

Bibliometric Analysis of Global Research on Long-Acting Reversible Contraception and Healthcare Workers

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ABSTRACT

INTRODUCTION: Long-acting reversible contraception (LARC) is a feasible solution to reduce unintended pregnancy and abortion rates. Nonetheless, the worldwide prevalence of LARC remains low. The LARC uptake depends heavily on healthcare workers because every LARC insertion requires a clinician's visit, and they are a trusted source of contraceptive information. The study is aimed to explore the trend and distributions of global publications related to LARC and healthcare workers. **MATERIALS AND METHODS:** Articles related to LARC and healthcare workers were retrieved from the Scopus database. Eligible publications were limited to research articles, reviews, and conference papers published in the English language with no date restriction. The bibliometric data was analysed using Biblioshiny to obtain distributions in terms of the number of publications, journals, countries, institutions, citations, and keywords. **RESULTS:** A total of 681 eligible publications related to LARC and healthcare workers were retrieved from the Scopus database between 1967 to 2022. The number of publications was low for the first four decades but increased steadily from 2010 onwards. The leading country in this research area was the United States of America and the majority of the most productive institutions were from this country. Half of the frequently cited publications highlighted healthcare workers' bias, attitude, and practice on LARC provision to clients. **CONCLUSION:** This bibliometric analysis can guide scholars to understand the global overview of research about LARC and healthcare workers. It may be useful for health practitioners and researchers who are interested in exploring this research area.

Keywords

Long-acting reversible contraception; healthcare worker; bibliometric; Biblioshiny

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INTRODUCTION

Long-acting reversible contraception (LARC) is a contraceptive method that has a long duration of action and does not require compliance once initiated.¹ Globally, the available LARCs are either contraceptive implants or intrauterine contraceptive devices (IUCD). There are two categories of IUCD: copper IUCD and levonorgestrel IUCD.² The LARC has high effectiveness, which is comparable to surgical sterilization, has a higher continuation rate compared to non-LARC users, and does not depend on user compliance.^{2, 3} A large prospective cohort study in the United States (Contraceptive CHOICE Project) showed that the unintended pregnancy and abortion rates can be reduced as compared to the national rates by increasing access to LARC.⁴ Besides, various global and national organizations had recommended LARC as the first-line contraception for women of all ages given its effectiveness, safety, and convenience of use.⁵⁻⁷ Despite the numerous benefits which LARC can offer and recommendations for broader use from well-established reputable organisations, the prevalence of LARC use remains low worldwide. The United Nations reported that the estimated global prevalence of IUCD and contraceptive implant use among women of reproductive age was 8.4% and 1.2% respectively.⁸ Additionally, LARC usage was half as compared to the use of short-acting contraception.⁸ It is alarming because short-acting

contraception has lower effectiveness and a higher discontinuation rate.^{2,3}

Healthcare workers (HCWs) are the key players in the LARC service provision because every LARC insertion or removal requires a visit to HCW.⁹ The HCWs are the 'street level bureaucrats' because they deal directly with clients and they have significant power to decide which clients will get LARC at their healthcare facility.¹⁰ Therefore, they may act as a barrier to LARC provision.

Besides, they are a trusted source of contraceptive information for clients. A study in Norway found that doctors and nurses were important sources of contraceptive information compared to friends, family members, sexual education programs, or media.¹¹ HCWs are thought to be knowledgeable which credits no question from the clients regarding the information they provide.¹⁰ Unfortunately, many HCWs reported that they had outdated and lack of knowledge about LARC.⁹ This discrepancy in knowledge is further impeded by the HCWs' beliefs, local values, and religious backgrounds which can influence them to impose restrictions beyond the latest guideline.¹⁰

Even though the scientific publications related to LARC and HCW are expanding at a rapid pace, there is a lack of information on the overall trend and distribution of these publications. The bibliometric analysis enables researchers to explore and analyse large volumes of diverse past research findings on a certain topic using rigorous methods.¹² Various software tools are available to conduct bibliometric analysis including performance analysis, science mapping analysis, and visualisation tools.¹² In 2015, Sweileh *et al* published the first bibliometric analysis in the field of contraception.¹³ It analysed the publications related to emergency contraception between 1967 to 2012. To the best of our knowledge, there is no bibliometric analysis on LARC and HCW at present.

