



# Breech Presentation - A scientiometric analysis of the global research output★

Dörthe Brüggmann<sup>1,2,\*</sup>, Jenny M. Jaque<sup>3</sup>, Doris Klingelhöfer<sup>2</sup>, David A. Groneberg<sup>2</sup>, Frank Louwen<sup>1</sup>

<sup>1</sup> Department of Gynecology and Obstetrics, Goethe-University, Frankfurt, Germany

<sup>2</sup> Division of Epidemiology, Institute of Occupational Medicine, Social Medicine and Environmental Medicine, Goethe-University, Frankfurt, Germany

<sup>3</sup> Department of Obstetrics and Gynecology, Keck School of Medicine of USC, Los Angeles, California, United States of America



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## ABSTRACT

**Objective:** Although breech presentations occur in 3–5% of term deliveries, the mode of delivery still remains a topic of debate. Hence, this study aimed to analyze the worldwide research output on breech presentation. All relevant publications issued in the Web of Science from 1900 to 2014 were assessed by an objective, standardized bibliometric procedure.

**Study design:** In this retrospective, descriptive study, we used the computerized NewQIS platform, to identify publications by a specific search term and to analyze them regarding quantitative parameters (e.g., countries of origin, journals) as well as qualitative characteristics (e.g., citation rate, country-specific H-index). In addition to geographical aspects, chronological developments and collaboration networks were investigated. In order to visualize the results, anamorphic maps were generated by the innovative “density equalizing map projections”(DEMP) technology.

**Results:** A total of 1,438 original articles, reviews, “Letters” and “Abstracts” on breech presentation were identified. 86% of this work was written in English. The highest number and the most cited publications came from the US and Canada as well as Western European countries. Exceptions were Israel and South Africa that appeared among the leading countries. The collaboration network included 26 countries, dominated by the US and the UK. We also present a table of the 14 most cited publications in the world.

**Summary:** This study underlines that the mere total of only 1,438 publications on breech do not do justice to this relevant and controversially discussed topic. The global research output was dominated by the industrialized world. Developing and emerging countries are largely excluded from research activities. To minimize this imbalance and to foster scientific collaborations, future research on this topic needs to be planned and funded according to these shortcomings.

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## Introduction

At term, approximately 3 – 5% of mothers will expect a baby in breech presentation [1]. The optimal mode of a breech delivery is still a much debated topic among obstetricians worldwide [2]. In 2000, the largest randomized trial to date demonstrated improved outcomes for breech babies following a cesarean section (CS, [3]). Based on these findings, practice patterns changed globally: The CS rates increased up to seven-fold in high resource countries. This

shift in practice was associated with unfavorable short- and long-term outcomes for maternal and child health as well as substantial health care costs [4,5].

Given longtime outcome analyses have failed to provide evidence to support this common clinical practice, and methodological flaws of the Term Breech Trial have been voiced, the general delivery of breech infants by elective CS has been widely questioned. Guidelines of international societies [6] and expert panels regard vaginal breech delivery as a viable option. A growing body of literature has demonstrated benefits of vaginal breech birth compared to CS and its numerous advantages for maternal and child health - as long as patients are appropriately selected, counseled and cared for by experienced physicians [6,7].

That said, we need more compelling evidence on the optimal mode of breech delivery. More research is required to collect accurate and reliable data aiming to improve clinical counseling,

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\* Corresponding author at: Department of Gynecology and Obstetrics, Goethe University, Theodor-Stern-Kai 7, 60590 Frankfurt, Germany.

E-mail address: [prevention@uni-frankfurt.de](mailto:prevention@uni-frankfurt.de) (D. Brüggmann).

the safety of vaginal breech delivery and ensure favorable short and long-term outcomes of mothers and babies. These scientific endeavors have to be planned and funded in the near future. Therefore, it was the aim of this bibliometric study to depict the current worldwide landscape on breech research. We employed the New Quality and Quantity Indices in Science (NewQIS) platform to investigate the global publication output regarding quantitative and qualitative aspects, geographical and chronological developments as well as collaborative networks.

