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Development And Evaluation Framework: Assessing The Training And Advancement Of Teaching Experts And Researchers In Universities Through Indicator Systems

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ABSTRACT

The objective of this study was to validate the modifications made to a system of indicators to assess the training and development of experts who work in teaching-research activity in universities. Based on the experience obtained in a research developed for the management of training and development of experts in a research center, modifications were made to the system obtained to adapt it to the activities carried out by teachers - researchers in higher education institutions. . The modified system was validated in the panel of experts with the use of the Delphi method and the application of the Likert scale, as well as with the statistical treatment of the participants' responses. Indicators of three variables of the "Expert qualification" dimension (professional career, leadership and national and international visibility) and of the "Teaching" variable of the "Expert management" dimension were modified. Cronbach's alpha coefficient (0.9274) demonstrated the internal consistency of the instrument used. The values of the medians and interquartile ranges reached allowed the consensus of the participants to be established in the validation of the indicator system. The modifications made

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to the original system allowed it to be adapted and applied for the assessment of teaching experts - researchers who work in the departments responsible for nuclear careers in the Faculty of Nuclear Sciences and Technologies of the Higher Institute of Technologies and Applied Sciences, attached to the University of Havana, which showed average development both from the point of view of the qualification and management of its experts.

Keywords: Management indicators; knowledge management; Personal Development; teaching and research expert; university; Delphi method

INTRODUCTION

Since the end of the 20th century, knowledge has been recognized by many authors as a strategic resource for organizations. Knowledge has a cost that is transferred to the value and price of the product and is integrated into its quality. It is a decisive factor that can make the difference. This introduces the need for great dynamism, flexibility and elasticity in its management processes.

Knowledge management identifies and exploits, in daily work, the knowledge created in the organization and that acquired from outside; It generalizes best practices, promotes the increase of the organization's intellectual capital and its market value, while facilitating the generation of new knowledge and its materialization into products and services. [1] Its implementation and use requires information management, document management, the use of information technologies and efficient management of human resources. (1) For this, the organization must carry out actions, among which are: the identification of knowledge leaders, who can "support knowledge management by identifying experts and other sources of information"; (1) the multiplication of knowledge

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leaders through “the creation of knowledge teams, in which new knowledge is shared and generated and leadership qualities are cultivated.” [1]

The quality of future professionals depends largely on the quality of the teaching staff that participates in their training. Therefore, the quality with which they carry out their work will depend on the training and development that teachers have and will have a positive impact on the training of professionals who enroll in the different undergraduate and postgraduate activities. Likewise, the faculty will gain experience and its members will be able to serve as experts in different tasks, commissions and activities inside and outside the institution.

González and other authors stated that "organizations have to have all their human resources, particularly those with the highest qualifications and experience who constitute themselves as experts and contribute to the materialization of the strategic projections of the institutions." They emphasized the need for “organizations to have this professional figure and care about their training and development.” [2] They designed, validated with the use of the Delphi method of consulting experts, and applied a system of indicators that allows assessing the development achieved by experts who work in a science, technology and innovation entity based on training actions and results obtained in a period of five years.

Based on the experience obtained by *Elías-Hardy* , *González-Olaguive* and *Martínez-Martínez* (2015), [2] modifications were made to the system of indicators proposed for the assessment of the training of experts in this type of institution to adapt it to the activities that teachers and researchers carry out in higher education entities when considering the similarities that exist in a set of

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functions that teachers and researchers perform. In this work, the modifications made are argued, the results of the validation of the system obtained with the use of the Delphi method of expert consultation are presented, as well as the application of the modified indicator system for the assessment of teaching and research experts at the Institute. Higher Degree in Technologies and Applied Sciences and the results achieved.

The objective of this study was to validate the modifications made to a system of indicators to assess the training and development of experts who work in teaching-research activity in universities.

System of indicators for teachers - researchers

The definition of whether a person is an expert or not in a topic or activity is carried out based on various criteria that depend on several factors such as, fundamentally, the type of activity, the years of work on the topic or activity, the results obtained. , among others. On the other hand, the objective for which the expert is being selected also affects the establishment of the criteria.

Elías-Hardy , *González-Olaguive* and *Martínez-Martínez* (2015) developed a working definition for the concept “expert” that the authors of this research assume for the development of the system of indicators for teachers - researchers: “high-level professional with recognized expertise in a certain area, possessor of a system of updated knowledge, skills, habits, values that allow him to solve problems, produce, conceive, judge and lead projects, strategies and technologies, participate in the training of other categories of personnel and "His results and contributions within and outside the limits of his organization give prestige and give visibility, projection and recognition to the very institution in which he works." [2]

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The training of experts in a science, technology and innovation entity was assessed by *Elías-Hardy* , *González-Olaguive* and *Martínez-Martínez* (2015) through a system of indicators composed of two dimensions: qualification of the expert and management of the expert. with its variables and indicators. This system was developed to assess the individual behavior of experts over a period of five years of work. As several experts coexist in the same functional work unit (department), individual and collective measurement criteria (category and range) were established for the designed indicators, variables and dimensions. Likewise, three generations of experts were considered taking into account different age periods: generation I (55 and over), II (45 to 54 years), III (35 to 44 years).

University professors and researchers developed similar activities in the areas of research and teaching. The time they dedicated to each activity was what established a difference between them. Professors dedicated more time to teaching activities, while researchers spent more of their time doing research. Hence, it was decided to adapt the system of indicators designed for the assessment of experts who worked in a science, technology and innovation entity and use it to assess the training and development of experts who worked in higher education centers.

Adequacy of the system of indicators for the assessment of the training and development of teaching and research experts

The functions of university professors are defined by the Regulations for the application of teaching categories in higher education. [3, 4] Among the general functions are: developing methodological and improvement activities, inherent to the undergraduate and postgraduate teaching process, [3] advice and methodological guidance in the preparation of subjects; [4] constantly raise their pedagogical,

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scientific-technical and cultural knowledge [3] and contribute to the improvement of the other members of the group; [4] direct [4] and carry out research, development work and technological innovation, as well as scientific, technical and application services; [3] guide the student during their journey through the degree, fulfilling the functions of tutoring course projects, diplomas and work practices; publish research results and participate in scientific events, as well as obtain scientific, technological, art and innovation results. [4] Other functions are also defined for each of the approved teaching categories, such as directing academic processes and/or university organizational units; [3] direct and guide the student during their journey through the degree, fulfilling the functions of tutoring course projects, diplomas and work practices; [4] direct and participate in the scientific educational training of staff with lower teaching categories, [3] recent graduates and student assistants; [4] master's and doctoral thesis tutoring. [4]

Success in fulfilling the functions stated above is possible depending on the training and development achieved by the university professor. Among the problems that must be faced within the framework of the training of an expert university professor are those related to the expert's own qualification and his preparation to practice as such; In addition, they must contribute to the training of other professionals and socialize their knowledge, among other activities. It should be noted that as the teacher gains experience, the level of complexity of his tasks increases, which is reflected in his training and work plan. Therefore, a strategy for training expert teachers must include actions such as:

- Postgraduate education.
- Management of work groups, organizational units.

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- Participation in projects occupying different roles.
- Management of personnel with lower teaching categories, recent graduates and student assistants.
- Participation in events, scientific societies, work commissions, courts.
- Publications and intellectual property registries.
- Tutoring for undergraduate thesis and postgraduate academic training (master's degrees, doctorates).

The main modifications were made in the indicators corresponding to the variables of the two dimensions:

1. Dimension “Qualification of the expert”:
    a. Professional career of the expert.
        - The technological category is eliminated from the first indicator and remains with the name “Categorized with teaching and/or scientific category.”
        - The name “Scientific degree due to academic training” is modified and the indicator “Experts with academic training” results.
    b. Leadership.
        - - The name is modified: “by expert leaders of groups of teachers and/or students”, where the project leader becomes one of the possible responsibilities of the university professor and the head of the pedagogical group (subject, discipline, year, career) or holds a teaching position: department head, vice dean, dean, rector.

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c. National and international visibility and projection.
   - Participation in national and international events. The participation of separate works in national and international events is counted.
   - Publications and patents. The publications are classified into groups I - II and III - IV; books and other records of intellectual property including computer software packages are recognized.
   - Participation in national or international projects, groups of experts or others, adding employment contracts as a teacher, researcher or expert, work commissions, arbitration of publications, evaluator, keynote speaker at events and meetings, awards received, decorations, among others.

2. Dimension "Expert management":
   a. Teaching:
      - The name of the indicator "Tutoring of undergraduate and postgraduate thesis" is modified to "Management of personnel in training".
      - The phrase "high academic level" is eliminated from the indicator "Productivity of the expert in the training of human resources".
      - The training of professionals (undergraduate level) is introduced in the three indicators (Teaching, Management of personnel in training and Productivity of the expert in the training of human resources); The postgraduate course is

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subdivided into postgraduate training (postgraduate courses, diploma courses) and academic training (master's degrees and doctorates). As a result of the modifications made, a system of indicators was obtained for the individual assessment (table 1) and another for the collective assessment (table 2).

Table 1 System of indicators for the individual assessment of expert teachers and researchers

Dimension	Variable	Indicator	Category and rank
Expert qualification	Professional career of the expert	Categorized with teaching and/or scientific category	Yes- Has any category No- Does not have any category
		Categorized with higher category	Yes- Holds any of the higher categories (Assistant, Head) No- Does not hold any of the higher categories
		Expert with scientific degree	With academic training - If you have a Doctor in specific sciences or higher, Master's degree or Postgraduate Specialist Without academic training - No
	Expert competence	Expert competence coefficient (K)	High - $0.8 \leq K < 1.0$ Medium - $0.5 \leq K < 0.8$ Low - $K < 0.5$
	Leadership	Expert heads of groups	Yes- Has been head of a group

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	of teachers and/or students	of professors or students (the type of group he has led is included: subject/discipline/career, main professor year, president or coordinator of diploma/master's/postgraduate specialty/doctorate, projects, laboratory/ department/vice dean/dean/science and technology unit/study center) No - Has not been group leader of teachers or students
National and international visibility and projection	Participation in national and international events	Yes - Participated in national and/or international events (the type of event is included; in national events, they are included according to the institutional, municipal, provincial, branch and national levels; in addition, participation role: organizing committee, scientific council, speaker, speaker) No- Did not

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		participate in national and/or international events
Publications (groups I and II, III and IV), patents and other intellectual property records		High intellectual production - 5 or more articles published in national and international journals and/or patents and other registries Medium intellectual production - 3 to 4 Low intellectual production - Less than 3 Observation: the type of group of publications 1 and 2 is collected, 3 and 4, others with ISBN or ISSN
Participation in national and/or international projects, groups of experts or others (project, contract, work commissions, evaluator, keynote speaker, arbitration of published articles, societies and commissions,		Yes - Participated in any task of national and international projection No - Did not participate in any task of national or international projection Observation: The type of participation is recorded, whether it is national or international and the number of participations for each type.

