, we observed that the top-cited papers after 1995 were more frequently cited (median 27 citations per year [IQR, 10–17] vs 13 citations per year [IQR, 20–35], $P < .001$).¹³³ Papers were also more likely to be randomized (4.8% vs 14.0%, $P = .009$) and more likely to originate from institutions outside the United States (17.5% vs 33.3%, $P = .045$).

Comment**Principal findings**

In this bibliometric study, we characterized the top-cited articles published

TABLE 1
Top-cited papers in the Journal from 1920 through 2018 according to the number of citations in Scopus

Citations, Scopus, n	Citations, Web of Science, n	Authors	Title	Year
2582	2315	Bump et al ¹³	The standardization of terminology of female pelvic organ prolapse and pelvic floor dysfunction	1996
1810	1393	National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy ¹⁴	Report of the National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy	2000
1438	1351	Roberts et al ¹⁵	Preeclampsia: an endothelial cell disorder	1989
1100	993	Carpenter and Coustan ¹⁶	Criteria for screening tests for gestational diabetes	1982
1094 ^b	1016	Redman et al ¹⁷	Preeclampsia: an excessive maternal inflammatory response to pregnancy	1999
1053 ^b	993	Davey and MacGillivray ¹⁸	The classification and definition of the hypertensive disorders of pregnancy	1988
1053	1013	Hadlock et al ¹⁹	Estimation of fetal weight with the use of head, body, and femur measurements—a prospective study	1985
949	855	Weinstein ²⁰	Syndrome of hemolysis, elevated liver enzymes, and low platelet count: a severe consequence of hypertension in pregnancy	1982
843	583	Baird et al ²¹	High cumulative incidence of uterine leiomyoma in black and white women: ultrasound evidence	2003
788	NF	Gluck et al ²²	Diagnosis of the respiratory distress syndrome by amniocentesis	1971
780	NF	Brenner et al ²³	A standard of fetal growth for the United States	1976
727	NF	Mendelson ²⁴	The aspiration of stomach contents into the lungs during obstetric anesthesia	1946
726	643	Gomez et al ²⁵	The fetal inflammatory response syndrome	1998
712	550	Sibai et al ²⁶	Maternal morbidity and mortality in 442 pregnancies with hemolysis, elevated liver enzymes, and low platelets (HELLP syndrome)	1993
696	535	Delancey ²⁷	Structural support of the urethra as it relates to stress urinary incontinence: the hammock hypothesis	1994
686	598	Dicker et al ²⁸	Complications of abdominal and vaginal hysterectomy among women of reproductive age in the United States: the collaborative review of sterilization	1982
677	606	Gibbs et al ²⁹	A review of premature birth and subclinical infection	1992
672	NF	Fanaroff et al ³⁰	Trends in neonatal morbidity and mortality for very low birthweight infants	2007
671	NF	Vaitukaitis et al ³¹	A radioimmunoassay which specifically measures human chorionic gonadotropin in the presence of human luteinizing hormone	1972
663	591	Hatch et al ³²	Hirsutism: implications, etiology, and management	1981
650 ^b	535	Crowley ³³	Antenatal corticosteroid therapy: a meta-analysis of the randomized trials 1972 to 1994	1995
641	534	Kutteh ³⁴	Antiphospholipid antibody-associated recurrent pregnancy loss: treatment with heparin and low-dose aspirin is superior to low-dose aspirin alone	1996
610	524	Wright et al ³⁵	2006 consensus guidelines for the management of women with abnormal cervical cancer screening tests	2007
606	504	Weiss et al ³⁶	Obesity, obstetric complications, and cesarean delivery rate—a population-based screening study	2004

Yadava. The Journal's top-cited articles from 1920 through 2018. *Am J Obstet Gynecol* 2019.

