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With Scientific Production: The Example Of Syphilis And Gonorrhea

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ABSTRACT

The objective of this work was to analyze the association between searching for information on syphilis and gonorrhea through Google, and scientific production on these two sexually transmitted infections. A cross-sectional descriptive study was carried out. The data were obtained from direct, *online* consultation , *Google Trends* and MEDLINE (via PubMed), with the use of the terms " *Syphilis* " and " *Gonorrhea* ". The variables studied were: relative search volume (VBR), average monthly VBR (VBRm), references (REF) and average monthly REF (REFm). The VBRm for the term *Syphilis* showed slight increasing progression and exponential adjustment ($R^2 = 0.05$; $p = 0.42$); For *Gonorrhea*, the VBRm evolution was increasing with linear adjustment ($R^2 = 0.67$; $p < 0.01$). The mREF for scientific production on *Syphilis* showed an increasing linear fit ($R^2 = 0.42$; $p = 0.01$) and for the mREF on *Gonorrhea* it was an increasing exponential fit ($R^2 = 0.47$; $p = 0.01$). The relationship of the VBRm for the term *Syphilis* in relation to its REFm gave a poor association ($R = 0.11$; $p = 0.69$). This relationship for *Gonorrhea* showed a significant positive correlation ($R = 0.67$; $p = 0.01$). The results obtained did not allow us to obtain a firm conclusion that answered the objective of this work. From now on, with greater monitoring, it will be possible to obtain results that confirm, or not, the association between the search for information and scientific production on health-related topics.

Keywords: Access to information; publications; information management ; association; syphilis; gonorrhea

INTRODUCTION

The mission of every researcher, in addition to research, is also to bring the results of said studies to the productive fabric. Research undoubtedly contributes to the generation of knowledge and the development or growth of the social, economic and productive environment. [1] Consequently, the analysis and evaluation of the information and knowledge resulting from scientific activity is an essential element for all public research, technology and development programs that are implemented in a society, and it is there where the Science of Information provides invaluable help by developing techniques and instruments to measure the production of knowledge and its transformation into goods. [2]

On the other hand, Web 2.0 offers unprecedented opportunities for patients and the general public when searching for health information. In fact, they have been looking for this information there for a long time, even before consulting with professionals, [3] For example, Wikipedia is currently the fifth most visited site on the Internet [4] and one of the most globalized applications. [5]

Eysenbach , [6] in 2009, coined the term “infodemiology” or “infoepidemiology” as an emerging set of public health information methods to analyze Internet search, communication, and publishing behavior. That is, “infodemiology” observes and analyzes Web-based behavior to understand real human behavior in order to predict, evaluate, and even prevent health-related problems that constantly arise in everyday life. [7]

At the beginning of the 21st century, sexually transmitted diseases were among the most common causes of illness in the world. Every day, almost one million people

contract a sexually transmitted disease (STD), and even excluding infection by the human immunodeficiency virus (HIV), STDs were, and are, an important public health problem, with high prevalence, both because of the burden of the disease they generate, and because of the complications and sequelae they produce if they are not diagnosed and treated early. [8]

Therefore, sexually transmitted infections (STIs) are among the top five disease categories for which information and help is sought. The hypothesis that populations provide data about their tastes and even their illness, through information search behavior on the Web, has already been demonstrated and there are studies that related the data obtained from information searches with cases of disease; for example in flu, hepatitis or HIV/AIDS. [9] *Johnson* and *Mehta* , [10] in 2014, already demonstrated, by studying search engine trends, that they were valid tools to integrate into real-time surveillance of STIs. In addition to this study on STIs, other authors used Google search trends to check the relationship with disease data, for example in the field of influenza, [11] home care, [9] or human immunodeficiency virus. [12]

Thus, it is more than proven that Google is a search engine that provides information - even about health - to anyone, who through the results obtained can easily access scientific documents existing on the Internet. Likewise, given the rebound that has been observed, in the 21st century, from the data on the incidence and prevalence of curable STIs, and especially syphilis and gonorrhea, it was decided to study these diseases. [8]

Consequently, the objective of this work was to analyze the association between the search for information on syphilis and gonorrhea through Google, and scientific production on these two sexually transmitted infections.