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		decorations	
	Organizational	Structuring the knowledge network	Yes - Expert associated with a group in which knowledge flow occurs (the role is listed, whether it is the head of the network or member; number of networks in which it participates). No- Expert not associated with any group
Expert management	Stages in the transit of knowledge	*Predominant modes of knowledge conversion (applying Nonaka* and *Takeuchi* 's SECI model of knowledge creation [5])	Expert with actions predominantly in the socialization phase Expert with actions predominantly in the externalization phase Expert with actions predominantly in the combination phase Expert with actions predominantly in the internalization phase
	Teaching	Teaching provision (in postgraduate studies it is classified into postgraduate improvement (courses,	Yes - Has taught undergraduate and postgraduate teaching (the level is collected according to the classification:

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	diploma) and academic training (master's and doctorate)	undergraduate, postgraduate course, diploma, training, master's degree, postgraduate specialty, doctorate) No - has not taught undergraduate or any form of Education Postgraduate
Management of personnel in training		Yes - Has directed people who are in training: undergraduate (inserted students (work practice, project, research), student assistants, diploma work or thesis), postgraduate improvement (recent graduates, final diploma work), postgraduate academic figures (master's thesis, final postgraduate specialty thesis, doctoral thesis) No- Has not directed people who are in training
Productivity of the human resources	expert in the training of	High - Has trained more than 3 professionals with a bachelor's degree and

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	(successful completion of the exercise of personnel in training)	scientific degree (doctor, master's and postgraduate specialist) Medium - Has trained between 3 and 2 professionals with a bachelor's degree and scientific degree (ibid.) Low - Has trained less 2 or has not trained professionals with a bachelor's degree and a scientific degree (ibid.)

Source: *Elías-Hardy* , *González-Olaguive* and *Martínez-Martínez.* [2)] Modified.

In the case of the variables “Expert competence” and “Stages in the transition of knowledge”, a survey consisting of three questions was applied to all identified experts, which included: [2]

- the degree of knowledge or information that the respondent considers to have about the area or topic in which he or she is considered an expert;
- the contribution of each of the sources of knowledge presented in the survey to the formation of your knowledge as an expert;
- the ways in which the knowledge transit processes occur in the work group in which the respondent is inserted (stages of socialization, externalization, combination and internalization of *Nonaka* and *Takeuchi* 's model of organizational knowledge creation) [5] based on the selection of a set of proposed actions.

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On the other hand, taking as a source of information the results obtained individually by each expert, the behavior of the indicators for a group of teachers/researchers is assessed (for example: from a department, a faculty, etc.), taking into account the criteria that appear in table 2 . To facilitate a quick view of the status of each indicator, a map was created where the boxes are identified with colors that represent the rating obtained from the information collected and prepared (its application is shown in the case presented in the results).

Table 2 System of indicators for the collective assessment of expert teachers and researchers

Dimension	**Variable**	**Variable description**	**Indicator**	**Category and Rank**
Expert Qualification	Professional Career of the Expert	It is related to the fulfillment of requirements and acquisition of the planned categories that define their status within the organization. This includes teaching, scientific categories and scientific degrees (academic training).	Categorized with teaching and/or scientific category.	High - More than 90% with some category. Medium - 80 -89% with some category. Low - Less than 80% with any category.
			Categorized with higher teaching and/or scientific categories.	High - More than 90% with some higher category. Medium - 80 -89% with some higher

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Dimension	Variable	Variable description	Indicator	Category and Rank
				category. Low - Less than 80% with some higher category.
			Experts with academic training.	High - More than 80% with a Dr.C., Master's or Postgraduate Specialist degree. Medium - 60 -79% with a Dr.C., Master's or Postgraduate Specialist degree. Low - Less than 60% with a Dr.C., Master's or Postgraduate Specialist degree.
	Expert Competence	It refers to the active and productive assimilation of the	Expert Competence Coefficient (K).	High- More than 90% with a high coefficient. Medium - 80 - 89% with high

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Dimension	Variable	Variable description	Indicator	Category and Rank
		contents of your area of expertise. This process requires a close link between theory and practice and guarantees knowledge of the state of the art and the acquisition of practical experiences with all their experiential and relational load.		coefficient. Low - Less than 80% with high coefficient.
	Leadership	Ability to lead groups of students, teams and work groups, projects, commissions and have their competence recognized by	Expert Heads of Groups of Teachers and/or Students.	High - More than 90% leader of groups of teachers and/or students. Medium - 80 -89% leader of groups of teachers and/or students. Low

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Dimension	Variable	Variable description	Indicator	Category and Rank
		colleagues and managers. It includes the possibility of planning, assigning and evaluating tasks, communicating, and promoting positive, ethical and cooperative work climates.		- Less than 80% leader of groups of teachers and/or students.
	Visibility and National and International Projection	It is given by the level of recognition that the expert achieves, mainly outside the organization (national and international) based on their results.	Participation in national and international events.	High - More than 90% participated in national and/or international events. Medium - 80 -89% participated in national and/or international events. Low - Less than 80%

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Dimension	Variable	Variable description	Indicator	Category and Rank
				participated in national and/or international events.
	Publications, patents and other intellectual property records.		High - More than 80% with high intellectual production. Mediu m - 60 - 79% with high intellectual production. Low - Less than 60% with high intellectual production.	
	Participation in national and/or international projects, groups of experts or others.		High - More than 90% participated in some task of national or international projection. Medium - 80 -89% participated in some national or	

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Dimension	Variable	Variable description	Indicator	Category and Rank
		international outreach task. Low - Less than 80% participated in some national or international outreach task.		
Expert Management	Organizational	It is related to the organizational element that guarantees that the expert has work groups associated with him with different levels of training with which he interacts systematically and in which the flow of knowledge transmission is structured.	Structuring of the Knowledge Network.	Good- More than 90% of experts have an associated knowledge transmission network. Regular - 80 -89% of experts have an associated knowledge transmission network. Bad - Less than 80% of experts have an associated knowledge transmission

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Dimension	Variable	Variable description	Indicator	Category and Rank
				network.
	Stages in the Transit of Knowledge	It refers to the type of actions that predominate in your interrelation with the rest of the members of your team within the framework of the spiral of transformation of knowledge from tacit (T) to explicit (E) proposed by the Japanese Nonaka and Takeuchi [5]. Take into account the moments of socialization (TT), externalization (TE), combination	Predominant mode of knowledge conversion.	Good - In more than 80% of the experts, actions that correspond to the externalization and combination stages predominate. Regular - Between 60-79% of experts, actions that correspond to the externalization and combination stages predominate. Bad - In less than 60% of the experts, actions that correspond to the externalization and combination stages predominate.

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Dimension	Variable	Variable description	Indicator	Category and Rank
		(EE) and internalization (ET).		
	Teaching	It refers to the participation of the expert in the different modes of higher education training: undergraduate, professional improvement and academic postgraduate and the results achieved.	Teaching delivery.	High - More than 90% have taught undergraduate and/or some form of Postgraduate Education. Medium - 80-89% have taught undergraduate and/or some form of Graduate Education. Low - Less than 80% have taught undergraduate and/or some form of Graduate Education.
			Management of personnel in training.	High - More than 90% have directed research and practical activities of

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Dimension	Variable	Variable description	Indicator	Category and Rank
				undergraduate and/or graduate students. Medium - 60 -79% have directed research and practical activities of undergraduate and/or graduate students. Low - Less than 60% have directed research and practical activities of undergraduate and/or graduate students.
			Productivity of the Expert in the training of human resources (successful completion	High - More than 80% with high productivity Medium - 60 - 79% with high productivity. Low - Less than 60% with high productivity.

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Dimension	Variable	Variable description	Indicator	Category and Rank
			of the exercise of personnel in training).	

Source: *Elías-Hardy , González-Olaguive* and *Martínez-Martínez.* [2] Modified.

The modified indicator system maintained the number of dimensions, variables and indicators proposed by *Elías-Hardy , González-Olaguive* and *Martínez-Martínez ,* [2] so that the evaluation of the variables in the declared categories and ranges is maintained. As can be seen in Table 2, there are variables that are studied through a single indicator (Expert Competence, Leadership, Organizational and Stages of Knowledge Transit) and the results obtained in these indicators allow the variable to be directly evaluated in the declared categories and ranges. In the case of the variables that have three indicators (Professional Career of the Expert, National and International Visibility and Projection, and Teaching), their comprehensive assessment was proposed based on the considerations declared in Table 3 . The figure that appears in each column expresses the number of indicators valued with the corresponding category where it is located.

Table 3 Comprehensive assessment for the variables with three indicators

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Indicador	Alto	Medio	Bajo	Valoración
	3	0	0	Alto
	2	1	0	Alto
	2	0	1	Medio
	1	2	0	Medio
	0	2	1	Medio
	1	1	1	Medio
	0	3	0	Medio
	1	0	2	Bajo
	0	1	2	Bajo
	0	0	3	Bajo

Source: *Elías-Hardy* , *González-Olaguive* and *Martínez-Martínez.* [2)] Modified.