Thus, the purpose of this bibliometric analysis is to explore the distribution of global publications in terms of the number of publications, journals, countries, institutions, citations, and relevant keywords related to global research activity related to LARC and HCW.

METHOD

Search strategy and selection criteria

The search was conducted and publications were retrieved on 2nd November 2022 from the Scopus database. The database was chosen because its content covers health, life sciences, physical sciences, and social sciences which fits our research area. Besides, the Scopus is one of the primary bibliographic databases used in bibliometric analysis.¹⁴ The following keywords and their respective MeSH terms were searched: ("long-acting reversible contracept*" OR "contraceptive implant" OR "intrauterine device") AND "healthcare worker". The wildcard search operator (*) was used to cover various available terms such as "long-acting reversible contraception", "long-acting reversible contraceptive" and "long-acting reversible contraceptives". The terms were searched in the titles, abstracts, or keywords of the publications. Eligible publications were limited to research articles, reviews, and conference papers published in the English language with no date restriction. Figure 1 illustrates the flow diagram for the study selection process.

Data Analysis

The full records of the publication data were exported in BibTeX format from the Scopus database. The publication data was analysed using Biblioshiny, an open-source web-based graphical interface that connects to R software.¹⁴ The interface is intuitive and well-organized which is suitable for non-coders. The graphs, tables, figures, or maps generated can be exported or saved into various format types.

Descriptive analysis based on bibliometric indicators such as the trend of publications, most relevant journals, most productive countries, most productive institutions, and most cited publications was conducted. For the keyword analysis, the author's keywords were used because they represent the content of the paper better as compared to automatically indexed keywords.¹⁵ Biblioshiny does not discriminate between plurals and other words' derivations. Therefore, we replace plural forms with singular forms and merge words with different spelling such as

“counselling” and “counseling”. The harmonised keywords were used to generate a Word TreeMap of the most relevant keywords.

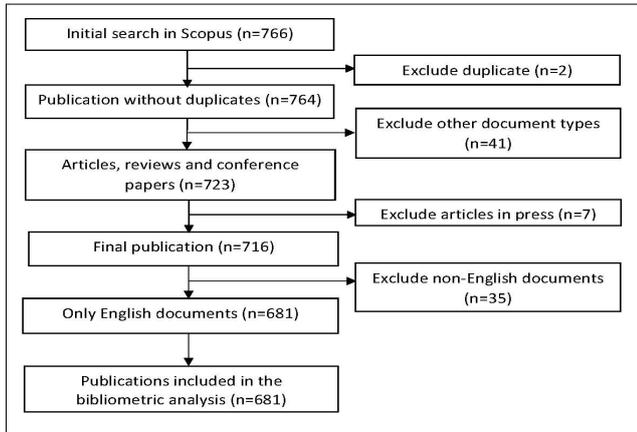


Figure 1 Flow diagram of study selection for the bibliometric analysis

RESULT

There were 681 publications on LARC and HCW published in the Scopus database from 1967 to November 2022. Our included studies were published by 2,369 authors from 83 different countries. The majority of the included publications were original articles (n=589, 86.5%), followed by review articles (n=82, 12.0%) and conference papers (n=10, 1.5%). These documents had been cited 16,733 times from other documents as of November 2022. The average citation per document was 13.06 citations.

