



Article

Polycystic ovary syndrome: analysis of the global research architecture using density equalizing mapping

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KEY MESSAGE

This study provides the first analysis of polycystic ovary syndrome (PCOS) research activities. The scientific architecture differs from other gynaecologic disorders. The top 10 performers in PCOS research include established nations, e.g. the USA and UK, and also a unique set of countries such as Turkey, China and Greece.

A B S T R A C T

Polycystic ovary syndrome (PCOS) is the most common cause of female infertility worldwide. Although the related research output is constantly growing, no detailed global map of the scientific architecture has so far been created encompassing quantitative, qualitative, socioeconomic and gender aspects. We used the NewQIS platform to assess all PCOS-related publications indexed between 1900 and 2014 in the Web of Science, and applied density equalizing mapping projections, scientometric techniques and economic benchmarking procedures. A total of 6261 PCOS-specific publications and 703 international research collaborations were found. The USA was identified as the most active country in total and collaborative research activity. In the socioeconomic analysis, the USA was also ranked first (25.49 PCOS-related publications per gross domestic product [GDP]/capita), followed by the UK, Italy and Greece. When research activity was related to population size, Scandinavian countries and Greece were leading the field. For many highly productive countries, gender analysis revealed a high ratio of female scientists working on PCOS with the exception of Japan. In this study, we have created the first picture of global PCOS research, which largely differs from other gynaecologic conditions and indicates that most related research and collaborations originate from high-income countries.

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Introduction

Polycystic ovary syndrome (PCOS) is the most common endocrinopathy among females of reproductive age. According to National Institutes of Health criteria, the condition affects between 6% and 10% of women worldwide, with similar prevalences across the globe (Asuncion et al., 2000; Azziz et al., 2004; Mortada and Williams, 2015; Palomba et al., 2015). Stein and Leventhal first recognised PCOS in 1935 (Palomba et al., 2015). It is a complex genetic and heterogeneous condition, which is characterized by androgen excess leading to hyperandrogenism, e.g. hirsutism, ovulatory dysfunction and polycystic ovaries (Khadilkar, 2016; Kollmann et al., 2016; Mortada and Williams, 2015; Palomba et al., 2015; Qi et al., 2016; Zuo et al., 2016). The Rotterdam criteria are a widely used diagnostic tool (Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group, 2004a, 2004b). At least two of the following three features are required for diagnosis: chronic oligoovulation or anovulation, clinical, biochemical hyperandrogenism, or both, and polycystic ovaries on ultrasonography (Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group, 2004a, 2004b; Mortada and Williams, 2015; Palomba et al., 2015).

Physical and emotional health can be affected by PCOS in a number of ways: the condition is a prevalent cause of subfertility and infertility as a result of anovulation (Goodarzi et al., 2011). Affected women are at risk for type 2 diabetes mellitus, metabolic syndrome, cardiovascular disease and endometrial cancer (Mortada and Williams, 2015; Palomba et al., 2015). Also, the clinical picture of PCOS differs depending on the geographic, socioeconomic and sociocultural background of the patient (Schmid et al., 2004a; Di Fede et al., 2009). For example, high socioeconomic status is associated with increased rates of 'ovulatory PCOS'. This phenotype is defined as hyperandrogenism in concert with regular menstrual cycles. Di Fede et al. (2009) linked this observation to differences in insulin levels and the quantity and distribution of adipose tissue. Also, researchers analysed psychosocial parameters related to infertility in patients with PCOS with different socio-cultural backgrounds (Schmid et al., 2004a, 2004b). In an Austrian study, immigrant Muslim women experienced a very high reproductive pressure and level of suffering from PCOS-related infertility compared with local Austrian women (Schmid et al., 2004b). In this context, Iran is an example of the affect of distinct area-specific, sociocultural issues as a driving force for related research. In the past decade, scientific endeavours related to PCOS were boosted in this nation leading to multiple country-specific studies such as an Iranian version of the modified PCOS health-related quality-of-life questionnaire (Bazarganipour et al., 2012; Khomami et al., 2015; Taghavi et al., 2015).

Although substantial progress has been achieved in investigating the pathogenesis, pathophysiology and related societal aspects of PCOS over the past decades, it is still the most enigmatic, complex and multifaceted disorder in the field of gynaecology. Numerous unresolved issues require investigation (Bachanek et al., 2015; Casarini et al., 2016; Palioura and Diamanti-Kandarakis, 2015; Singh and Singh, 2015). Therefore, multidisciplinary, translational and clinical research is needed to advance the field. Scientometric approaches are helpful in planning research strategies so they meet identified shortcomings and to supply decision makers with information concerning funding strategies. These analytic procedures evaluate the growing body of literature related to a specific field in quantitative and qualitative measures and identify countries and institutions producing scientific work with outstanding relevance to the field. In this context, it is the objective of this study to assess the scientific performance

on PCOS. The 'New Quality and Quantity Indices in Science' (NewQIS) platform (Groneberg-Kloft et al., 2009a, 2009b) used here combines scientometric tools and advanced density equalizing mapping procedures (Gastner and Newman, 2004) to assess and depict the global PCOS research architecture as well as to evaluate related scientific productivity in the context of geographical, socioeconomic and gender aspects.

Materials and methods

NewQIS protocol

We used the NewQIS platform to identify PCOS-related research among the extensive amount of biomedical publications in a validated, reliable and standardized way (Groneberg-Kloft et al., 2009a, 2009b). The method encompasses the use of advanced visualization algorithms based on Gastner and Newman's density equalizing calculations and scientometric tools to evaluate PCOS-associated research activity in terms of quantitative and qualitative aspects, geographical and chronological developments, existing research networks and socioeconomic benchmarks (Bruggmann et al., 2016a, 2016b, 2016c, 2016d; Groneberg-Kloft et al., 2009a, 2009b, 2013).

Data source

As previously described (Gerber et al., 2013, 2014; Kusma et al., 2009), the database Web of Science (WoS, Thomson Scientific) was used for data collection. We based this study on this particular resource because WoS provides the unique opportunity to analyse the global publication activity and also allows an in-depth citation analysis. Using this unique feature, we calculated combined semi-qualitative country- and PCOS-specific indices, such as the modified h-indices or average citation rates.

Search strategy

The following search term was used to identify PCOS-related research: TITLE = (PCOS OR polycystic ovar* OR stein-leventhal OR sclerocystic ovar*). We examined the time period from 1900 to 2015; items published in 2016 were excluded from the search as collection of related data, e.g. citations, would not have been completed at the time the study was carried out. The aforementioned search term was entered as described previously (Bruggmann et al., 2016a, 2016b, 2016c, 2016d; Groneberg et al., 2016; Quarcoo et al., 2015; Scutaru et al., 2010). We restricted our investigation to ARTICLES and performed a TITLE in contrast to a TOPIC search to ensure the identification of original research studies only and to minimize the inclusion of unspecific publications compromising the validity of our analysis.

Data analysis and categorization

The exact bibliographic details of all PCOS-related publications were sorted after retrieval of the file metadata and analysed according to numerous criteria (Groneberg et al., 2015; Ohlendorf et al., 2015; Scutaru et al., 2010). These included the following: originating countries, languages, document types, citations, cited references, year published and subject categories for all PCOS-related publications.

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