METHODS

A cross-sectional descriptive study was carried out. Data on information search were obtained from direct consultation, through *online* access , to Google Trends (https://trends.google.es/), and those from scientific production from MEDLINE, via PubMed (https:/ /www.ncbi.nlm.nih.gov/pubmed/).

Terms and data search

The words " Syphilis " and " *Gonorrhea* " were used in Google Trends as a "search term" and to try to resemble the searches carried out by non-experts, no type of filter was used (free search). The search was carried out in MEDLINE using the *Medical Subject Headings* (MeSH): "Syphilis"MeSH] and "Gonorrhea"MeSH]. The study period was from 2004 (the first year in which Google Trends offers the data) until 2018. The consultation date was April 4, 2019.

Obtaining and storing data

The results obtained were downloaded, from both platforms, in a normalized *comma-separated values* (CSV) format that allowed their subsequent storage in an Excel file. The quality control of this information was carried out using double tables, with possible inconsistencies corrected by consulting the original downloaded table. For statistical analysis, the *Statistical Package for the Social Sciences* (SPSS) program for Windows version 22.0 was used.

Study variables

1. *Relative search volume (VBR):* Result provided by Google Trends whose values are normalized on a scale from 0 (relative search volume less than 1% of the maximum volume) to 100 (relative search volume reaches its maximum). For example, a VBR = 25, represents 25% of the highest observed search proportion during the study period.

2. *Average monthly VBR (VBRm):* Sum of the monthly VBR of a given year divided by 12.
3. *References (REF):* Number of annual REFERENCES obtained from the search carried out in MEDLINE using the corresponding MeSH:
    - Average monthly referrals (REFm): Number of referrals (REF) for a given year divided by 12.

Data analysis

For the quantitative variables (VBR, VBRm, REF and REFm), the mean and its standard deviation, the median, the interquartile range (AIQ), the maximum and the minimum were calculated. The temporal evolution of search trends was examined using regression analysis, where the coefficient of determination was calculated. To obtain the relationship between quantitative variables, the Pearson correlation coefficient was used. The significance level used in all hypothesis tests was $\alpha \leq 0.05$.

RESULTS

When searching in Google Trends (Fig. 1) and in MEDLINE (Fig. 2), the results could be obtained for both VBRm from Google Trends and REFm from MEDLINE (via PubMed), as shown in Table 1 .

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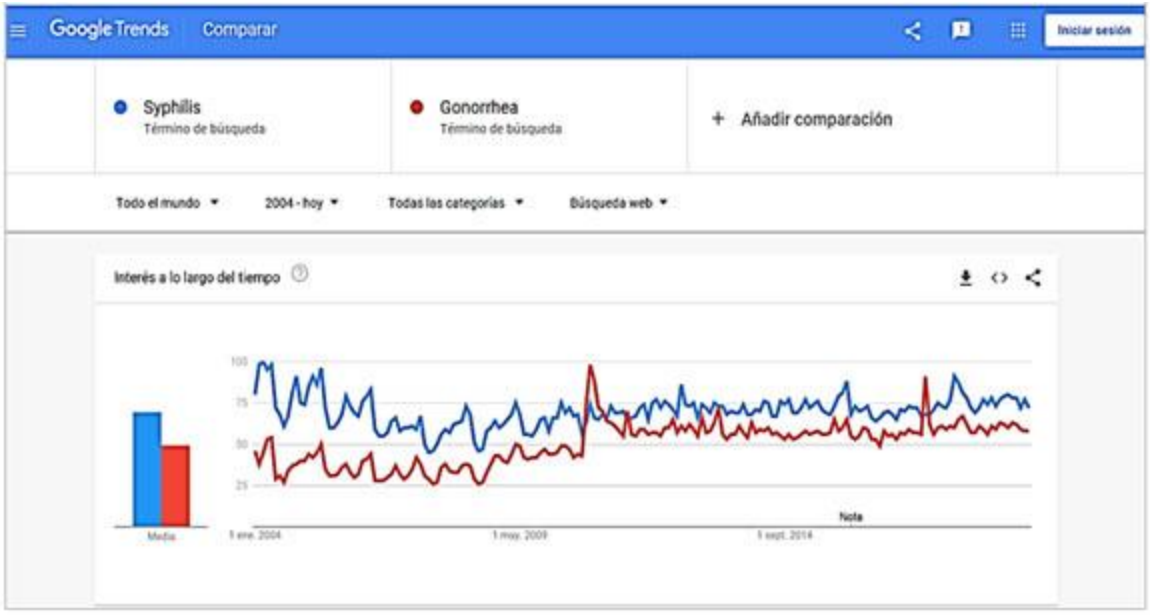