Application of the expert consultation method (Delphi) for the validation of the designed indicator system

The validation of the system of indicators for the evaluation of the training and development of expert teachers and researchers was carried out with the application of the Delphi method of consulting experts.

The panel of experts consulted was made up of 10 professionals with more than 25 years of teaching, scientific and management experience; 70% of them held the teaching category of full professor and all were doctors in specific sciences; They have held positions such as career department heads, teaching and research vice deans, postgraduate director, teaching vice chancellor, director of science and technology at the agency level; They have served as experts in teaching, scientific and management activities, as well as carrying out consulting and advisory activities at a national and international level. For each of the experts, their

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competence coefficient was determined, which was found to be in a range between 0.85 and 1.0 - considered high - so the opinions of all the experts consulted were included in the study.

A questionnaire was designed to collect the assessment of the panel of experts, taking into consideration whether the dimensions selected were appropriate; the correspondence of the variables to each dimension; the contribution of the indicator to the measurement of the variable; whether the designed criteria were adequate to recognize the expert status of a teacher and researcher who works in a university institution, as well as the table for the evaluation of the variables with three indicators. This questionnaire also included the proposal for the system of individual and collective indicators designed that should be assessed.

To collect the attitude of the experts in relation to the aspects that were consulted, the additive Likert scale was used, applied in a self-administered manner, where the expert selected the category that best described their response according to the scale provided (Very adequate, Fairly adequate, Adequate, Not Adequate and Not Adequate). The instrument provided that the consulted expert could express his ignorance of the topic (I don't know) and also issue opinions, suggestions and/or proposals. For the processing of the responses, values were assigned (Very suitable (6), Quite suitable (5), Suitable (4), Not very suitable (3), Not suitable (2), I don't know (1), No response (0)), determined the ranges for each category and the scores for each expert were obtained by adding the values written for the items evaluated.

The reliability analysis was carried out using Cronbach's alpha coefficient and a value of 0.9274 was obtained; This demonstrates the internal consistency of the

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instrument used, since the value is above 0.8 (the recommended value of this coefficient ranges between 0.7 and 0.9). [6]

For each question in the study, the median (m) was determined as a central measure of the response tendency of the group of experts. [2] The median remained in the range 6 (Very adequate) for the declared dimensions, as well as between 5 and 4 for the variables, indicators and criteria designed. The results obtained were satisfactory.

The interquartile range (k) was also calculated as the difference between the third and first quartile, in order to measure the dispersion of the sample. This was inversely proportional to the group consensus (the higher the rank, the lower the consensus). [2] In this context, unanimity was achieved when k = 0 and an acceptable degree of convergence (consensus) was estimated among the experts when $k \leq 1$. The participants in the expert panel had consensus on the dimensions and the table for the assessment of the variables with three indicators. There was also consensus regarding the correspondence of the variables to the defined dimension, except in the case of leadership (k= 3). The contribution of the indicators to the measurement of the variable with which it has been related did not reach consensus for “Categorized with teaching and/or scientific category” (k= 1.5), “National recognition” (k= 1.5) and “Predominant mode of knowledge conversion” (k= 3). The individual indicators with the least consensus were “Categorized with teaching and/or scientific category” (k= 2.5) and “Predominant mode of knowledge conversion” (k= 1.5), while the collective indicator with the least consensus was “Expert competence coefficient” (k = 3).

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In the opinion of the panel of experts consulted, the proposed system of indicators is applicable to assess the training and development of expert teachers and researchers who work in higher education institutions.

The modified and validated indicator system for the individual and collective assessment of expert teachers and researchers was applied at the Faculty of Nuclear Sciences and Technologies (FCTN) of the Higher Institute of Technologies and Applied Sciences (InSTEC) attached to the University of Havana. , organizational unit where nuclear professionals are trained.

Application of the system of indicators for the assessment of the training and development of teachers - expert researchers in a university

In the case of nuclear activity, the accumulated scientific and technological experiences must be preserved taking into consideration the new applications of nuclear energy in different spheres of human activity in Cuba, fundamentally in medicine.

In recent years, the installation of nuclear medical equipment throughout the country has created a new need for pre- and postgraduate training of professionals for the assembly, operation and maintenance of said technology. This training is fundamentally developed at the Faculty of Nuclear Sciences and Technologies (FCTN) of the Higher Institute of Technologies and Applied Sciences (InSTEC) attached to the University of Havana. Three nuclear careers: engineering in nuclear and energy technologies, bachelor's degree in nuclear physics (accredited for excellence), and bachelor's degree in radiochemistry (certified) train nuclear professionals at the undergraduate level. Likewise, three accredited master's degrees of excellence: engineering in energy and nuclear facilities, nuclear physics

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and radiochemistry; and a master's degree (licensed) in medical physics are part of the postgraduate education options along with doctorates in nuclear technologies, core physics and radiochemistry.

The training of experts in nuclear sciences and technologies has its antecedents in the first group of teachers who integrated the departments of Nuclear Engineering and Nuclear Physics in the Faculty of Technology (currently the Technological University of Havana, CUJAE) and in the Faculty of Physics of the University of Havana. That first generation achieved a solid training and it is a strength of the institution to have part of these professionals, who have guaranteed the transition to new generations of experts. It is for these reasons that it was decided to apply the indicator system designed in this institution. To apply the system, the following premises were taken into account:

- The departments in the FCTN career were selected.
- Period covered by information collection: 2011 - 2015.
- Knowledge networks were established by discipline of each career that included recent graduates incorporated into the departments under study.
- The data were taken from the annual evaluations, life Abstracts filed in teaching category files, and Abstract information for the accreditation of careers and master's degrees.
- The faculty was considered to be made up of the department's professors and professors - collaborators from other areas of InSTEC who taught in that period. The personnel of the basic training department General Physics, Mathematics and Computing were not considered.

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- The teacher must have worked for a minimum of four years in the period analyzed.
- Three generations of experts were considered as proposed for the original indicator system, considering age period: generation I (55 and older), II (45 to 54 years), III (35 to 44 years).

The results obtained at the faculty level are shown in the table , where it is observed that the experts have achieved an average development both from the point of view of their qualification and their management in the period 2011-2015. The results achieved at the level of each department and by generation are also presented.

The variables with high development in the faculty were the national and international visibility of the expert, organizational management with a good structuring of the knowledge network and a predominant mode of externalization and combination of the organizational knowledge creation cycle according to the Nonaka *model* and *Takeuchi*. [5] It is observed that leadership was the variable with the lowest development, since only 46.7% of the experts lead work groups. On the other hand, the indicators that have low development are experts with higher categories and productivity of the expert in the training of human resources, both undergraduate and postgraduate. The data presented allows us to establish in a comfortable visual form the degree of development of each indicator, variable and dimension, which facilitates the determination of indicators with a low degree of development. On the other hand, by showing the results achieved in each department and generation, the impact of each one on the overall result of the faculty can be established. For example, note that the low development in the

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faculty of the indicator “Experts with higher categories” responds to the low development in generations II and III of two departments, and the absence of a generation I teacher in one department. The low development of the “Leadership” variable is influenced by the low levels achieved in all generations of the three departments.

Table Results of the application of the system of indicators that characterize the development of experts in the Faculty of Nuclear Sciences and Technologies (2011-2015)

-			Facultad			Departamento 1			Departamento 2			Departamento 3		
Dimensión	Variables	Indicadores	Generación de experto			Generación de experto			Generación de experto			Generación de experto		
			I (5)	II (6)	III (1)	I (5)	II (6)	III (1)	I (0)	II (5)	III (3)	I	II	III
Cualificación del experto Medio	Carrera profesional Medio	Expertos categorizados Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)	-	Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)
		Expertos con categorías superiores Bajo (70 %)	Medio (83,3 %)	Bajo (70,6 %)	Bajo (57,1 %)	Alto (100 %)	Bajo (66,7 %)	Bajo (0 %)	-	Alto (100 %)	Bajo (33,3 %)	Bajo (0 %)	Bajo (50 %)	Alto (100 %)
		Expertos con grado científico Alto (93,3 %)	Alto (100 %)	Alto (88,2 %)	Alto (100 %)	Alto (100 %)	Alto (83,3 %)	Alto (100 %)	-	Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (83,3 %)	Alto (100 %)
	Competencia del experto Medio	Coeficiente de competencia Medio (83,3 %)	Bajo (50 %)	Alto (94,1 %)	Medio (85,7 %)	Bajo (40 %)	Medio (83,3 %)	Alto (100 %)	-	Alto (100 %)	Bajo (66,7 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)
	Liderazgo Bajo	Expertos jefes de proyectos Bajo (46,7 %)	Bajo (50 %)	Bajo (52,9 %)	Bajo (28,6 %)	Bajo (60 %)	Bajo (50 %)	Bajo (0 %)	-	Bajo (60 %)	Bajo (33,3 %)	Bajo (0 %)	Bajo (50 %)	Bajo (33,3 %)
	Visibilidad Alto	Participación en eventos Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)	-	Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)
		Publicaciones y patentes Medio (70 %)	Bajo (50 %)	Medio (70,6 %)	Alto (85,7 %)	Medio (60 %)	Bajo (50 %)	Bajo (0 %)	-	Alto (80 %)	Alto (100 %)	Bajo (0 %)	Alto (83,3 %)	Alto (100 %)
		Reconocimiento nacional e internacional Alto (90 %)	Medio (83,3 %)	Alto (94,1 %)	Medio (85,7 %)	Alto (100 %)	Medio (83,3 %)	Bajo (0 %)	-	Alto (100 %)	Alto (100%)	Bajo (0 %)	Alto (100 %)	Alto (100 %)
Gestión del Experto Medio	Organizacional Alto	Estructuración de la red de conocimientos Buena (100 %)	Buena (100 %)	Buena (100 %)	Buena (100 %)	Buena (100 %)	Buena (100 %)	Buena (100 %)	-	Buena (100 %)	Buena (100 %)	Buena (100 %)	Buena (100 %)	Buena (100 %)
	Etapas en el transito del conocimiento Alto	Modos de Conversion del Conocimiento Buena (93,3 %)	Buena (100 %)	Buena (88,2 %)	Buena (100 %)	Buena (100 %)	Buena (83,3 %)	Buena (100 %)	-	Buena (100 %)	Buena (100 %)	Buena (100 %)	Buena (83,3 %)	Buena (100 %)
	Docencia Medio	Impartición de docencia Medio	Pregrado Alto (96,7 %) / Alto (100 %)	Alto (100 %)	Medio (85,7 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)	-	Alto (100 %)	Bajo (66,7 %)	Alto (100 %)	Alto (100 %)	Alto (100 %)
			Posgrado Bajo (60 %) / Bajo (50 %)	Bajo (70,6 %)	Bajo (42,8 %)	Bajo (60 %)	Medio (83,3 %)	Bajo (0 %)	-	Medio (80 %)	Bajo (66,7 %)	Bajo (0 %)	Bajo (50 %)	Bajo (33,3 %)
		Tutoria de Tesis Medio	Pregrado Medio (73,3 %) / Medio (66,7 %)	Medio (66,7 %)	Bajo (57,1 %)	Medio (80 %)	Medio (83,3 %)	Bajo (0 %)	-	Alto (100 %)	Medio (66,7 %)	Bajo (0 %)	Medio (66,7 %)	Medio (66,7 %)
			Posgrado Medio (60 %) / Medio (66,7 %)	Bajo (58,8 %)	Bajo (57,1 %)	Medio (80 %)	Medio (66,7 %)	Bajo (0 %)	-	Medio (80 %)	Medio (66,7 %)	Bajo (0 %)	Bajo (33,3 %)	Medio (66,7 %)
		Productividad del experto en la formación de recursos humanos Bajo	Nivel académico (graduado) Bajo (36,7 %) / Bajo (33,3 %)	Bajo (47,1 %)	Bajo (14,3 %)	Bajo (40 %)	Bajo (50 %)	Bajo (0 %)	-	Alto (80 %)	Bajo (33,3 %)	Bajo (0 %)	Bajo (16,7 %)	Bajo (0 %)
			Alto nivel académico de posgrado Bajo (20 %) / Bajo (35,3 %)	Bajo (17,6 %)	Bajo (14,3 %)	Bajo (40 %)	Bajo (33,3 %)	Bajo (0 %)	-	Bajo (20 %)	Bajo (0 %)	Bajo (0 %)	Bajo (0 %)	Bajo (33,3 %)