Publication by year

Figure 2 depicts the trend of the publications related to LARC and HCW spanning 55 years from 1967 to November 2022. The earliest publication on LARC and HCW was published in 1967, entitled “Nurse-Midwives Insert IUDs in Barbados”.¹⁶ It was published in The International Planned Parenthood Federation Medical Bulletin. In the first four decades, the number of publications fluctuated between zero to 14 publications

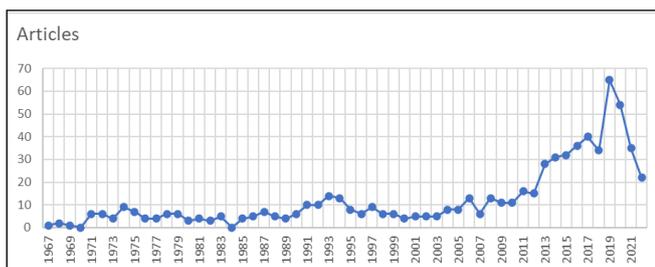


Figure 2 Annual trend of publications pertaining to LARC and HCW

per year. Then it increased rapidly from 2010 onwards, reaching its highest record in 2019 (n=65). Afterwards, the number of publications declined.

Publication by journal

The publications identified in this study had been published in 298 journals. Table 1 illustrates the journals with the highest number of papers published. These journals had published nearly one-third of all publications pertaining to LARC and HCW (31.7%; n=216/681). Almost all journals are specifically related to contraception, obstetrics and gynaecology, or reproductive health. The Contraception topped the journal rank with the highest number of publications (n=67, 9.8%), followed by the European Journal of Contraception and Reproductive (n=27, 4.0%) and the International Journal of Gynecology and Obstetrics (n=19, 2.8%).

Table 1 The top ten prominent journals

Rank	Journal	No. of articles, n (%)	Quartile ^a
1	Contraception	67 (9.8%)	Q1
2	European Journal of Contraception and Reproductive	27 (4.0%)	Q2
3	International Journal of Gynecology and Obstetrics	19 (2.8%)	Q1
4	Reproductive Health	18 (2.6%)	Q1
5	American Journal of Obstetrics and Gynecology	17 (2.5%)	Q1
6	Journal of Family Planning and Reproductive Health	16 (2.3%)	NA
6	Studies in Family Planning	16 (2.3%)	Q1
8	Journal of Pediatric and Adolescent Gynecology	14 (2.1%)	Q2
9	BMC Women's Health	11 (1.6%)	Q2
9	Global Health Science and Practice	11 (1.6%)	Q2

^a Based on Scopus indexing¹⁷

Publication by country

The publications related to LARC and HCW originated from 83 different countries. Table 2 presents the top ten countries with the highest number of publications related to LARC and HCW. A publication can be written by several authors from different countries. The United States was the leading publishing country with 661 publications, followed by the United Kingdom (165) and Australia (79). Our analysis discovered that there were three middle-income countries (South Africa, Nigeria, and Brazil) and only one low-income country (Ethiopia); while the remaining are high-income countries.

Among the top ten publishing countries, contraceptive pill was the most commonly used contraceptive method in each country except for South Africa (injectable contraception), Ethiopia (injectable contraception), and Nigeria (condom).⁸ Overall, short-acting reversible contraceptions were commonly used in these countries.

Table 2 The top ten publishing countries

Rank	Country	Number, n	World Region
1	United States of America	661	North America
2	United Kingdom	165	Europe
3	Australia	79	Oceania
4	Canada	57	North America
5	South Africa	50	Sub Saharan Africa
6	Sweden	42	Europe
7	Nigeria	38	Sub Saharan Africa
8	Ethiopia	36	Sub Saharan Africa
9	France	32	Europe
10	Brazil	29	Latin America

Publication by Institution

892 different research institutions contributed to the 681 publications related to LARC and HCW. A publication can be written by several authors from different institutions. The top ten institutions that published the most on LARC and HCW are listed in Table 3. The University of California was the institution that produced the most work on the subject (n = 43). 12 out of 14 institutions were academic institutions. The most productive institutions are located in the United States or the United Kingdom, except for the University of Gondar in Ethiopia and the University of The Witwatersrand in South Africa.