Fig. 1 - Search carried out in Google Trends.

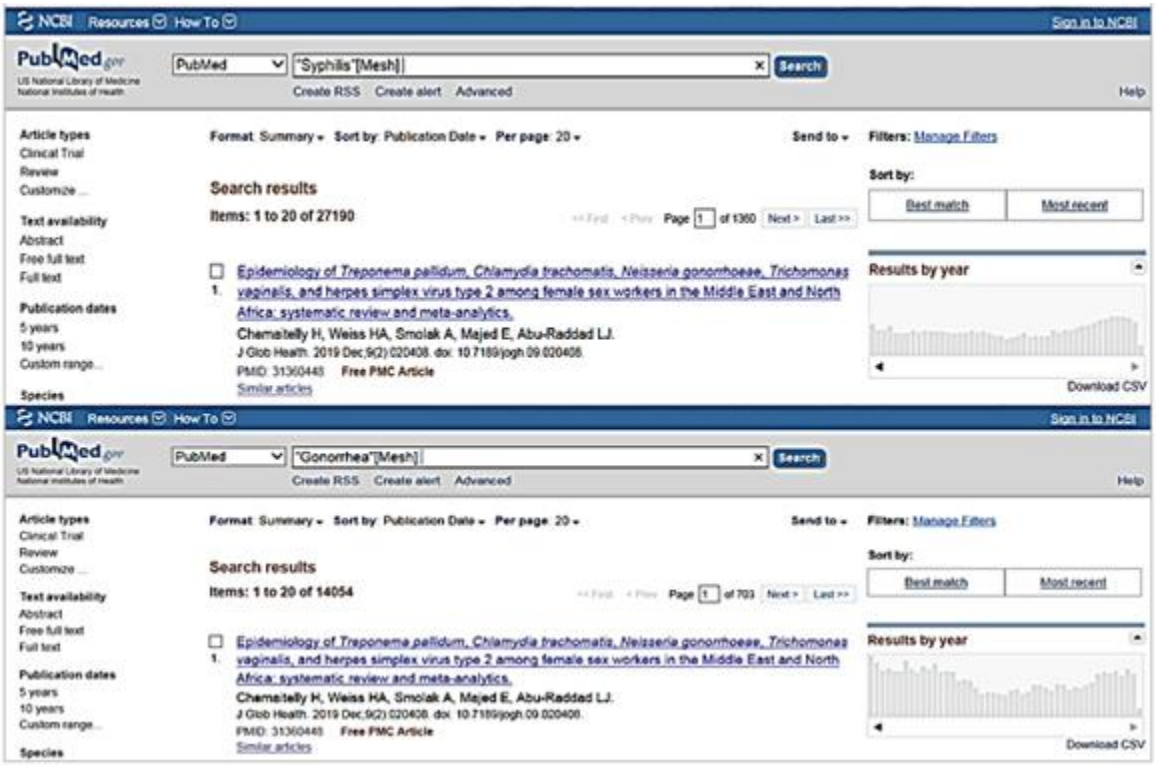

Fig. 2 - Searches carried out in MEDLINE (via PubMed).