## Methods

### Database

The NewQIS computing platform combines scientometric methods and “density equalizing map projections” (DEMP) to assess and visualize research productivity related to a specific topic in an objective, reliable and standardized way [8]. Anamorphic maps depict the global research productivity based on the algorithm of Gastner and Newman [9]. Here, the size of each country is modified to reflect our country-specific findings, e.g. total number of publications on breech leading to a new geographic distribution of the global landscape.

Our data collection was based on the Web of Science (WoS) Core Collection database (Thomson Reuters). We created the following search term: TITLE: (breech AND (presentation\* OR \*complete\* OR position\* OR deliver\* OR pregnanc\* OR birth\* OR infant\* OR fetus\* OR foetus\* OR child\* OR neonat\* OR fetal OR vaginal OR baby OR babies OR detection\* OR c-section\* OR caesarian OR version\* OR presenting OR term OR singleton). We conducted a TITLE contrary to a TOPIC search to narrow down the analysis and exclude off-topic publications compromising the validity of our data collection. Publications related to breech were identified from 1900 to 2014 and included original articles, reviews, letters, and abstracts.

### Data analysis

We analyzed the breech-related research output and publishing journals in regards to quantitative aspects such as the total number of publications, citation numbers, countries of origin, institutions, languages, document types, cited reference numbers, attributed subject categories and publication date. As variables gauging the quality of the items, H-Indices, citation numbers and average citations per publication (citation rate, CR) were investigated. Here we present the “modified country-specific” H-Index, which is based on the concept of the Hirsch-Index. This variable is a proxy measure for the impact of an author’s research output on the scientific community and therefor estimates the quality of a research publication.

### Gender analysis

We investigated the proportion of male to female researchers working on breech related research. Countries were included with a minimum of 60 gender-defined authors and with more than 50% of authors identifiable by gender. We employed name databases to identify the authors’ genders and conducted a manual search (utilizing websites, corresponding addresses and social networks) in case of non-gender specific first names or initials.

### Cooperation analysis

All publications were analyzed for collaborative efforts between publishing authors by assessment of their affiliations. A publication was defined as a collaborative work if an item was issued by a minimum of two or more authors from different institutions or

countries. Fig. 5 depicts the global research connections on “breech presentation”. Connecting vectors illustrate co-operations; their width and shade of grey reflected the number of joint publications.

## Results

We identified 1,438 original articles, reviews, letters, abstracts publications related to our search term. 86% of publications were written in English (1237 items), followed by items issued in German (146 items, 10%) French (40 items, 2.7%), Spanish (3 items, 0.2%) and Africaans (2 items, 0.1%). The number of authors per article increased from 2.8 in 1973 to 4.2 in 2015, which indicates an increasing number of articles are created by collaborative efforts.

### Chronological development

The first publication was authored in 1901. After a moderate increase in productivity from 1901 to the 1970s, we identified a steep increase in publication activity after 1973 with three prominent peaks in 1992 (37 annual publications), 1996 (42 annual publications) and 2007 (44 annual publications). This chronological development was paralleled by an increase in annual citations the publications received. We identified also three annual citation peaks in 1980 (496 annual citations), 2000 (896 annual citations), 2004 (547 annual citations).

### Analysis of research origin and citations

The United States of America (US) was ranked first when country-specific publication activity was examined. Authors located in this nation issued 264 publications on “breech presentation”. The US was followed by the United Kingdom (UK, 157 publications), Germany (108 publications), Canada (65 publications), France (61 publications), The Netherlands (60 publications), Israel (57 publications) and Australia (46 publications, Fig. 1).

We analyzed the chronological development of publication activity: Here, a continuous number of annual publications was issued by authors from the UK, Israel and the US during the investigated time period from 1900 to 2014. Significant changes in annual productivity were seen in Germany where the highest annual publication productivity was seen before 2000, and for France with a markedly growing publication activity after 1990.

The country-specific citation numbers and modified H-Indices showed a global distribution different to the overall number of publications. The majority of citations were received by US-American publications (3,433 citations, c), followed by articles from the Canada (c = 1809), the UK (c = 1031), Sweden (c = 691), the Netherlands (c = 577), and Israel (c = 562). Germany occupied the 8<sup>th</sup> rank – although ranked third in regards to research quantity – followed by France ranked 9<sup>th</sup> (ranked 5<sup>th</sup> regarding its productivity, Fig. 2).