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TABLE 1
Top-cited papers in the Journal from 1920 through 2018 according to the number of citations in Scopus (continued)

Citations, Scopus, n	Citations, Web of Science, n	Authors	Title	Year
606	536	Hendrix et al ³⁷	Pelvic organ prolapse in the Women's Health Initiative: gravity and gravidity	2002
592	445	Miller et al ³⁸	Clinical risk factors for placenta previa-placenta accreta	1997
589 ^b	526	Abrams et al ³⁹	The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society	2002
584	542	Merkatz et al ⁴⁰	An association between low maternal serum A-fetoprotein and fetal chromosomal abnormalities	1984
580 ^b	522	Yoon et al ⁴¹	Amniotic fluid inflammatory cytokines (interleukin-6, interleukin-1B, and tumor necrosis factor-alpha), neonatal brain white matter lesions, and cerebral pal	1997
577 ^b	480	Dekker and Sibai ⁴²	Etiology and pathogenesis of preeclampsia: current concepts	1998
565	438	DeLancey ⁴³	Anatomic aspects of vaginal eversion after hysterectomy	1992
564	476	Hoskins et al ⁴⁴	The effect of diameter of largest residual disease on survival after primary cytoreductive surgery in patients with suboptimal residual epithelial ovarian carcinoma	1994
553	NF	Cohn et al ⁴⁵	Cardiovascular responses to hypoxemia and acidemia in fetal lambs	1974
546 ^b	NF	Yoshioka et al ⁴⁶	Lipid peroxidation in maternal and cord blood protective mechanism against activated-oxygen toxicity in the blood	1979
542 ^b	520	Sacks et al ⁴⁷	Normal pregnancy and preeclampsia both produce inflammatory changes in peripheral blood leukocytes akin to those of sepsis	1998
528 ^c	390	ASCUS-LSIL Triage Group ⁴⁸	Results of a randomized trial on the management of cytology interpretations of atypical squamous cells of undetermined significance	2003
520 ^{b,c}	419	da Fonseca et al ⁴⁹	Prophylactic administration of progesterone by vaginal suppository to reduce the incidence of spontaneous preterm birth in women at increased risk: a randomized placebo-controlled double-blind study	2003
517	NF	Noyes et al ⁵⁰	Dating the endometrial biopsy	1975
514 ^b	453	Yoon et al ⁵¹	Fetal exposure to an intraamniotic inflammation and the development of cerebral palsy at the age of three years	2000
509	425	Wadhwa et al ⁵²	The association between prenatal stress and infant birth weight and gestational age at birth: a prospective investigation	1993
506	506	Manning et al ⁵³	Antepartum fetal evaluation: development of a fetal biophysical profile	1980
504	518	Walsh ⁵⁴	Preeclampsia: an imbalance in placental prostacyclin and thromboxane production	1985
504	476	Shepard et al ⁵⁵	An evaluation of two equations for predicting fetal weight by ultrasound	1982
500 ^b	524	Westrom ⁵⁶	Incidence, prevalence, and trends of acute pelvic inflammatory disease and its consequences in industrialized countries	1980
494	NF	Burch ⁵⁷	Urethrovaginal fixation to Cooper's ligament for correction of stress incontinence, cystocele, and prolapse	1961
493	408	Wu et al ⁵⁸	Abnormal placentation: twenty-year analysis	2004
492	482	Romero et al ⁵⁹	Infection and labor. III. Interleukin-1: a signal for the onset of parturition	1989

Yadava. The Journal's top-cited articles from 1920 through 2018. Am J Obstet Gynecol 2019.

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TABLE 1
Top-cited papers in the Journal from 1920 through 2018 according to the number of citations in Scopus (continued)