The dimensions “Qualification of the expert” and “Management of the expert” have been valued with an average rating, so it is necessary to review and propose the improvement of actions aimed fundamentally at increasing the number of teachers of the II and III generation with categories higher education, the leadership of teachers in all departments and generations, the participation of

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teachers in the delivery of postgraduate teaching and productivity in the training of human resources.

CONCLUSIONS

The modifications made to the system of indicators designed for the assessment of experts who work in a science, technology and innovation entity allow it to be adapted and applied for the assessment of teaching experts - researchers who work in a university. Indicators of three variables of the "Expert Qualification" dimension (professional career, leadership and national and international visibility) and of the "Teaching" variable corresponding to the "Expert Management" dimension are modified.

Cronbach's alpha coefficient (0.9274) demonstrates the internal consistency of the instrument used. The values of the medians and the interquartile ranges achieved allow establishing the consensus of the participants in the validation of the indicator system.

As a result of the application of the Delphi method of consulting experts to validate the proposed system of indicators, it is obtained that the dimensions and the table for the assessment of the variables with three indicators reach consensus. All variables also reach consensus except "Leadership", as well as all indicators except "Categorized with teaching and/or scientific category", "National recognition" and "Predominant mode of knowledge conversion". The individual indicators with the least consensus are "Categorized with teaching and/or scientific category" and "Predominant mode of knowledge conversion", while the collective indicator with the least consensus is "Expert competence coefficient".

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The experts of the faculty under study show an average development in the period analyzed, both from the point of view of their qualification and their management, where leadership is the variable with the lowest development, as do the indicators "Experts with higher categories" and "Expert productivity" in the training of human resources at both undergraduate and postgraduate levels.

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Exploring Information Retrieval and Its Link to Scientific Output: A Case Study on 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

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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

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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

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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.

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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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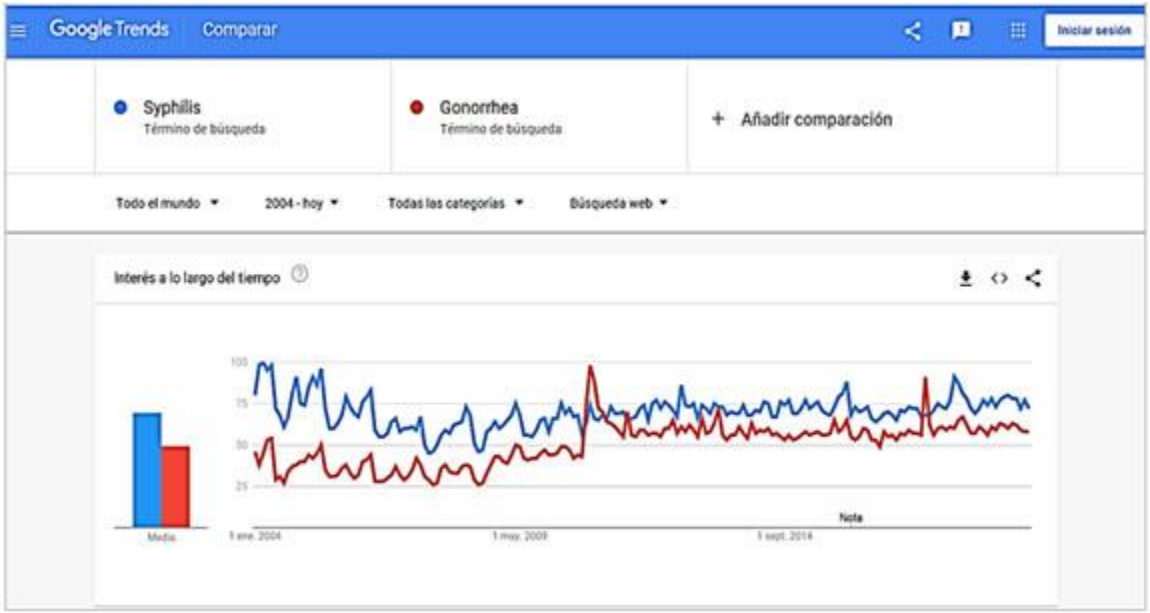

Fig. 1 - Search carried out in Google Trends.

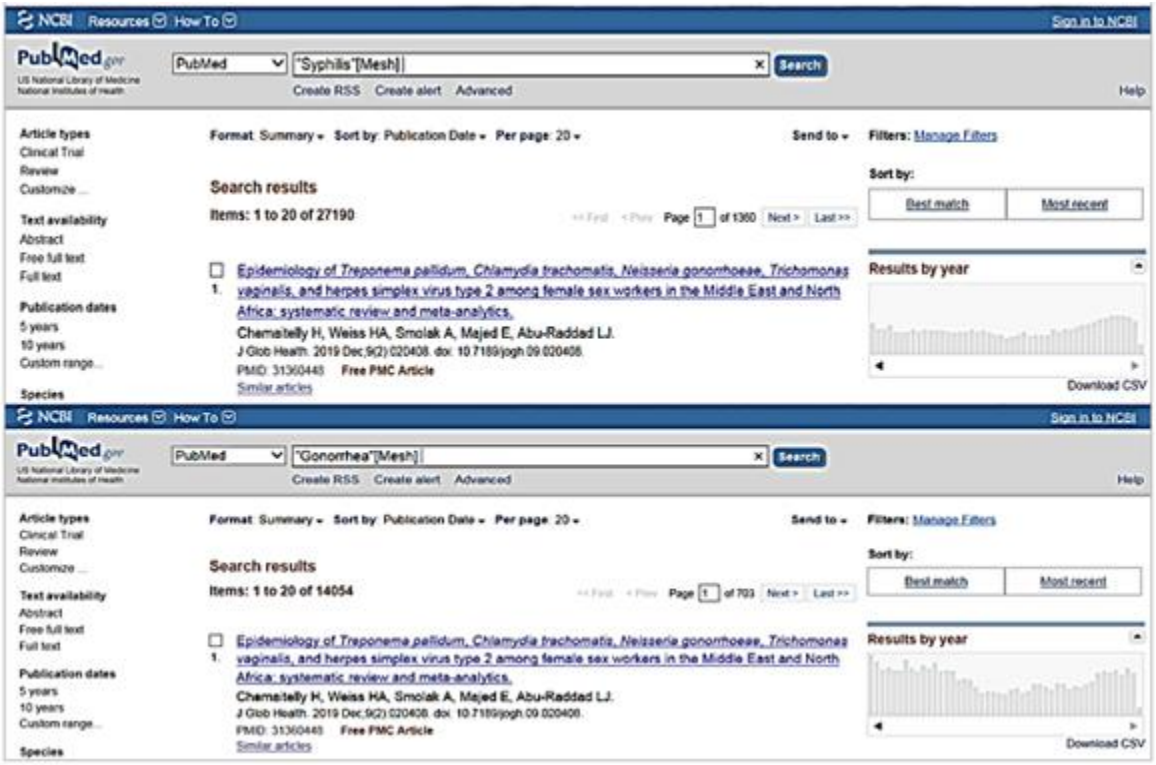

Fig. 2 - Searches carried out in MEDLINE (via PubMed).

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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 .