Regarding the average citation number per publication defined as citation rate (CR), Canada was leading the field (CR: 28), followed by Sweden (CR: 19), the US (CR: 13), Israel (CR: 9) and the Netherlands (CR: 9, Fig. 3). We included only countries in this analysis with a minimum of 30 publications issued by authors affiliated with this country.

The analysis of the country-specific H-index resembled the investigation of the total citation numbers: The US was ranked first (H-Index, HI of 34), followed by the UK (HI 19), Sweden (HI 19), Canada (HI 18), the Netherlands (HI 17) and Israel (HI 16, Fig. 4).

### Collaborations

We identified the US as the nucleus of collaborative efforts in the community followed by the UK. The most prolific bilateral

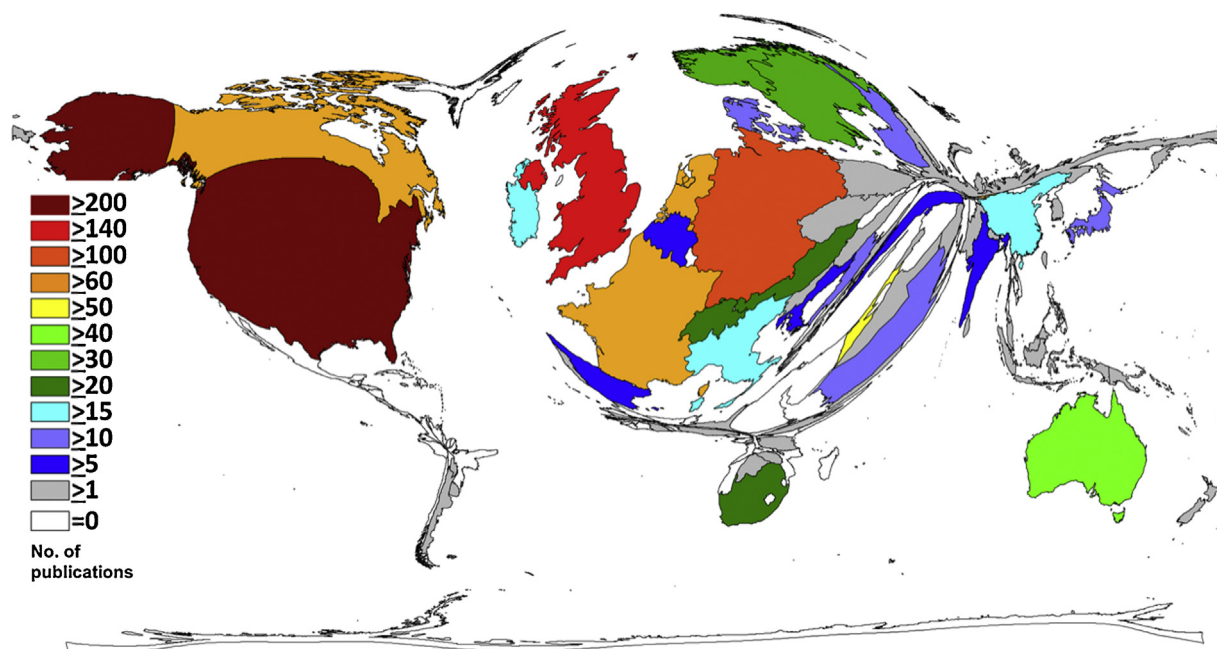


Fig. 1. Density equalizing map of the global number of publications related to breech presentation.

collaborations were established between the US and Israel (4 collaborations), the UK and the Netherlands (5 collaborations) as well as the UK and South Africa (5 collaborations, Fig.5).

#### Subject areas

Most published items were assigned to “Obstetrics and Gynecology”. In second position was the subject area of “General and Internal Medicine”, followed by “Pediatrics”. The prominence of “General and Internal Medicine” is commonly related to review articles published in high impact journals such as Lancet, NEJM or the Cochrane Database, which are assigned to this respective subject category. Only 23 articles were published in the

subject area of “Public Health”. Until 1970, all publications were assigned to only three categories, “Obstetrics and Gynecology”, “Internal Medicine” and “Pediatrics”. From 1971 until 1980 Radiology “was identified as a prominent subject category. “Complementary Medicine “appeared first in 1991 and became prominent after 2006.