Citations, Scopus, n	Citations, Web of Science, n	Authors	Title	Year
491	416	Bernstein et al ⁶⁰	Morbidity and mortality among very-low-birth-weight neonates with intrauterine growth restriction	2000
488	NF	Kegel ⁶¹	Progressive resistance exercise in the functional restoration of the perineal muscles	1948
475	447	Spitzer et al ⁶²	Validity and utility of the PRIME-MD Patient Health Questionnaire in assessment of 3000 obstetric-gynecologic patients: the PRIME-MD Patient Health Questionnaire Obstetrics-Gynecology Study	2000
468	455	Romero et al ⁶³	Infection and labor. V. Prevalence, microbiology, and clinical significance on intraamniotic infection in women with preterm labor and intact membranes	1989
467	426	Baron et al ⁶⁴	The antiestrogenic effect of cigarette smoking in women	1990
466 ^b	403	Dekker et al ⁶⁵	Underlying disorders associated with severe early-onset preeclampsia	1995
466	391	Cates and Wasserheit ⁶⁶	Genital chlamydial infections: epidemiology and reproductive sequelae	1991
464 ^c	430	Cowchock et al ⁶⁷	Repeated fetal losses associated with antiphospholipid antibodies: a collaborative randomized trial comparing prednisone with low-dose heparin treatment	1992
460 ^c	359	Benson et al ⁶⁸	Vaginal versus abdominal reconstructive surgery for the treatment of pelvic support defects: a prospective randomized study with long-term outcome evaluation	1996
451 ^b	373	French et al ⁶⁹	Repeated antenatal corticosteroids: size at birth and subsequent development	1999
451	413	Sibai et al ⁷⁰	Maternal-perinatal outcome associated with the syndrome of hemolysis, elevated liver enzymes, and low platelets in severe preeclampsia-eclampsia	1986
450 ^b	394	Yoon et al ⁷¹	Interleukin-6 concentrations in umbilical cord plasma are elevated in neonates with white matter lesions associated with periventricular leukomalacia	1996
449	NF	Gluck and Kulovich ⁷²	Lecithin/sphingomyelin ratios in amniotic fluid in normal and abnormal pregnancy	1973
446 ^b	447	Daffos et al ⁷³	Fetal blood, sampling during pregnancy with use of a needle guided by ultrasound: a study of 606 consecutive cases	1985
445	421	Barber et al ⁷⁴	Short forms of two condition-specific quality-of-life questionnaires for women with pelvic floor disorders (PFDI-20 and PFIQ-7)	2005
443	365	Copper et al ⁷⁵	The preterm prediction study: maternal stress is associated with spontaneous preterm birth at less than thirty-five weeks' gestation	1996
441	369	James et al ⁷⁶	Venous thromboembolism during pregnancy and the postpartum period: incidence, risk factors, and mortality	2006
437 ^b	338	Karlsson et al ⁷⁷	Transvaginal ultrasonography of the endometrium in women with postmenopausal bleeding—a Nordic multicenter study	1995
436	361	Sibai ⁷⁸	The HELLP syndrome (hemolysis, elevated liver enzymes, and low platelets): much ado about nothing?	1990
430	318	Clark et al ⁷⁹	Amniotic fluid embolism: analysis of the national registry	1995
426	362	Schmidt et al ⁸⁰	Estrogen replacement in perimenopause-related depression: a preliminary report ^c	2000
425	NF	Gardner and Dukes ⁸¹	Haemophilus vaginalis vaginitis: a newly defined specific infection previously classified "nonspecific" vaginitis	1955

Yadava. The Journal's top-cited articles from 1920 through 2018. Am J Obstet Gynecol 2019.

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TABLE 1
Top-cited papers in the Journal from 1920 through 2018 according to the number of citations in Scopus (continued)

Citations, Scopus, n	Citations, Web of Science, n	Authors	Title	Year
423	311	Oken et al ⁸²	Gestational weight gain and child adiposity at age 3 years	2007
423 ^b	314	Hodnett ⁸³	Pain and women's satisfaction with the experience of childbirth: a systematic review	2002
423	385	Hubel et al ⁸⁴	Lipid peroxidation in pregnancy: new perspectives on preeclampsia	1989
417 ^b	NF	Liley ⁸⁵	Liquor amnii analysis in the management of the pregnancy complicated by resus sensitization	1961
412	360	Romero et al ⁸⁶	A fetal systemic inflammatory response is followed by the spontaneous onset of preterm parturition	1998
411	327	Peterson et al ⁸⁷	The risk of pregnancy after tubal sterilization: findings from the US collaborative review of sterilization	1996
410 ^b	351	Samuelsson et al ⁸⁸	Signs of genital prolapse in a Swedish population of women 20 to 59 years of age and possible related factors	1999
405 ^{b,c}	337	Ward et al ⁸⁹	A prospective multicenter randomized trial of tension-free vaginal tape and colposuspension for primary urodynamic stress incontinence: two-year follow up	2004
401 ^b	310	Nicolaides ⁹⁰	Nuchal translucency and other first-trimester sonographic markers of chromosomal abnormalities	2004
401 ^c	338	Weber et al ⁹¹	Anterior colporrhaphy: a randomized trial of three surgical techniques	2001
400	393	Fuchs et al ⁹²	Oxytocin receptors in the human uterus during pregnancy and parturition	1984
398	NF	Szulman and Surti ⁹³	The syndromes of hydatidiform mole. I. Cytogenetic and morphologic correlations	1978
396	322	Brinton et al ⁹⁴	Cancer risk after a hospital diagnosis of endometriosis	1997
392	304	Adzick et al ⁹⁵	Fetal lung lesions: management and outcome	1998
390	322	Saftlas et al ⁹⁶	Epidemiology of preeclampsia and eclampsia in the United States 1979–1986	1990
389	354	Cox et al ⁹⁷	Human papillomavirus testing by hybrid capture appears to be useful in triaging women with a cytologic diagnosis of atypical squamous cells of undetermined significance	1995
388	346	Moore and Cayle ⁹⁸	The amniotic fluid index in normal human pregnancy	1990
388	323	Eschenbach et al ⁹⁹	Diagnosis and clinical manifestations of bacterial vaginosis	1988
386	NF	Peeters et al ¹⁰⁰	Blood flow to fetal organs as a function of arterial oxygen content	1979
385 ^b	344	Granberg et al ¹⁰¹	Endometrial thickness as measured by endovaginal ultrasonography for identifying endometrial abnormality	1991
383 ^{b,c}	336	MacDonald et al ¹⁰²	The Dublin randomized controlled trial of intrapartum fetal heart rate monitoring	1985
380	379	Goldrath et al ¹⁰³	Laser photovaporization of the endometrium for the treatment of menorrhagia	1981
378	305	Sobel et al ¹⁰⁴	Vulvovaginal candidiasis: epidemiologic, diagnostic, and therapeutic considerations	1998
378	325	Zuckerman et al ¹⁰⁵	Depressive symptoms during pregnancy: relationship to poor health behaviors	1989
377	NF	MacDonald et al ¹⁰⁶	Effect of obesity on conversion of plasma androstenedione to estrone in postmenopausal women with and without endometrial cancer	1978