Table 3 The top ten most productive institutions

Rank	Affiliation	No. of publications
1	University of California	43
2	Emory University	21
2	University of Cape Town	21
4	University College London	15
4	University of Michigan	15
6	University of Edinburgh	13
7	University of British Columbia	12
8	London School of Hygiene and Tropical Medicine	11
9	University of Pittsburgh	10
10	Albert Einstein College of Medicine	9
10	Centres for Disease Control and Prevention	9
10	Department of Reproductive Health and Research	9
10	University of Gondar	9
10	University of The Witwatersrand	9

Publications by Number of Citations

Table 4 shows the top ten most frequently cited publications related to LARC and HCW. The most widely cited paper was “Challenges in Translating Evidence to Practice: The Provision of Intrauterine Contraception”, published in *Obstetrics and Gynecology* by Harper et al.¹⁸ It was cited 189 times since its publication in 2008. On the other hand, the paper entitled “Provider Bias in Long-Acting Reversible Contraception (LARC) Promotion and Removal: Perceptions of Young Adult Women” had the highest average citation per year. The publication was cited on average of 18.0 times per year since its publication in 2016. Notably, many of the frequently cited publications emphasised the intrauterine contraceptive device. Besides, the content of half of these publications revolves around HCWs’ bias, attitude, and practice on the provision of LARC to the general population or specific group of clients based on their age, parity, race, ethnicity, or socioeconomic status.

Table 4 The top ten most frequently cited publications

Rank	Author, Year	Title	Document Type	Journal	No. of citation	Average citation/year
1	Harper et al, 2008 ¹⁸	Challenges in Translating Evidence to Practice: The Provision of Intrauterine Contraception	Article	Obstetrics and Gynecology	189	12.60
2	Morris et al, 1979 ¹⁹	Effects of written drug information on patient knowledge and compliance: a literature review.	Review	American Public Health Association	182	4.14
3	Stanwood et al, 2002 ²⁰	Obstetrician-gynecologists and the intrauterine device: a survey of attitudes and practice	Article	Obstetrics and Gynecology	153	7.29
4	Burrows et al, 2012 ²¹	The Effects of Hormonal Contraceptives on Female Sexuality: A Review	Review	The Journal of Sexual Medicine	146	13.27
5	Dehendorf et al, 2010 ²²	Recommendations for intrauterine contraception: a randomised trial of the effects of patients' race/ethnicity and socioeconomic status	Article	American Journal of Obstetrics and Gynecology	142	10.92
6	Buhling, et al, 2014 ²³	Worldwide use of intrauterine contraception: a review	Review	Contraception	132	14.67
7	Tyler et al, 2012 ²⁴	Health Care Provider Attitudes and Practices Related to Intrauterine Devices for Nulliparous Women	Article	Obstetrics and Gynecology	128	11.64
8	Luukainen et al, 1986 ²⁵	Five years' experience with levonorgestrel-releasing IUDs	Article	Contraception	127	3.43
9	Higgins et al, 2016 ²⁶	Provider Bias in Long-Acting Reversible Contraception (LARC) Promotion and Removal: Perceptions of Young Adult Women	Review	American Journal of Obstetrics and Gynecology	126	18.00
10	Mardh et al, 2002 ²⁷	Facts and myths on recurrent vulvovaginal candidiasis—a review on epidemiology, clinical manifestations, diagnosis, pathogenesis, and therapy	Review	International Journal of STD & AIDS	118	5.62

Most relevant keywords

Keywords are essential to help search engines to find relevant papers. With the correct keywords, they can increase the visibility of the papers of the researchers. The top 15 commonly used author's keywords in the publications are presented in the form of a Word TreeMap as shown in Figure 3. The top five most common author's keywords were "contraception", "intrauterine device", "long-acting reversible contraception", "contraceptive implant" and "counselling". Additionally, it can be seen that the word "intrauterine device" is three times more common than the "contraceptive implant". Interestingly, the term "knowledge", "attitude" and practice" are also commonly used by the authors as keywords.