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Table 1 Monthly relative search volumes (VBRm), obtained from Google Trends, and average monthly references (REFm), observed in MEDLINE, for the terms *Syphilis* and *Gonorrhea*

Año	VBRm[1] Syphilis	VBRm[1] Gonorrhea	REFm[2] Syphilis	REFm[2] Gonorrhea
2004	76,92	37,33	24,83	13,08
2005	66,33	34,50	23,25	16,75
2006	58,67	29,58	26,67	16,08
2007	50,67	30,50	24,83	13,92
2008	53,92	31,08	27,33	15,08
2009	57,42	39,25	29,50	14,58
2010	60,83	52,83	30,50	16,08
2011	62,42	55,00	32,67	17,67
2012	66,67	53,33	35,67	21,92
2013	64,67	53,17	37,33	23,00
2014	64,75	51,00	39,08	22,25
2015	67,83	52,75	39,42	23,42
2016	62,08	50,08	38,92	21,42
2017	64,33	55,08	34,58	23,50
2018	69,67	54,42	24,25	15,25

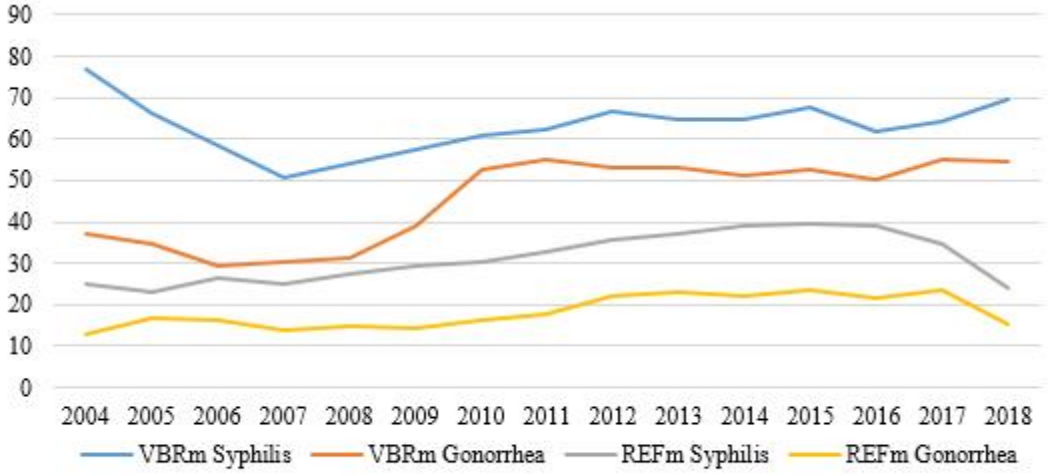
The statistics, for the entire analyzed period, both for the VBR for *Syphilis* and *Gonorrhea* , and for the REF, obtained from the searches carried out can be consulted in Table 2 .

Table 2 Statistics, for the entire analyzed period, of the average monthly relative search volume (VBRm) and the average monthly number of references (REFm), obtained from the searches carried out in Google Trends and MEDLINE for *Syphilis* and *Gonorrhea*

Datos estadísticos	VBRm *Syphilis*	VBRm *Gonorrhea*	REFm *Syphilis*	REFm *Gonorrhea*
Media	63,15 ± 1,67	45,33 ± 2,63	31,26 ± 1,53	18,27 ± 0,99
Mediana	64,33	51,00	30,50	16,75
AIQ[1]	8,00	18,83	12,50	7,17
Máximo	76,92	55,08	39,42	23,50
Mínimo	50,67	29,58	23,25	13,08

Temporal evolution

From the annual results, both of the VBRm and the REFm, obtained for the two terms under study, it was possible to know their progress throughout the period studied (Fig. 3).