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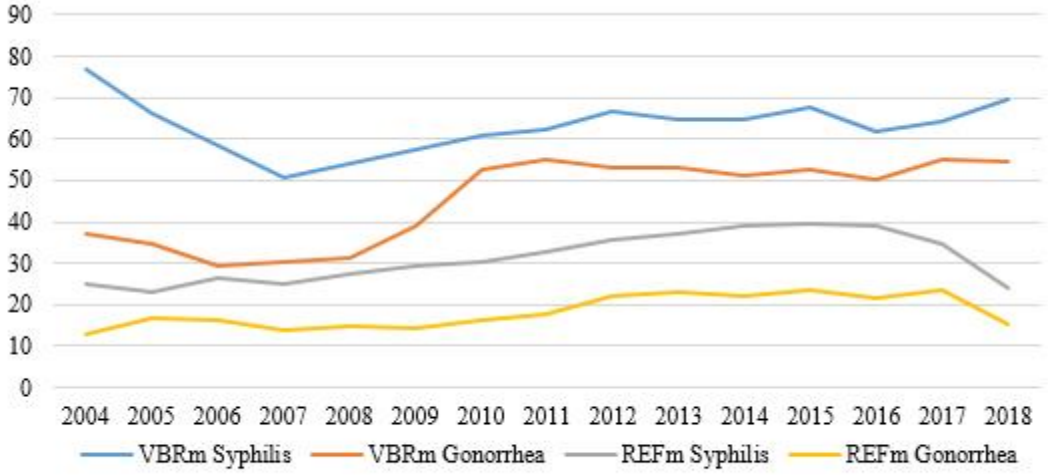
Table 2 Statistics, for the entire analyzed period, of the average monthly relative search volume (VBRm) and the average monthly number of references (REFm), obtained from the searches carried out in Google Trends and MEDLINE for *Syphilis* and *Gonorrhea*

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.

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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

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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.

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.

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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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Bibliometric Examination of Diabetic Retinopathy in Cuban Medical Journals: An Information Product Enriched with Value

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ABSTRACT

Metric studies on scientific production constitute useful information products for academic communities; However, there are no abundant investigations that quantify and evaluate the sources that publish works on diabetic retinopathy. This work aimed to determine the scientific production on diabetic retinopathy published in Cuban medical journals between 1970 and 2017. A bibliographic review was carried out based on the identification in the records of the terms adults - diabetic retinopathy]. The Zotero bibliographic reference manager was used to retrieve and analyze the metadata of each selected article; Microsoft Excel for the tabulation of the results and Mindjet mindManager (2010), for the preparation of the concept map. 56 articles related to the topic were selected after applying the inclusion and exclusion criteria. The scientific production of diabetic retinopathy published in Cuban medical journals is concentrated in the last 10 years. The weight of article distribution falls on journals that belong to National Institutes. Likewise, the trend in the types of works is concentrated in original research of a descriptive nature, case studies and review articles; and to a lesser extent cohort, analytical and experimental studies.

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Keywords: Diabetic retinopathy; Adults; Cuban medical journals; scientific production; bibliometric indicators

INTRODUCTION

Diabetic retinopathy is the most common ocular manifestation of diabetes mellitus damage to target organs, characterized by progressive lesions and occlusions of retinal vessels. The first described retinal changes date back to 1855 in Vienna by *Eduard Von Jaeger* ; but it was not until 1875 that *Theodor Leber* demonstrated the causal relationship between retinal examination findings and diabetes mellitus. *Arthur Ballantyne* revealed histopathological in 1945 that the change in the capillary wall contributed to the development of diabetic retinopathy. Research on endothelial cell dysfunction and clinical observations using fluorescein angiography solidified the paradigm of this entity as a vascular disease. [1]

It was in the 1960s when the first suggestions for the use of photocoagulation or laser therapy to treat diabetic retinopathy began. Since then and until today, this nosological entity is among the leading causes of blindness globally, with negative impacts on public health and social security systems, a situation that represents a medical and social problem worldwide. the prevalence of diabetes mellitus will increase and be considered an epidemic. [1]

It is estimated that by 2035 there will be 592 million diabetic people. According to *Rodríguez Rodríguez* , the number of people who are likely to become blind due to diabetic retinopathy would be 4.4 million, taking into account the global average risk of blindness calculated in 2002 at 0.75%. [2] A better understanding of the risk factors, its pathogenesis and its functional manifestations has allowed important advances in the prevention and treatment of diabetic retinopathy.

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Its prevalence worldwide ranges from 17.6% in India to 33.2% in the United States. In 2010, there were 126.6 million people with diabetic retinopathy in the world, and an increase of 191.0 million is expected by 2030. The number of patients with visual impairment due to this cause will increase from 37.3 million to 56. ,3, and the risk of developing it is 5 to 10% annually in those diabetic patients who have not developed it. [3]

The natural history, diagnosis and treatment of diabetic retinopathy are based on the results of the main multicenter studies carried out in the United States and England, which constitute a mandatory framework for studying the risk factors that affect this pathology. The duration of diabetes, age, high blood pressure, elevated blood lipids and sustained hyperglycemia are the risk factors most associated with its appearance. [4, 5, 6]

Although the associated factors and prognosis for the progression of diabetic retinopathy are known, a completely effective and safe intervention has not been found to prevent its progression; and every day visual disabilities and blindness increase, which generates a dramatic human and social situation, increasing economic costs, disability payments, rehabilitation programs and social security, with the consequent decrease in productivity, reasons that motivate the World Health Organization to create the pragmatic framework to eliminate preventable blindness by 2020 for this reason. [7]

There are multiple international clinical reviews and meta-analyses on diabetic retinopathy, [8, 9, 10, 11, 12, 13)] as well as scientometric studies that investigate other topics in ophthalmology, [14, 15)] but quantitative analyzes of related publications are still scarce. with this one in Cuba.

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In the particular case of Cuba, numerous bibliometric studies have been carried out in health sciences, some more general and others specific, such as the one referring to the world scientific production on human cytogenetics indexed by the PubMed database, corresponding to the period 1999-2008, [16] and specifically on Cuban medical journals, the strategies and priorities for the scientific publication of Neurology were investigated, [17] the analysis of some bibliometric indicators referring to endodontics, [18] on breastfeeding, [19] and on the patterns of communication and impact of Cuban scientific production in public health. [20] However, regarding diabetic retinopathy there are not abundant investigations that quantify the rates of scientific production of Cuban authors, the dissemination of scientific knowledge and the evaluation of the sources that disseminate these works.

One of the challenges of Bibliometrics and Scientometrics is to examine and measure scientific production in a scientific domain or discipline, which is why multiple methods have been developed aimed at evaluating the quantitative and qualitative aspects of literature in a scientific field. Currently, scientific production indexed in databases makes it possible to automatically process the various units of information contained in bibliographic records, such as citations, authors, keywords or terms contained in titles and summaries. [fifteen]

The work presented is a bibliometric study of Cuban scientific production on diabetic retinopathy in which the distribution of articles is determined according to the collection of Cuban medical journals, according to topics and years of publication, the co-authorship network, the most productive authors. , the co-

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occurrence of terms in the titles for the identification of topics and the number of citations and year of citation.

The analysis of scientific production in this field of knowledge is aimed at influencing professionals to draw up strategies for future research. Quantifying the rates of scientific production and dissemination of scientific knowledge makes it possible to analyze and evaluate the sources that disseminate the works, analyze the chronological evolution of production, the productivity of authors and their affiliations, the propagation of publications, the growth of specific fields of science and assessing the impact of publications helps to carry out descriptive and critical analyzes of the evolution of the knowledge generated and disseminated; That is, bibliometric studies can be taken as a reference for planning future activities. This work aimed to determine the scientific production on diabetic retinopathy published in Cuban medical journals between the years 1970 and 2017.

METHODS

To select the sample, the following inclusion criteria were used: Publications in the form of full-text articles that addressed diabetic retinopathy as a study topic, published in Cuban medical journals until 2017. Theses, conference proceedings were excluded. , books, book chapters and conferences. The articles available in full text in Cuban scientific journals available in the Virtual Health Library were used as sources of information. Thus, the study sample was made up of 56 articles published in Cuban medical journals until 2017.

The search strategy was designed based on the research question: What is the scientific production on diabetic retinopathy published in Cuban medical journals? The terms used were: (subject headings): diabetic retinopathy], adults-

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diabetic retinopathy-]. With this combination, articles published in 17 Cuban medical journals available in the VHL were identified and compiled from the Cumed database.

The CUMED database allowed us to obtain information on the 56 articles that were part of the sample and referred to the full texts published in Cuban journals indexed in Scielo-Cuba, from where they were imported directly to the Zotero library. This bibliographic reference manager made it possible to recover and enter the information of each article only once, extract the metadata from the PDFs and the bibliographic information from the website of each journal. Subsequently, the data obtained were organized and processed according to the bibliometric indicators and were tabulated using Microsoft Excel. To obtain the citation count of the analyzed articles, Google Scholar was used; One of the information that this search engine extracted from each source was the number of times the displayed result was cited.

To represent the production by its theme, mindjet mindManager (2010) was used, free software that allows the construction of approach schemes and solution of information problems, and facilitates the understanding of the content and a better organization of knowledge, its processing and interpretation. The variables selected for the study are shown in the following table :

Table- Variables selected for the study

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Variable	Indicadores bibliométricos
Artículo científico	**Título**
	Año de publicación
	Nombre del (de los) autor (es)
	Número de artículos por autor
	Cantidad de coautores
	Cantidad de citas por artículo
	Fecha de citación
	Palabras en el título
	Resumen/Key words
	Tipos de estudio
-	**Institución de afiliación de los autores**
Revista Médica Cubana	Institución responsable de la publicación
	Número de artículos por revista
	Fecha de publicación
	Provincia
-	Indexación

RESULTS

Of the 56 articles that address diabetic retinopathy, 10 (18%) were published before the year 2000; 17 (30%) between 2000 and 2009; and 29 (51%) from 2010 to 2017. As can be seen, in the last 10 years the largest number of articles was published (Fig. 1).