Yadava. The Journal's top-cited articles from 1920 through 2018. *Am J Obstet Gynecol* 2019.

(continued)

TABLE 1
Top-cited papers in the Journal from 1920 through 2018 according to the number of citations in Scopus (continued)

Citations, Scopus, n	Citations, Web of Science, n	Authors	Title	Year
375	336	Ness and Roberts ¹⁰⁷	Heterogeneous causes constituting the single syndrome of preeclampsia: a hypothesis and its implications	1996
373	326	Langer et al ¹⁰⁸	Gestational diabetes: the consequences of not treating	2005
373 ^b	NF	Westrom ¹⁰⁹	Effect of acute pelvic inflammatory disease on fertility	1975
372 ^c	335	Sibai et al ¹¹⁰	Risk factors associated with preeclampsia in healthy nulliparous women	1997
372 ^b	331	Sermer et al ¹¹¹	Impact of increasing carbohydrate intolerance on maternal-fetal outcomes in 3637 women without gestational diabetes: the Toronto Tri-Hospital Gestational Diabetes project	1995
370	348	Yalcin and Bump ¹¹²	Validation of two global impression questionnaires for incontinence	2003
367	379 ^a	Romero et al ¹¹³	Infection and labor. IV. Cachetin tumor necrosis factor in the amniotic-fluid of women with intraamniotic infection and preterm labor	1989
366 ^b	338 ^a	Chamberlain et al ¹¹⁴	Ultrasound evaluation of amniotic fluid volume. 1. The relationship of marginal and decreased amniotic fluid volumes to perinatal outcome	1984
365 ^b	323 ^a	Ishihara et al ¹¹⁵	Increased apoptosis in the syncytiotrophoblast in human term placentas complicated by either preeclampsia or intrauterine growth retardation	2002
365	305 ^a	Luber et al ¹¹⁶	The demographics of pelvic floor disorders: current observations and future projections	2001
363	318 ^a	Swift et al ¹¹⁷	Pelvic Organ Support Study (POSST): the distribution, clinical definition, and epidemiologic condition of pelvic organ support defects	2005
362	325 ^a	Sibai et al ¹¹⁸	Risk factors for preeclampsia in healthy nulliparous women: a prospective multicenter study. The National Institute of Child Health and Human Development Network of Maternal-Fetal Medicine Units	1995
360	358 ^a	Minkoff et al ¹¹⁹	Risk factors for prematurity and premature rupture of membranes: a prospective study of the vaginal flora in pregnancy	1984
355	322 ^a	Lancaster et al ¹²⁰	Risk factors for depressive symptoms during pregnancy: a systematic review	2010
352 ^b	324 ^a	Straypedersen and Straypedersen ¹²¹	Etiologic factors and subsequent reproductive-performance in 195 couples with a prior history of habitual abortion	1984
352 ^c	310 ^a	Thorp et al ¹²²	The effect of intrapartum epidural analgesia on nulliparous labor: a randomized, controlled, prospective trial	1993
347 ^b	332 ^a	Yoon et al ¹²³	Amniotic fluid interleukin-6—a sensitive test for antenatal diagnosis of acute inflammatory lesions of preterm placenta and prediction of perinatal morbidity	1995
338	306 ^a	Ehrich et al ¹²⁴	Noninvasive detection of fetal trisomy 21 by sequencing of DNA in maternal blood: a study in a clinical setting	2011
337	313 ^a	Andersen et al ¹²⁵	Prediction of risk for preterm delivery by ultrasonographic measurement of cervical length	1990
329	307 ^a	Buchanan et al ¹²⁶	Insulin sensitivity and B-cell responsiveness to glucose during late pregnancy in lean and moderately obese women with normal glucose tolerance or mild gestational diabetes	1990
328	315 ^a	Ehrenberg et al ¹²⁷	The influence of obesity and diabetes on the prevalence of macrosomia	2004