All investigated countries published the majority of articles in “Obstetrics and Gynecology”. The UK has the highest percentage of articles attributed to “General and Internal Medicine”. We identified several striking country-specific research interests. Authors working in Canada and France focused heavily on the field of Anesthesiology”, as well as authors from the Netherlands and Australia on Complementary Medicine”.

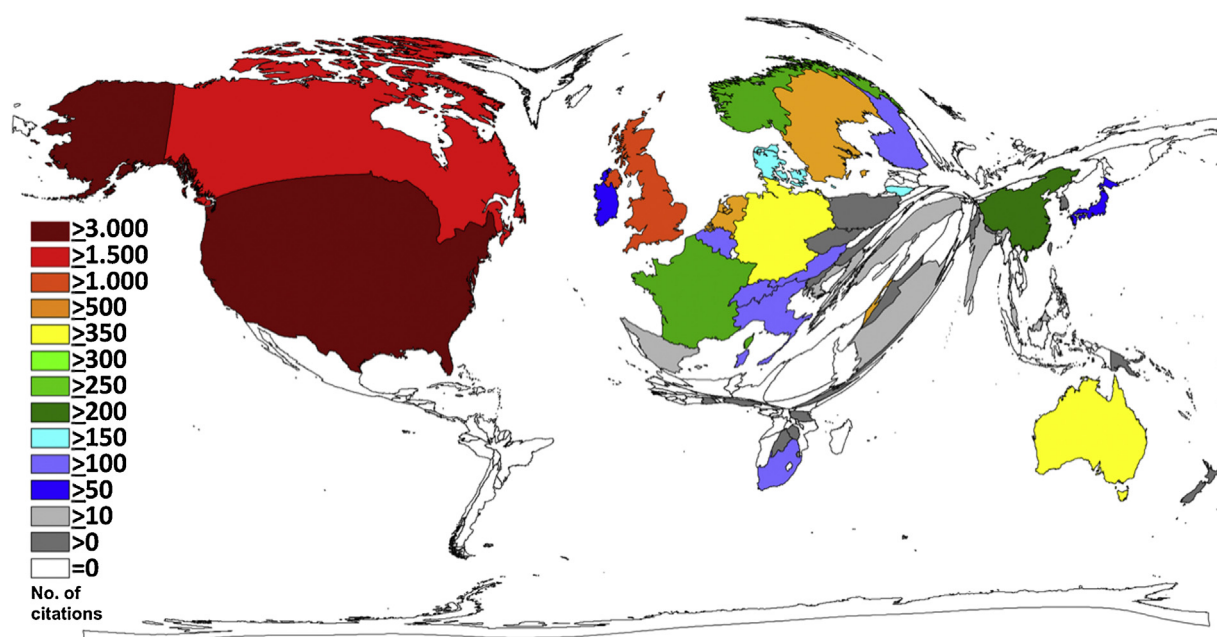


Fig. 2. Density equalizing map of the global number of citations related to breech presentation.