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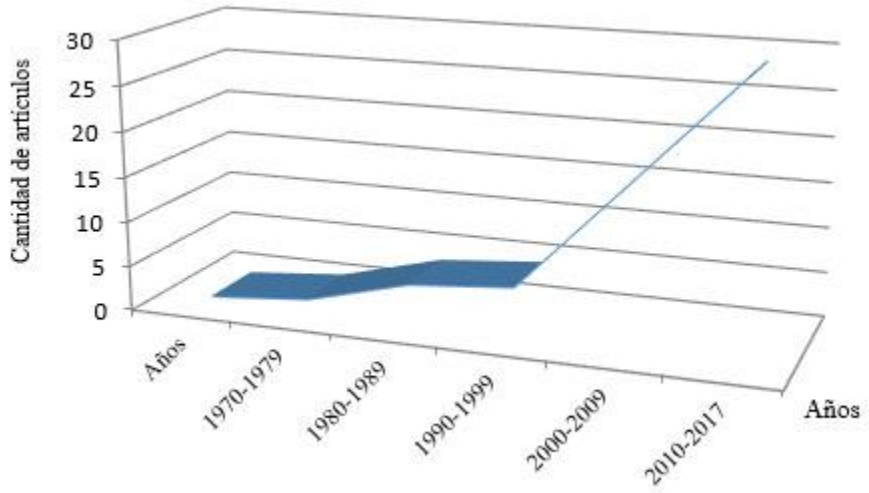

Fig. 1- Scientific production on diabetic retinopathy in Cuban medical journals between the years 1970 and 2017.

In relation to the distribution of articles according to the collection of Cuban medical journals and years of publication, it was found that 17 journals published articles on the topic under study. Between 2008 and 2017 (last 10 years), 11 journals (64.70%) published at least 1 article; and between 2013 and 2017 (last 5 years) 9 (52.94%) also did so (Table 1).

Table 1- Number of articles published in Cuban medical journals between 1970 and 2017

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Título de la revista	Total de artículos
Gaceta Médica Espirituana	1
Revista Cubana de Medicina	3
Medicentro	1
Revista de Ciencias Médicas de Pinar del Río	1
Revista de Información Científica	4
Revista Cubana de Medicina General e Integral	2
Revista Cubana de Oftalmología	18
Revista Cubana de Farmacología	1
Revista Cubana de Obstetricia y Ginecología	1
MEDISAN	4
Revista Cubana de Endocrinología	7
Revista Electrónica	2
MediCiego	4
Revista de Medicina Militar	1
Archivo Médico de Camagüey	4
Revista de Humanidades Médicas	1
Revista Habanera de Ciencias Médicas	1

Regarding the distribution of the journals in which the articles were published, 100% are Cuban and are indexed in the Cumed and SeCimed databases, as well as the highest percentage is represented in at least 2 multidisciplinary international journals (Scholar Google and Latinindex). Only 6 (35%) are indexed in the Lilacs regional database and 4 (23.5%) are found in 2 global databases (Scopus and Web of Science). (Fig. 2)

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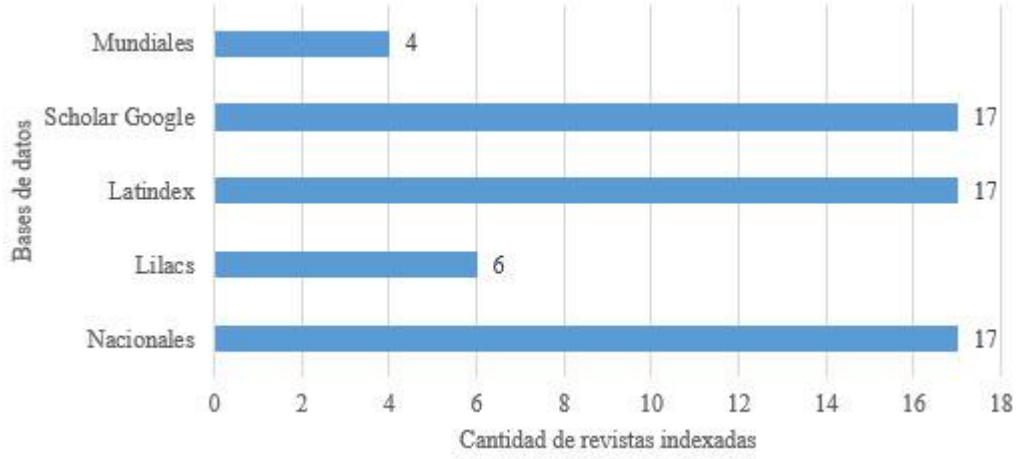

Fig. 2 - Cuban medical journals indexed in national, regional and global databases.

The origin of the diabetic retinopathy articles according to the provinces of the institutions of affiliation of the authors, as shown in Table 2 , was higher in Havana, followed by Ciego de Ávila, Guantánamo and Santiago de Cuba. Of the works analyzed, only two belong to studies carried out in other countries, although published in Cuban magazines. Regarding the institutions of affiliation of the authors, those belonging to National Institutes prevailed (Ramón Pando Ferrer Institute of Ophthalmology and Endocrinology) followed by primary health care areas and provincial hospitals.

Table 2- Articles published according to the origin of the authors

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Provincia	País	N	%
La Habana	Cuba	35	62,5
Pinar del Río	Cuba	1	1,78
Villa Clara	Cuba	1	1,78
Sancti Spíritus	Cuba	1	1,78
Ciego de Avila	Cuba	4	7,14
Camagüey	Cuba	4	7,14
Las Tunas	Cuba	2	3,57
Guantánamo	Cuba	4	7,14
Santiago de Cuba	Cuba	4	7,14
Total	-	56	-

In relation to the analysis of production by topic in the frequency of appearance of terms in the titles of articles and keywords, it is evident that the predominant descriptors in the study carried out were diabetic retinopathy, found in 31 works, followed by risk factors in the elderly, blindness, diabetic macular edema, low vision and epidemiology, as shown in Figure 3 .

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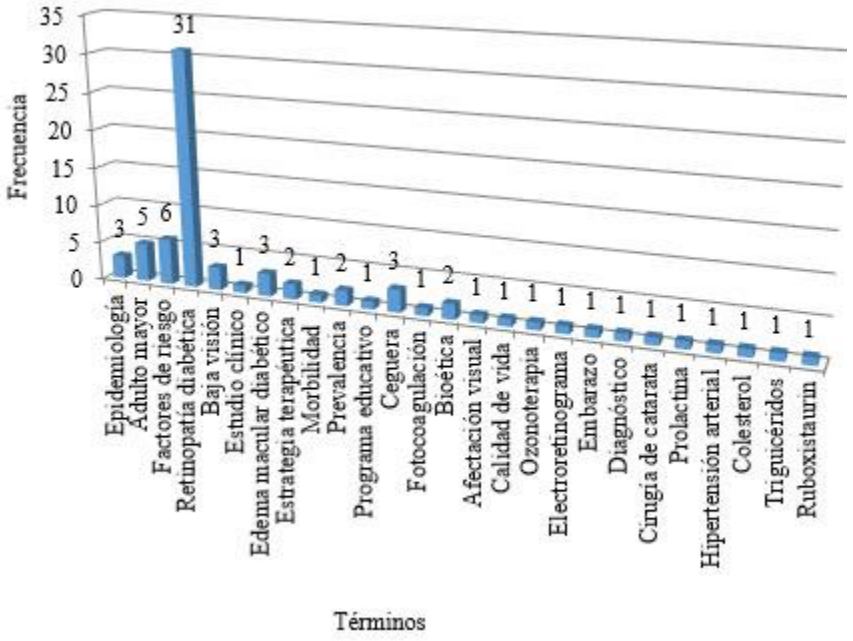

Fig. 3 - Frequency of appearance of terms in article titles.

By analyzing the descriptors that were part of the search strategy and after grouping similar terms, it was possible to build a conceptual map that shows thematic groups related to diabetic retinopathy. It is possible to observe some thematic groups emerging from the descriptors of the publications, which is shown in Figure 4 .

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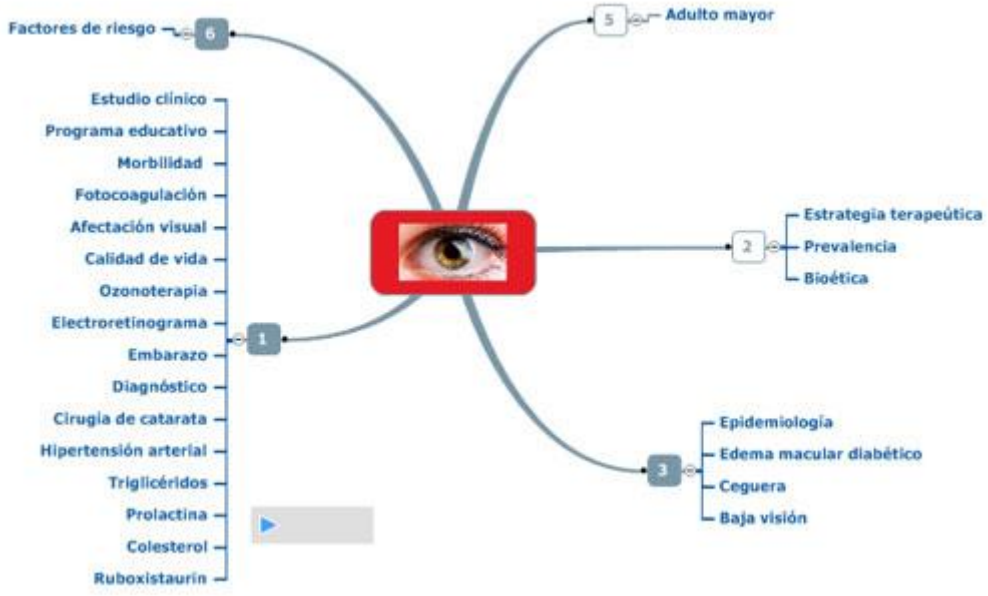

Fig. 4 - Thematic groups related to diabetic retinopathy.

The distribution of citations by the years covered by the research shows a tendency to increase. Of the 56 articles evaluated, 26 (46.42%) were not cited in the analyzed time period and 30 received at least one consultation (53.57%). The highest number of times an article was cited was 20 (Fig. 5).