Yadava. The Journal's top-cited articles from 1920 through 2018. *Am J Obstet Gynecol* 2019.

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TABLE 1**Top-cited papers in the Journal from 1920 through 2018 according to the number of citations in Scopus** (continued)

Citations, Scopus, n	Citations, Web of Science, n	Authors	Title	Year
325	309 ^a	Yallampalli and Garfield ¹²⁸	Inhibition of nitric oxide synthesis in rats during pregnancy produces signs similar to those of preeclampsia	1993
321 ^b	331 ^a	De Wolf et al ¹²⁹	Decidual vasculopathy and extensive placental infarction in a patient with repeated thromboembolic accidents, recurrent fetal loss, and a lupus anticoagulant	1982
299	332 ^a	MacGregor et al ¹³⁰	Cocaine use during pregnancy—adverse perinatal outcome	1987
272	312 ^a	Wasnich et al ¹³¹	Prediction of postmenopausal fracture risk with use of bone mineral measurements	1985
237	305 ^a	Beer et al ¹³²	Major histocompatibility complex antigens, maternal and paternal immune responses, and chronic habitual abortions in humans	1981

NF, not found in database.

^a These citations were top cited in Web of Science but not included in Scopus' top 100; ^b Origin outside the United States; ^c Randomized controlled trial.

Yadava. *The Journal's top-cited articles from 1920 through 2018. Am J Obstet Gynecol* 2019.

in the Journal during the last 100 years. Most papers were related to obstetrics topics and were published by authors from the United States. However, as the Journal's influence has increased, we observed that top-cited articles published after 1995 were more frequently cited, consisted of more RCTs, and were more likely to be from international authors. When analyzed by subspecialty, there was an increase in urogynecology publications seen in more recent years.

Results of the study in context

We observed a larger contribution from international authors after 1995. The growing contribution of international authors in American publications is also noted in another bibliometric study.¹³⁴ Zhu et al¹³⁵ looked at publication trends by Chinese authors in obstetrics and gynecology and showed more Chinese authorship in American journals. This trend may be due to multiple factors, such as changes in funding availability and research support in foreign countries. This trend may also be attributed to increasing availability of American publications online, which has been a major focus of the Journal.⁷

Top-cited articles after 1995 were more likely to be randomized controlled trials and were more frequently cited.

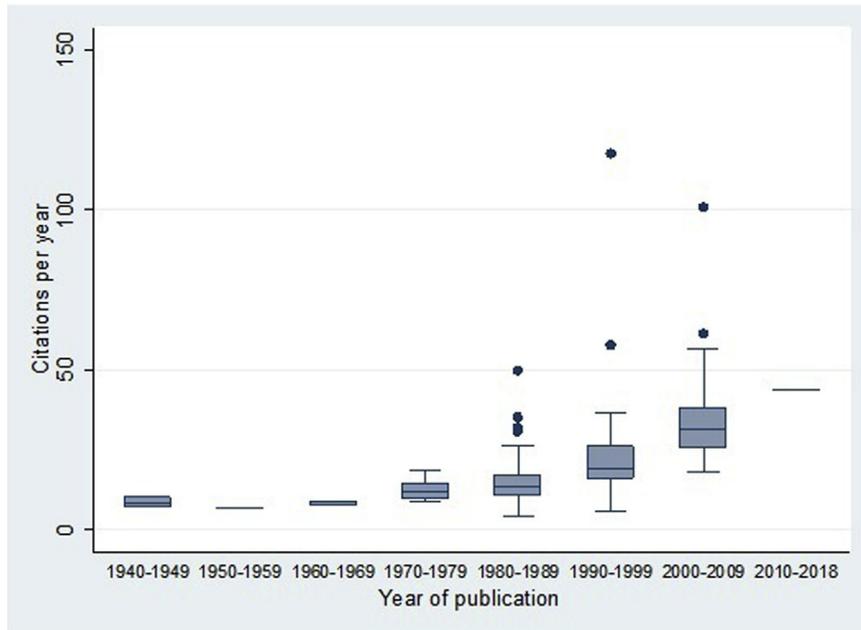
TABLE 2**Characteristics of top-cited papers in the Journal from 1920 through 2018**