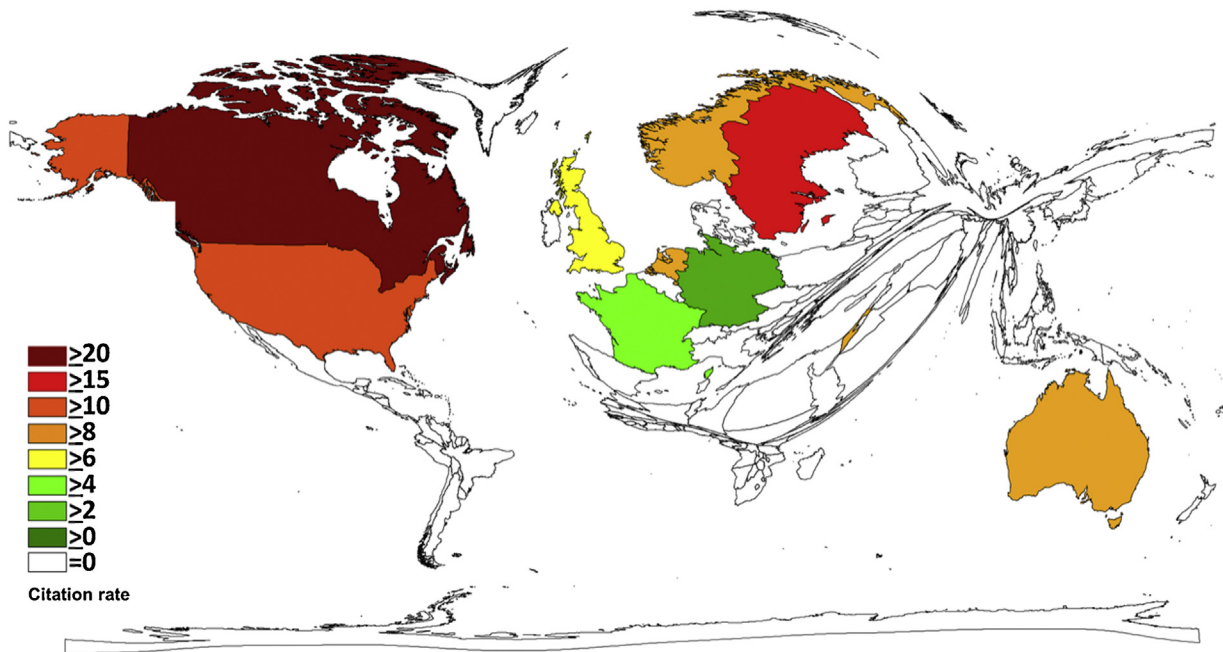


Fig. 3. Density equalizing map of the number of citation rates worldwide related to breech presentation.

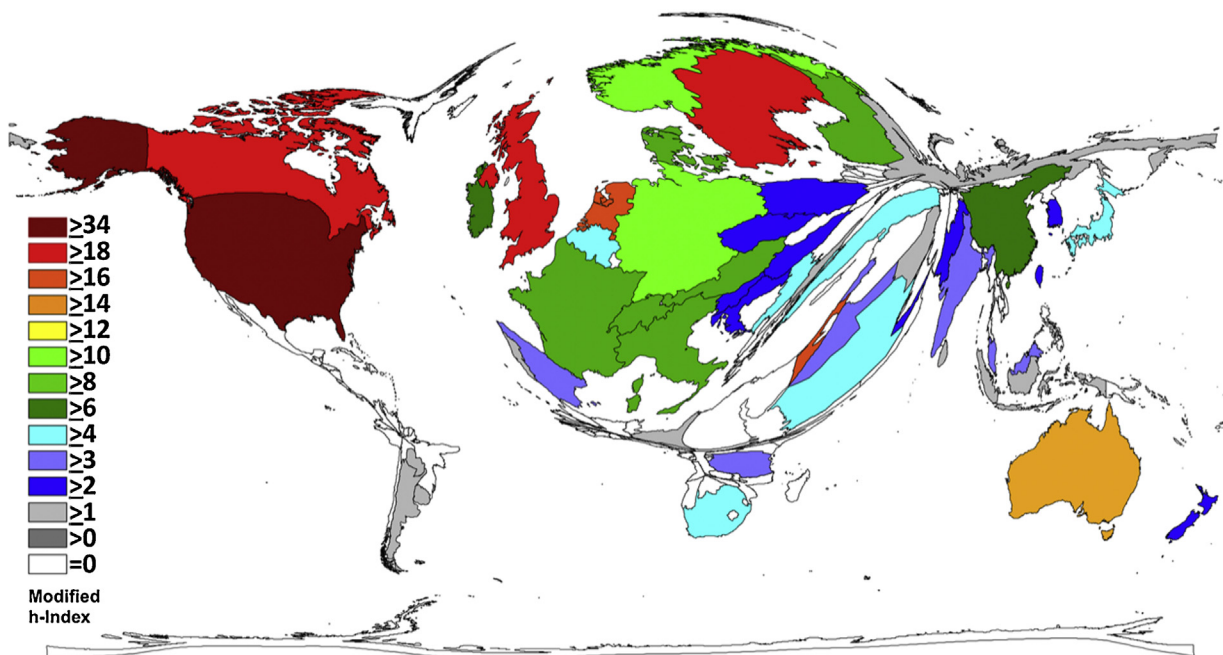


Fig. 4. Density equalizing map of the modified H-index worldwide related to breech presentation.