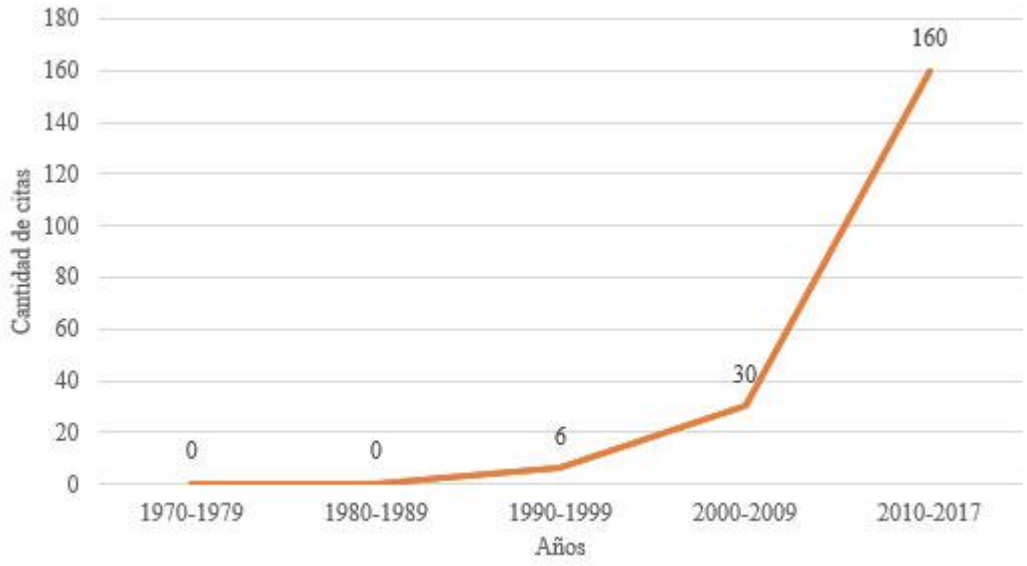

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Fig. 5 - Number of citations per article between the years 1970 and 2017.

The scientific productivity of the authors is an academic problem in relation to quantitative and qualitative scientific practice. "Therefore, one could ask whether the contribution of large producers is of lower, equal, or higher quality than the contribution of smaller producers." [21] Lotka's law addresses the distribution of authors according to their productivity; suggests that there is an unequal distribution of productivity among authors and that, regardless of the discipline, the majority of authors publish the smallest number of works, while a few authors publish most of the relevant bibliography on a research topic, and they form the most fertile group.

In the following table, the general data obtained from the analysis of the scientific production of 42 authors is organized into 5 columns. The calculation was based on the number of contributions made by each lead author. Examination of the co-author network revealed a figure of 114, representing an average of 1.87 participants per article. In the degree of collaboration, it was found that the smallest number of articles has one co-author and the majority between three and four, without a tendency towards hyper-authorship.

Table 3- Application of Lotka's law to scientific production on diabetic retinopathy.

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Nro. de contribuciones por autor (X)	Número de autores (Y)	Total de artículos (X-Y)	Suma acumulativa (X-Y)	Porcentaje de autores (% de Y)
1	34	34	34	80,95
2	4	8	42	9,52
3	2	6	48	4,76
4	2	8	56	4,76
Total	42	56	-	-

There is a concentration of 80.95% of authors who contribute a single article and the highest productivity is 4 articles at 9.52%, an interesting aspect that stands out in Figure 6 . It is also noteworthy that although most authors publish the smallest number of works, productivity is not so unequal, if one takes into account that the difference is only 1 to 4 works and the time coverage is extensive.

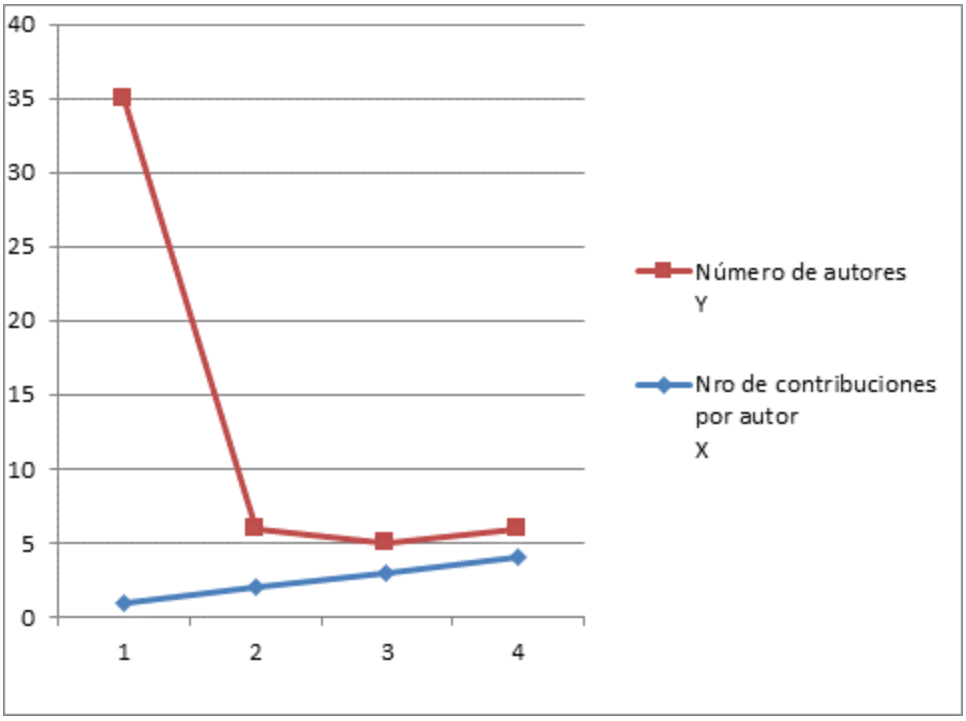

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Fig. 6 - Productivity of authors according to the number of contributions made on the topic studied.

Regarding the types of scientific articles, the highest proportion corresponded to original works, with a total of 29 (51.78%), followed by inquiries with descriptive scope, with 17 (30.35%), reviews, with 10 (17.85%) and case studies were less prevalent, with only 5 (8.92%).

DISCUSSION

In the present study, the scientific production on diabetic retinopathy published in Cuban medical journals is concentrated in the last 10 years. According to other works, there is currently a tendency to increase the number of authors per publication in the medical sciences, since the presence of collaborative studies necessary to obtain valid results is increasing. [19] In this case, the increase may also be motivated by a greater interest of researchers in the study of the topic, because its prevalence in the world increases. For example, in 2010 there were 126.6 million people with diabetic retinopathy and an increase of 191.0 million is expected by 2030. [3] In addition, the development that the specialty of Ophthalmology has had technologically is taken into account. and the wide possibilities of publishing, motivated by the development of Cuban medical journals in all the country's provinces and national institutions.

Another element of great importance is that the weight of the distribution of the articles falls on journals that belong to National Institutes or Scientific Societies, such as the Cuban Journal of Ophthalmology, the Cuban Journal of Endocrinology and the Scientific Information Journal, as far as possible. influence the presence of a greater number of specialists, the existence of multidisciplinary consultations and

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differentiated care for this nosological entity through national and branch programs. The other journals that presented the greatest quantity are part of the network of journals of the National Health System in the different provinces.

In recent studies, the average h-index values in Scholar Google are almost 30% higher than those obtained in the Web of Science and 15% higher than those collected by Scopus. [22]) The distribution of scientific production on diabetic retinopathy in national, regional and global databases has led to an increasing trend in the number of citations in recent years. Although the presence of Cuban authors in databases such as Scopus or Web of Science is still limited, the truth is that they are all indexed in Scholar Google, a valid tool for researchers in health sciences, both for the purposes of information retrieval and for the extraction of bibliometric indicators. Although the achievements achieved denote hard editorial work, one of the researchers' purposes is improvement aimed at increasing the scientific visibility of the publication through indexing in other databases of recognized international prestige. [23]

Research on diabetic retinopathy is oriented towards predominant thematic groups such as epidemiology. Likewise, international studies carried out in recent years are similar to this topic. [24] Others, such as blindness, diabetic macular edema, bioethics, prevalence and therapeutic strategy, also comprise an emerging thematic group composed of a diversity of issues addressed in a smaller amount. Recent research emphasizes the lack of analytical and experimental studies. [25] The trend of research on diabetic retinopathy is concentrated on original works of a descriptive nature, reviews, case studies and review articles, and to a lesser extent cohort, analytical and experimental studies are carried out. Internationally, analytical and

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experimental studies prevail.[24,26] and although metric research on scientific production constitutes useful information products for academic communities, in Cuba there are not abundant investigations that quantify and evaluate the sources that publish works on diabetic retinopathy.

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Revitalizing the National Center for Biopreparations' Website: Aligning with Contemporary Trends in Homologs

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ABSTRACT

Business websites must ensure that your employees, suppliers, competitors, customers and stakeholders can find general and company-specific information. This work aimed to determine the necessary elements for the redesign of the Website of the National Center for Biopreparations (BioCen) in accordance with current trends in homologs. For this, the websites of counterpart companies were determined through interviews with directors and specialists of the Center. Seven were chosen to identify trends in Information Architecture based on five analysis categories. These trends were not reflected in the current BioCen website. The redesign proposal included, according to counterparts, the labels; the definition of content, in the *OnePage* format ; the structure of the main page with different and few information levels; the use of images, in accordance with the texts; different navigation systems; changes to the header and footer components.

Keywords: National Center for Biopreparations; websites; homolog study; information architecture

INTRODUCTION

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"(…) The web represents one of the most widespread and used services, made up of multiple web products that are consulted daily by a countless number of Internet users. One of these products is websites, which constitute the virtual representation of content that identifies a topic, a person, a company or organization in cyberspace. [1]

"Companies try to ensure that their employees and users (suppliers, competitors, customers, etc.) can find general information about the company on their sites, and especially, the products and services they provide." [2]

Cuba is not immune to this reality and, without a doubt, Cuban companies are becoming increasingly receptive to the world of business websites. Likewise, the National Center for Biopreparations (BioCen), a BioCubaFarma company, requires strengthening the company's external communication, identifying new suppliers and clients for the organization, promoting its products and services, increasing sales, gaining visibility at the national level and internationally, consolidate the company's relationships and interactions with the community, as well as promote feedback channels.