Characteristics	(n = 120)
Year of publication	1993 (1984–1999)
United States	90 (75)
Number of citations	448 (382–571)
Citations per year	19 (13–28)
Study type	
Basic science	13 (10.8)
Observational	62 (51.7)
Review	13 (10.8)
Consensus	5 (4.2)
Systematic review/meta-analysis	1 (0.8)
Randomized controlled trial	11 (9.2)
New procedure/assay	8 (6.7)
Other	7 (5.8)
Subspecialty	
Obstetric, maternal	49 (40.8)
Obstetric, fetal	30 (25)
Gynecological oncology	2 (1.7)
Reproductive endocrinology/infertility	3 (2.5)
Urogynecology	15 (12.5)
Other benign gynecology	21 (17.5)
Open access	1 (0.8)

Data are n (percentage) or median (interquartile range). Open access is freely available for public access as categorized by Web of Science.

Yadava. *The Journal's top-cited articles from 1920 through 2018. Am J Obstet Gynecol* 2019.

FIGURE
Median number of citations per year by decade of publication



The value of $P < .001$ was determined by the Kruskal-Wallis test for nonparametric continuous data. Yadava. *The Journal's top-cited articles from 1920 through 2018. Am J Obstet Gynecol* 2019.

This finding likely reflects the growing emphasis of the Journal to publish higher-quality evidence. This may also

have contributed to the growing impact of the Journal as reflected in this analysis by higher citation rates.

TABLE 3
Two time point analyses comparing the Journal's top-cited articles before and after 1995

Variables	Before 1995 (n = 63)	After 1995 (n = 57)	P value
Years	1993 (1984–1999)	2013 (2010–2016)	< .001
United States	52 (82.5)	38 (66.7)	.045
Number of citations	464 (380–565)	441 (389–577)	.89
Citations per year	14 (10–17)	27 (20–35)	< .001
Study type			.009
Basic	10 (15.9)	3 (5.3)	
Observational	31 (49.2)	31 (54.4)	
Review	7 (11.1)	6 (10.5)	
Consensus	0	5 (8.8)	
Systematic review/meta-analysis	0	1 (1.8)	
Randomized controlled trial	3 (4.8)	8 (14)	
New procedure/assay	7 (11.1)	1 (1.8)	
Other	5 (7.9)	2 (3.5)	

Yadava. *The Journal's top-cited articles from 1920 through 2018. Am J Obstet Gynecol* 2019. (continued)

We also observed an increase in urogynecology publications after 1995, which corresponds with the growth of this subspecialty. The field was established in the 1970s but was expanded with the establishment of an American Board of Obstetrics and Gynecology–approved fellowship in 1995. The first National Institutes of Health request for applications for studies in urogynecology was in 1999. These milestones mirror the increase in citations in the field.¹³⁶

Research implications

All of the papers in this list are important and worthy of review by practicing obstetrician-gynecologists. Our list includes the paper by Carpenter and Coustan,¹⁶ which established the criteria for the diagnosis of gestational diabetes; the meta-analysis by Crowley³³ that established antenatal corticosteroid therapy as an important intervention in the United States; and the description of urethral support related to incontinence by DeLancey.²⁷ Publications like these have led to changes in clinical practice and opened doors for further research within the field of obstetrics and gynecology.

A bibliometric analysis of frequently cited papers in obstetrics and gynecology journals was published in 2010.³ Forty-nine of the 100 most frequently cited papers in obstetrics and gynecology were published in the Journal. Although this represented a substantial contribution to the field of obstetrics and gynecology, some of the Journal's influential papers were not included in that analysis but were captured here.