#### Most prolific journals

The journal publishing the majority of articles on the subject was the “American Journal of Obstetrics and Gynecology” (AJOG, 218 items, 3798 citations), followed by “Obstetrics and Gynecology” (100 items, 1754 citations). The “British Medical Journal” (71 items, 295 citations), the “Acta Obstet Gyn Scan” (62 items, 634 citations), the “European Journal of Obstetrics and Gynecology” (52 items, 392 citations), as well as “Geburtshilfe und Frauenheilkunde” (50 items, 173 citations) followed.

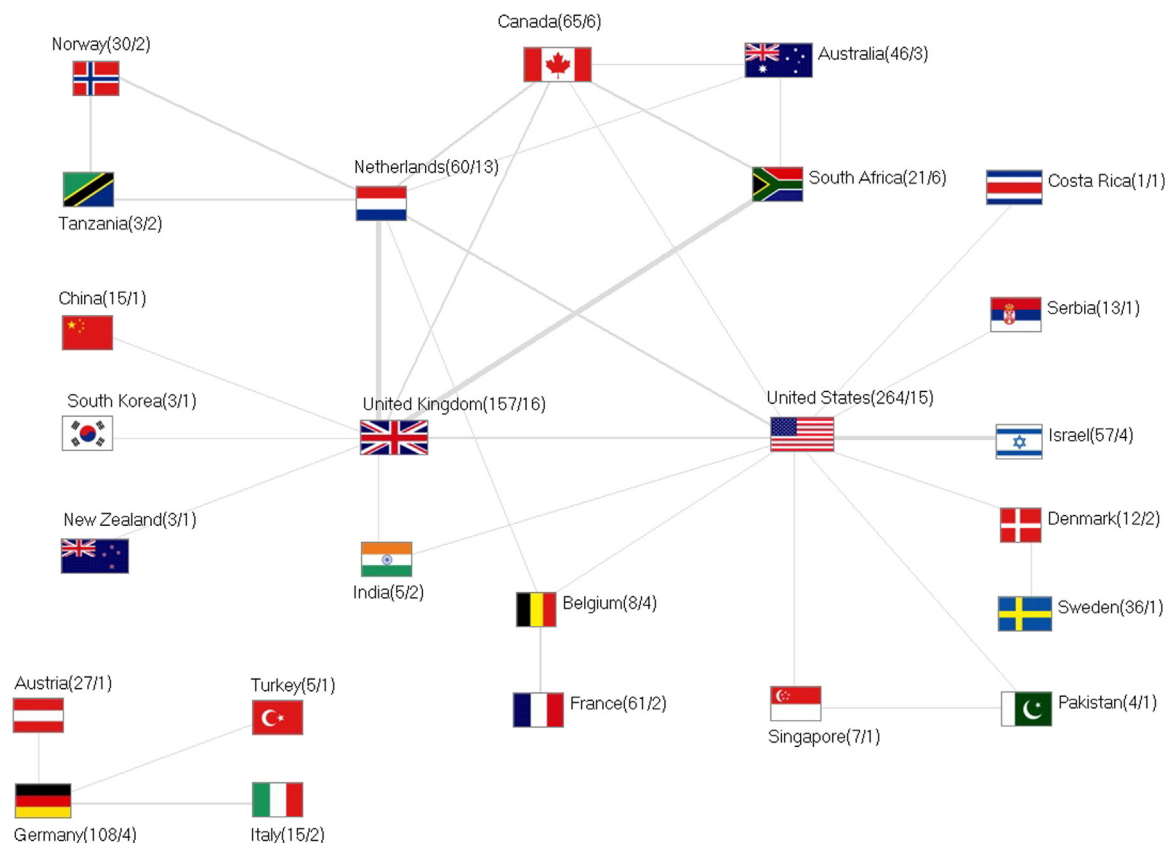
Articles published in the journals “Lancet” (CR 22.93), “British Journal of Obstetrics and Gynecology” (CR 19.63), “Obstetrics and

Gynecology” (CR 17.52), the “American Journal of Obstetrics and Gynecology” (CR 17.42) and the “Acta Obstet Gyn Scan” (CR 10.23) were characterized by a remarkably high citation rate indicating the high recognition these publications receive in the respective field. We compiled the fourteen publications that have gained more than 80 citations in the field (Table 1).