Fuente: Datos obtenidos de Google Trends y MEDLINE.

Fig. 3 - Temporal evolution of the average monthly relative search volume (VBRm) and the average monthly number of references (REFm) for the two study terms: *Syphilis* and *Gonorrhea*.

The search trends obtained in Google Trends for the term *Syphilis* showed a slight increasing progression and fit to an exponential model (R^2 = 0.05; p = 0.42). For *Gonorrhea*, the VBRm evolution was clearly increasing with adjustment to a linear model (R^2 = 0.67; $p < 0.01$). The regression analysis of the REFm variable for scientific production on *Syphilis* showed an increasing linear fit (R^2 = 0.42; p= 0.01) and for the REFm variable of the documents on *Gonorrhea* it was an exponentially increasing fit (R^2 = 0.47; p= 0.01).

Degree of relationship

The relationship of the VBRm obtained for the search term *Syphilis* in relation to its scientific production REFm gave a scarce association in the period analyzed as a whole (R= 0.11; p= 0.69), while for the association between VBRm and REFm For *Gonorrhea*, a significant positive correlation was observed (R = 0.67; p = 0.01).

DISCUSSION

In this study we wanted to verify if the information needs about the two curable STIs (Syphilis and Gonorrhea) were associated with scientific production on them. The first observation that could be seen is that both scientific production and the need for information on these two diseases have shown, since 2004, constant growth. This result was predictable, since scientific production *per se* presents growth of around 8% annually [13] and queries driven by classic Internet search continued to rise, according to data from the fourth quarter of 2018. [14] It must also be taken into account that According to the scientometric theories announced by *Price* , the growth of scientific production would be observed in periods of between 15 to 30 years of evolution, a situation that is barely reached at the time of this work. [fifteen]

The statistics obtained indicated that both VBRm and REFm presented average values. No milestone was highlighted (specific and notable event in the VBR) that showed special interest in information searches or a clear rebound in scientific production. The location of milestones (peaks) is an important fact for epidemiological surveillance, since a relationship with disease rebounds has been demonstrated [16,17] and also as a response to information campaigns that provoked greater interest in this information. [18]

The degree of association observed presented antagonistic data. On the one hand, there was an adequate relationship between scientific production and the searches carried out in relation to *Gonorrhea* . But, on the other hand, the association obtained by relating the number of scientific articles to searches on *Syphilis* only gave a poor correlation. These results do not allow us to obtain a firm conclusion that answers the objective of this work.

Although it is true that previous studies obtained an adequate correlation between the results of the search for information and those of illness (for example influenza, [11] home care [9] or the human immunodeficiency virus), [12] it was not found, in the scientific literature, no document that studied whether the possible growth of scientific publications had been investigated as a consequence of the population's interest in this information or as a consequence of the resurgence of the disease.

Regarding the possible limitations of the study, according to *Johnson & Mehta,* [10] it must be kept in mind that it was an analysis of ecological data and the findings may not have been representative at the individual level; For example, the trends are population-based and cannot conclude that only individuals infected with STIs are, in fact, those generating all the search volume related to these

diseases. Additionally, there is uncertainty about the cause of search trends (actual increase in infection, news, curiosity, etc.) and when they occur (before STI diagnosis or after). [19] On the other hand, the reasons that lead to scientific publication are not always motivated by the existence of a disease (for example: curricular needs, personal satisfaction, etc.). [twenty]

Conclusions

Monitoring *online* queries , through Google, can reveal people's concerns and evaluate behavioral changes in relation to health information, and even the need for the generation of knowledge in line with the social need for this. .

The results obtained did not allow us to obtain a firm conclusion that would answer the objective of this work, the association between the search for information and scientific production on health sciences. From now on, with greater monitoring, it will be possible to obtain results that confirm, or not, the association between the search for information and scientific production on health-related topics.

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