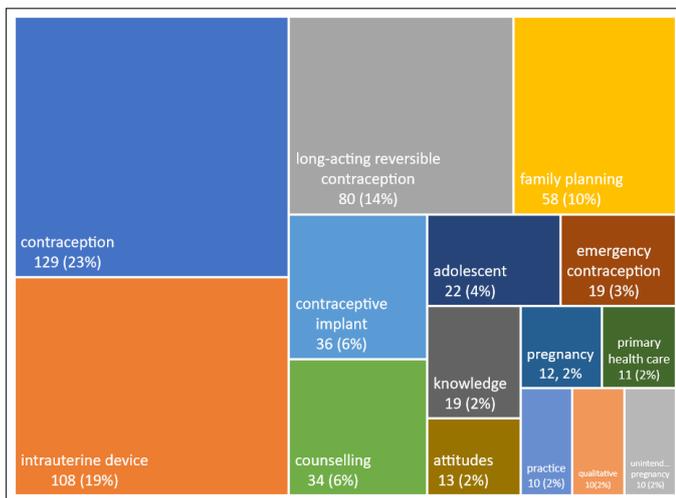


Figure 3 Word TreeMap of the most commonly used author's keyword

DISCUSSION

This bibliometric analysis gives an insight into the trend and distribution of publications related to LARC and HCW. The first published paper on LARC and HCW entitled "Nurse-Midwives Insert IUDs in Barbados" ¹⁶ was published a year before the USA FDA first approved IUCD ²⁸. It portrayed that the nurse-midwives were the key players in IUCD provision during the introduction of IUCD due to the shortage of doctors.¹⁶ Currently, despite the WHO recommendation to allow nurses and midwives to insert IUCD, most countries only authorise doctors to perform the procedure.^{2, 23} This restriction may negatively influence the IUCD uptake rate.²³

Notably, the rate of publications from 1967 to 2010 was low with less than 14 publications per year. The low publications can be attributed to the troubled history of LARC. As IUCD was gaining popularity in the United States market, a type of IUCD (the Dalkon Sheild) was suspended in 1974 due to its serious design flaw which caused severe infection and death.²⁸ Undeniably the safety controversy tarnished IUCD's reputation, even though only one type was implicated. Further, Norplant was taken off the market in 2002 after 12 years of approval by the United States FDA due to difficult removals.²⁸ However, the introduction of Implanon in 2006 started the rebound of contraceptive implants.

The steady increment from 2010 onwards can be explained by the recognition of LARC from various bodies. In 2009, the American College of Obstetricians and Gynecology recommended LARC as the first-line option for the majority of women.⁷ In addition, the use of LARC was expanded to adolescents to prevent unintended pregnancy. The American Academy of Pediatrics policy statement recommended LARC as a first-line method of contraception for teenagers due to its efficiency, safety, and ease of use.⁶ Moreover, LARC is the preferred contraceptive method for women of all ages based on the WHO Medical Eligibility Criteria Guidelines in 2015.⁵ The acknowledgement from reputable organisations could be the reason researchers became more interested in this area. Of note, the number of publications declined from 2020 onwards possibly due to the COVID-19 pandemic whereby researchers and HCW diverted their attention to COVID-19.

This study listed the most productive journals in this research area. The list can guide researchers to select the most appropriate journals to read or publish research findings related to LARC and HCW. The most productive journal in this area was Contraception, which is similar to a previous bibliometric analysis on emergency contraception.¹³ It is worth noting that nine out of ten listed journals in Table 1 were categorised into the first and second quartiles. It signifies that the majority of the publications about LARC and HCW were published in journals with quality and prestige.

The United States contributed the highest number of publications related to LARC and HCW. The finding is also similar to that of bibliometric analysis on emergency contraception.¹⁵ Moreover, many of the most productive institutions in this research field were located in the United States. It can be correlated to the need for effective contraception to reduce the high rate of unintended pregnancy and induced abortion in the United States.⁴ There was also a large prospective cohort study among 9000 women in the United States which discovered that LARC can reduce unintended pregnancy.⁴ It possibly brought more attention from the local researchers to this study area. Besides, the aforementioned recognition of wider LARC use from health organisations in the United States^{6, 7} may also attract local researchers to explore this field.