#### Gender

In the field of breech research, male authors dominated over female authors in the US, Germany, Canada, and France. In the UK, female authors represented the largest proportion of scientist





**Fig. 5.** Breech research collaborations between countries. Numbers in brackets (Publication numbers/Number of collaborative publications).

**Table 1**  
The 14 most cited articles (citation threshold >80) in the area of breech research are displayed including their title, publication year, country of origin, citation count and journal.

Title	First Author	Year	Country	Citations	Journal
Planned caesarean section versus planned vaginal birth for breech presentation at term: a randomized multicentre trial	Hannah ME	2000	Canada	721	Lancet
The Randomized Management of Term Frank Breech Presentation - A Study Of 208 Cases	Collea JV	1980	United States	177	Am J Obstet Gynecol.
Maternal outcomes at 2 years after planned cesarean section versus planned vaginal birth for breech presentation at term: The international randomized Term Breech Trial	Hannah ME	2004	Canada	142	Am J Obstet Gynecol
Outcomes at 3 months after planned cesarean vs planned vaginal delivery for breech presentation at term - The international randomized Term Breech Trial	Hannah ME	2002	Canada	126	JAMA
Outcomes of children at 2 years after planned cesarean birth versus planned vaginal birth for breech presentation at term: The International Randomized Term Breech Trial	Whyte H	2004	Canada	125	Am J Obstet Gynecol
Randomized Management Of The Non-Frank Breech Presentation At Term - A Preliminary-Report	Gimovsky ML	1983	United States	120	Am J Obstet Gynecol
Reduction Of Perinatal Mortality And Morbidity In Breech Delivery Through Routine Use Of Cesarean Section	Wright RC.	1959	United States	117	Obstet Gynecol
Characteristics And Perils Of Breech Presentation	Brenner WE	1974	United States	110	Am J Obstet Gynecol
Management Of Breech Presentation At Term	Rovinsky JJ	1973	United States	104	Am J Obstet Gynecol
Breech Delivery At Term - A Critical-Review Of The Literature	Cheng M	1993	Canada	100	Obstet Gynecol
Long-Term Follow-Up Of Preterm Infants In Breech Presentation Delivered By Cesarean-Section - Prospective-Study	Ingemarsson I	1978	Sweden	99	Lancet
Is planned vaginal delivery for breech presentation at term still an option? Results of an observational prospective survey in France and Belgium	Goffinet F	2006	France, Belgium	92	Am J Obstet Gynecol
Moxibustion for correction of breech presentation - A randomized controlled trial	Cardini F	1998	China	92	JAMA
The Frequency Of Breech Presentation By Gestational-Age At Birth - A Large Population-Based Study	Hickok DE	1992	United States	83	Am J Obstet Gynecol

working in the field whereas both genders contributed equally to the subject in the Netherlands, Australia, Norway and Israel.

#### Comment

Since 1901 numerous authors published on breech delivery mainly to enhance knowledge on clinical practice and patient

counseling. Complementing these clinical studies, we present the first concise analysis of the international research productivity during the last century related to this topic. When the historical development was analyzed, we found a slow but continuous increase of the scientific output on breech presentation during the first 70 years of the last century. This pattern is seen for biomedical research in many areas [10,11] and can be explained by a generally

lower research productivity during this time period. Research activities increased significantly in the '80 s, which can be attributed to the growing importance of publishing for the professional fate of scientists and clinicians. The increase in publication volume was paralleled by equally growing citation numbers over the years. We identified three prominent citation peaks in 1980 (496 annual citations), 2000 (896 annual citations), 2004 (547 annual citations). These were linked to key publications in the field: In 1980, Colleae et al. published the first randomized study investigating the optimal clinical management of frank breech deliveries in 208 cases [12]. Hannah et al. conducted the largest multicenter trial to date regarding the favorable mode of delivery for term breech fetuses. The authors published data in 2000 and 2004 reporting on the short- and long-term outcomes of mothers and newborns after vaginal delivery versus CS [3,13].