Strengths and limitations

Our study has several strengths. We used 2 respected bibliometric databases. Both Web of Science and Scopus have been used for bibliometric studies.^{9–12} Scopus is the largest abstract and citation database of peer-reviewed literature, whereas Web of Science was the first of its kind and is the most widely used bibliometric database. Neither database is accepted as superior to the other, which is why we used both for our analysis.

There are some weaknesses to our study design. The list of top-cited articles was based on the absolute number of citations that articles received. Although this could preferentially favor older articles, nearly half of the top-cited papers were published between 1995 and 2011. There are other potential influences that may affect citation rates as well, including the availability of PubMed in 1997, journal and author self-citations, incomplete citing, and omission bias.³

Another weakness is that influential papers that were not frequently cited were excluded from the database. Some papers from the Journal that have shaped the field were cited only a limited number of times until their findings became well known. This bibliometric phenomenon is referred to as obliteration by incorporation and has been demonstrated in other bibliometric studies.⁶ The description of the Papanicolaou smear¹³⁷ and the first description of fetal bradycardia¹³⁸ are 2 examples of landmark papers in the Journal that have shaped clinical practice but were not cited sufficiently to be included in this analysis. A partial list of other important papers published in the Journal that were

TABLE 3
Two time point analyses comparing the Journal's top-cited articles before and after 1995 (continued)

Variables	Before 1995 (n = 63)	After 1995 (n = 57)	P value
Subspecialty			.183
Obstetric, maternal	26 (41.3)	23 (40.4)	
Obstetric, fetal	17 (27)	13 (22.8)	
Gynecological oncology	2 (3.2)	0	
Reproductive	3 (4.8)	0	
Endocrinology/infertility			
Urogynecology	4 (6.4)	11 (19.3)	
Other benign gynecology	11 (17.5)	10 (17.5)	
Open access	0	1 (1.8)	.475

P values were determined by χ^2 or Fisher exact tests (categorical data) and Wilcoxon rank-sum test (for nonparametric continuous data). Data are n (percentage) or median (interquartile range). Open access is available for free public access.

Yadava. The Journal's top-cited articles from 1920 through 2018. *Am J Obstet Gynecol* 2019.

not frequently cited was reported by Romero et al⁷ and summarized here in Table 4. While this is not a comprehensive list, it demonstrates that many papers of clinical importance are missed when looking only at citations.

Conclusions

Despite these limitations, this list of top-cited papers provides insight into

many of the most important papers in the Journal's history. It provides insight into the Journal's publications that have shaped the scope and practice of obstetrics and gynecology. As the Journal's impact has increased, so has the quality of its publications and its international influence. We look forward to the next century of the Journal's publications. ■

TABLE 4
Landmark papers from the Journal not included in top-cited list

Authors	Title	Year
Papanicolaou and Traut ¹³⁷	The diagnostic value of vaginal smears in carcinoma of the uterus	1941
Morris ¹³⁸	The syndrome of testicular feminization in male pseudohermaphrodites	1953
Hon ¹³⁹	Observations on pathologic fetal bradycardia	1959
Quilligan et al ¹⁴⁰	Correlation of fetal heart rate patterns and blood gas values: II, bradycardia	1965
Trierweiler et al ¹⁴¹	Baseline fetal heart rate characteristics as an indicator of fetal status during the antepartum period	1978
Vintzileos et al ¹⁴²	Comparison of intrapartum electronic fetal heart rate monitoring versus intermittent auscultation in detecting fetal acidemia at birth	1995
Macones et al ¹⁴³	A polymorphism in the promoter region of TNF and bacterial vaginosis: preliminary evidence of gene-environment interaction in the etiology of spontaneous preterm birth	2004
Langer et al ¹⁴⁴	Shoulder dystocia: should the fetus weighing greater than or equal to 4000 grams be delivered by cesarean section?	1991
Sibai et al ¹⁴⁵	Aggressive versus expectant management of severe preeclampsia at 28 to 32 weeks' gestation: a randomized controlled trial	1994
Burrows and Kelton ¹⁴⁶	Thrombocytopenia at delivery: a prospective survey of 6715 deliveries	1990

Yadava. The Journal's top-cited articles from 1920 through 2018. *Am J Obstet Gynecol* 2019.

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