The remarkable involvement of Sub-Saharan African countries and institutions can be seen in Table 2 and Table 3, respectively. In Sub-Saharan Africa, the unmet need for family planning is high and unintended pregnancy is common, yet the prevalence of LARC is low.²⁹ Hence, Marie Stopes International's (MSI) LARC Expansion Intervention was implemented in 14 Sub-Saharan African countries since 2008.²⁹ This intervention is employed by HCW through an integrated LARC provision which includes: i) provision at static clinics in urban areas, ii) provision at mobile outreach units in rural areas, iii) training of nurses and midwives for LARC insertion and removals and 4) partnership with private HCW in rural areas. As a result, the annual LARC service distribution increased by 1,037 % (from 149,881 to 1.7 million) from 2008 to 2014.²⁹ The involvement of various types of HCW from both urban and rural areas in multiple Sub-Saharan countries was likely to increase publications related to LARC and HCW.

Though various methods exist, the citation is the most objective and straightforward way to measure a publication's impact and influence.¹² Even though the older publications have higher chances to be cited compared to the newer publications, this does not exclude newer publications from having a significant impact in the field.³⁰ For instance, the paper by Higgins et al²⁶ which was published in 2016 achieved 126 citations;

while the paper by Morris et al¹⁹ received a total of 182 citations after four decades after its publication. Thus, both the total number of citations and the average citations per year can help to analyse the most influential publications.

The top ten most frequently cited publications in Table 4 portray that many publications emphasize the IUCD and none focus specifically on the contraceptive implant. The finding is congruent with the Word TreeMap where the word "intrauterine device" was three times more commonly used as the author's keywords compared to the word "contraceptive implant". The possible explanation for this is that the estimated global prevalence of IUCD use in 2019 (8.9%) was higher compared to that of the contraceptive implant (1.2%).⁸

Many of the highly cited publications highlighted HCWs' attitudes and practices on LARC provision towards clients. The result is linked to the high proportion of the words "knowledge", "attitude" and "practices" in the Word TreeMap. Poor knowledge among HCWs will cause them to convey inaccurate information about LARC to their clients. It will worsen the clients' latent fear regarding modern contraceptive methods.¹⁰ Moreover, HCWs are more likely to perform unnecessary procedures such as laboratory tests before LARC insertion if they have out-to-date knowledge.¹⁰

Besides, HCWs' attitude toward the client's selection is crucial because HCWs have the power to decide who is eligible for LARC insertion.¹⁰ For instance, a study showed that nearly one-third of HCWs had misconceptions about IUCD safety among nulliparous women.²⁴ There was an erroneous belief that IUCD will cause future subfertility and a higher risk of pelvic inflammatory disease.²⁴ This attitude is contradictory to the WHO recommendation which reported that IUCD is safe and suitable for nulliparous women.⁵ Nonetheless, changing HCWs' knowledge and attitude is more feasible because it is within the direct control of the healthcare system as compared to changing the factors from the client's side such as local culture, beliefs or socioeconomic status.¹⁰

Several limitations need to be addressed in this bibliometric analysis. Firstly, the data search was restricted to the publications in the Scopus database only. Even though it is one of the largest databases, of course, it does not include every publication related to LARC and HCW. Secondly, only publications in the English language were included in the analysis. Therefore, there is a lack of representation of the actual publications.

CONCLUSION

The present study summarises the publication information from across the globe related to LARC and HCW. The findings discover a rising trend of research activity in the past decade, with the United States and other high-income countries dominating the number of publications. However, Sub-Saharan African countries and institutions have made significant contributions to the field of LARC and HCW research. The influential papers and the relevant keywords revealed useful information on promising areas for future research. It is hoped that the results from this bibliometric analysis will be a guide to health practitioners and researchers who are eager to explore this research area.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

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