The leading countries regarding the scientific output on breech were located in North America and in Western Europe – a pattern also characteristic for most biomedical research. We identified the US as the most impactful player in the breech research community. Authors affiliated with this nation published the highest overall volume, which received the most citations and the highest H-Index of all countries. Also, the US was involved in the highest number of prolific collaborations. The rates of cesarean sections due to breech presentation in the US are among the highest globally [14]. Although the ACOG committee opinion regards the vaginal breech delivery as a viable option under certain circumstances (ACOG Committee Opinion, number 745, 2018), the medicolegal realities in the country push providers to counsel patients accordingly. This creates an environment not very conducive for vaginal breech births. In light of these circumstances, we sub-analysed all US-American publications related to “breech presentation” to identify country-specific research foci. Results were not reliable due to the rather low number of overall breech publications. We hypothesize that – if this analysis would have been successful – research interests would be identified that reflect the common clinical practice in the US such as “external cephalic version” rather than “vaginal breech delivery”.

Besides Western European countries, Israel and South Africa were found among the 12 highest ranked nations. We regard this as an exceptional finding since they are not commonly found among the leading research nations. These two countries might benefit from the fruitful collaborations they established with the US and the UK, which we identified as the two most globally active nations related to breech research. Also, it is rather unusual that Scandinavian countries did not demonstrate an outstanding interest in scientific endeavors related to breech; only Norway and Sweden were listed among the 15 nations having published more than 15 articles in the field. Nevertheless, works by Swedish authors gained 19 citations per publication – placing them in the second highest position after Canada – indicating the remarkable scientific quality of their scientific output (4<sup>th</sup> rank).

Canada occupied a notable position within our country-specific analysis. Authors based in this country published a relatively low overall number of publications (4<sup>th</sup> rank, 65 publications) and by far the most citations per publication (CR of 28) in concert with a relatively low H-index (4<sup>th</sup> rank). These findings indicate the high popularity a small number of Canadian papers have gained in the scientific community. Table 1 reveals these key papers as publications related to the Term Breech Trial that were issued 2000, 2002 and 2004. The first Term Breech Trial paper was by far the highest cited paper, which was cited nearly 6 times more than the second most cited paper in the field.

“Breech presentation” is a very specific topic. Hence, it is not surprising that most published items were associated with the subject area of “Obstetrics and Gynecology”. Until 1970, we found that all publications were assigned to only three categories,

“Obstetrics and Gynecology”, “Internal Medicine” and “Pediatrics”. The field diversified after 1971: From 1971 until 1980 Radiology was identified as a prominent subject category related to the scientific investigation of imaging modalities to predict a successful vaginal breech delivery. Items attributed to “Complementary Medicine” appeared first in 1991 and became prominent after 2006, which indicates the increasing popularity of non-traditional medical approaches. The majority of breech articles were published in US-American journals: The “American Journal of Obstetrics and Gynecology” (218 items, 3798 citations) was identified as the leading journal in the field. It was followed by “Obstetrics and Gynecology” (100 items, 1754 citations), which has published around 50% less articles on breech than AJOG. Hence, these two North-American journals demonstrate an outstanding interest in clinical research related to breech presentations and can be regarded as the leading publishing platforms for researchers working in this area. Finally, we want to address important limitations of this study: The WoS covers mostly publication written in English translating into a possible language bias with an underrepresentation of non-English articles. We regard this issue as less significant since high quality research is commonly published in English journals to reach a large audience. Further, we have to address that citation numbers and the H-index rather gauge scientific popularity than truly reflect outstanding scientific quality as illustrated by the Matthew effect. Here, publications issued by scientists of acknowledged standing will be cited exponentially more than little-known authors [15].

In conclusion, we want to emphasize the fact that a mere total of 1,438 breech-related publications do not do justice to this relevant and problematic issue, which is a reality to nearly 5% of pregnant women at term. More research needs to be done fostered by funding which is dedicated to this issue since many important clinical questions remain. For example, we lack stringent criteria for the selection of suitable patients for vaginal delivery... Also, accurate predictors to counsel patients about the likelihood of a successful vaginal breech delivery are required for daily practice, and the role of clinical and radiological exams in this context has to be investigated further. Due to decreasing vaginal breech delivery rates, particularly in the developed world and the lack of provider competency, we stress the necessity to strengthen the global network working on breech research. Here, epidemiological data, ideas and clinical knowledge can be exchanged and benefit all participants and most importantly – our patients.

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