In this sense, it is necessary to have a website with an adequate information architecture, but for this it is necessary to ask: What are the trends in the information architecture of websites of peer companies? How are the trends identified above reflected in the current website? What elements are necessary for the redesign of the Information Architecture of the Website of the National Center for Biopreparations (BioCen) in accordance with current trends in counterparts?

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The objective of this work is to determine the necessary elements for the redesign of the Information Architecture of the Website of the National Center for Biopreparations (BioCen) in accordance with current trends in counterparts.

METHODS

The development of the work responds to a mixed approach research with the application of qualitative methods for the analysis of national and international standards on peer websites and also the use of non-parametric quantitative techniques that allow quantifying the results of the peer study.

The type of research is descriptive, since it considers the phenomenon studied and its components, variables are defined and characteristics, properties and important features of the phenomenon are specified. In addition, it describes the trends of the group or population of the object of study. Semi-structured interviews are carried out with managers and specialists in the fundamental areas of BioCen to identify possible counterparts of the company and their websites are analyzed.

Theoretical - conceptual references

Based on the different authors [3,4,5,6,7] it can be stated that information systems (IS) are systems designed for the capture, processing, storage, recovery and dissemination of information in organizations. According to these authors, they allow easier access to the information that users need, and this improves the communication process. A company's IS tries to maintain its essential communication channels, process certain types of routine transactions, and inform managers and third parties of the events that occur in it.

According to different definitions, [8,9] websites can be considered SI. Websites, as an information system, are instruments or tools that facilitate the management of

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company information and its communication with the environment. They enhance the use and exploitation of information in organizations, as well as the access, processing, utilization and relevant dissemination of information.

"Companies, to capture customers today, need to be visible on the Internet to gain visibility in the market. Definitely, one of the ways to get information to a large number of people is through the Internet, and, therefore, one of the ways is to support the content that you want to communicate to the public, on websites." [10] Websites allow information to be transmitted about their products or services, and also enable organizations to strengthen relationships with their clients or users. [1] A website is a set of web pages that belong to the same topic or domain. These allow you to easily locate the information that interests users. They offer information and services. [eleven]

Coutin [2] considers that a website can offer information about a business organization. In this type of site, the company's image is promoted and offered in a virtual way. They use it to make themselves known, provide their own information and function as a means of contact for their clients or members. In addition, it serves to promote your goods and services. "A business website constitutes the Company's digital business card; "It is a communication tool that allows products and services to be promoted, guides Internet users about the operation, location and contacts of the Company and presents its international recognition-quality certification and awards." [2]

Information architecture (IA) involves the design of a website's organization, labeling, navigation, and search systems. In this way it can be seen that AI is a process, and at the same time a discipline that is responsible for providing an

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adequate organization of the informational content of the IS, fundamentally the digital content of the web. Finding the most appropriate labels to represent said content is one of the functions that the professionals in charge of making them have to perform, as well as ensuring easy and comfortable navigation by users on the sites, and an efficient and effective search and recovery of the information they need to find. [12, 13, 14]

"Enterprise information architecture (IEA) is a framework for defining information-centric principles, architectural models, standards and basic processes for information and technology decision-making in the context of an enterprise or organization. It translates business requirements into informational strategies and defines what content elements are necessary to carry out in said strategies" [15] The AIE is a vision of AI in companies related to the management of information and knowledge, and with the integration of AI to business strategies and organizational culture, and is essentially evident in organizational information systems such as Intranets, corporate websites, repositories, among others. [16, 17]

IDENTIFICATION OF THE WEBSITES CORRESPONDING TO BIOCEN'S APPROVED COMPANIES AND DETERMINATION OF THE ANALYSIS CATEGORIES

BioCen's counterpart companies were identified from interviews carried out with the directors and different specialists from the center's fundamental areas, which were selected based on the company's organizational chart, strategic objectives and mission. In them they were asked to name centers, companies, institutes or other forms of business administration that fulfilled functions homologous to BioCen. 100% of those interviewed identified the companies of the OSDE

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(Superior Organization of Business Management) BioCubaFarma as counterparts to BioCen at the national level. Among them the Center for Genetic Engineering and Biotechnology (CIGB), the Center for Molecular Immunology (CIM), the Finlay Vaccine Institute, and the Center for Research and Development of Medicines (CIDEM).

When carrying out the search, the CIDEM and CIM websites were not available, so they were discarded, leaving the national sample made up of the Finlay Institute and the CIGB. In addition, the BioCubaFarma site was considered, to which BioCen is subordinate (3 national sites). At the international level, 18 companies homologous to BioCen were identified in the interviews, of which 4 were discarded because they did not have a website and 5 that were not available during the search period (March 10, 2018 to March 18, 2018). . Of the remaining 9, those with the highest frequency of repetition in the interviews were considered (10 times) and those with the greatest similarity to the BioCen mission were selected. Thus, the international sample remained at 4 sites (table).

Table List of sites for the Homolog Study

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Región	Empresas	URL
Nacional	OSDE BioCubaFarma	https://www.biocubafarma.cu
	Instituto "Finlay"	https://www.finlay.edu.cu
	Centro de Ingeniería Genética y Biotecnología	http://www.cigb.edu.cu
Internacional	GlaxoSmithKline	https://www.gsk.com/
	Merck	http://www.Merck.com
	Landsteiner Scientific	http://www.landsteiner.com
	Pfizer	https://www.pfizer.es/

General categories were established that were adaptable to this study, that provided the necessary elements, or at least sufficient for the identification of trends in AI. *The parameters and indicators used by Baro* [18] in his diploma work were taken as reference :

1. Contents and structure of the main page.
2. Categories of the global navigation system.
3. Organizational information.
4. Products and services offered.

And it was added by these authors:

Header and footer.

All data on the selected sites were compiled and tabulated taking into account the analysis categories:

Contents and structure of the main page. The peer study allowed the identification of general behaviors and trends:

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- - Internal content that is at different levels of depth is promoted, and that companies are interested in ensuring that users/customers do not stop knowing (7/7). The contents are located at a first level of relevance and, in turn, at lower levels.
- - Its most common forms of presentation are *sliders* with static/animated images and texts that offer to internal content, and the combination of images with descriptive texts and (5/7).
- - Some sites use a *hero* b image (2/7).
- - One Page is used , *which* saves the number of clicks to obtain the necessary information (7/7).

On the current BioCen website (http://www.biocen.cu) all the contents of the main page are at the same level of priority or relevance. No images are used. The presentation is iconic-textual; however, the icon does not inform. The content is incomplete and no relevant messages are included.

Categories of the global navigation system. The peer study allowed the identification of general behaviors and trends: Not all analyzed sites use the same content categories in their global navigation system; However, there are common contents in several of them, as well as predominant tags:

1. 1) Institutional information (7/7):
    - - Companies
    - - About
    - - About us
    - - Us
2. 2) Products (6/7):

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- - Business
- - Productive System
- - Product Portfolio
- - Products

3. 3) News (6/7):
   - - News
   - - To know
   - - Press room
   - - Editorial Room
   - - Media
4. 4) Research (5/7):
   - - Research development
   - - Projects
   - - Investigation and development
   - - Investigation
5. 5) Responsibility (3/7):
   - - Social Commitment
   - - Responsibility
6. 6) Racing (3/7):
   - - Job board
   - - Careers
7. 7) Multimedia (2/7):
   - - Gallery
   - - Multimedia

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There are categories that were only repeated once in the cases analyzed, such as:

- - Others
- - Clinic and impact
- - Sanitary professional
- - Pharmacovigilance
- - License
- - Behind the Science
- - Business to Business
- - Employees

In the sites that have been the object of study of this research, it is a trend that the content of the global navigation system is represented by textual labels (7/7). Although they are presented in different ways on each site, there is a tendency to represent it in the form of a hamburger menu (which consists of an icon formed by three horizontal lines that when activated, is displayed) and a text that says “Menu” in the upper right part of the header (4/7). In addition, the “breadcrumb or Ariadne's thread” technique is used, which consists of a line of text indicating the route followed and the way to return.

On the current BioCen website (http://www.biocen.cu), the global navigation system is made up of 5 categories that are displayed in the header of all pages on the site. These do not fully respond to the mission of the center. The contents are not properly labeled. The search box is not consistent. The “breadcrumb” technique is not included and it does not have a search engine.

Organizational information. The peer study allowed the identification of general behaviors and trends. The institutional information that companies provide to their

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users/clients varies in terms of quantity and diversity of content, as well as the way in which it is presented; However, there are contents that are the most common in the sites analyzed, such as:

- - The name and logo of the company.
- - The mission and vision of the company.
- - News related to the company and its social function.
- - Historical summaries of the company.
- - Structure and human resources.
- - Research lines and scientific publications.

This information is usually presented in the form of text with associated images. The current BioCen website (http://www.biocen.cu) does not offer news content, does not offer videos, does not mention the current mission, vision and values of the company, the organizational structure, the sense of responsibility social development, scientific publications and scientific-technical potential. The content is not properly organized or structured.

Products and services offered. The peer study allowed the identification of general behaviors and trends. In all the sites analyzed, the products and services offered by the companies are presented in one way or another. Products are promoted in different ways; However, it is a trend to do so using images accompanied by texts that describe them, and to use to access all the content of this typology, although other variants are also used to represent the products: plain text (only simple text, without) and in the form of a list ordered alphabetically. The metadata used to describe them are:

- - Name

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- - Brand
- - Properties
- - Medical indications
- - Medical prescription (if applicable)
- - Form of product presentation
- - Name of the active ingredient
- - Quality certification
- - Fabrication place
- - Patent
- - Benefits

Although greater emphasis is placed on the promotion of products, the services they offer are also promoted. They are presented mainly with the use of images and descriptive texts.

BioCen's current website (http://www.biocen.cu) offers its products primarily in plain text form. In the case of products, some of them are listed alphabetically with a brief description, but they do not have all the elements that are usually used to represent them.

Header and footer. The peer study allowed the identification of general behaviors and trends: All sites have in common the presence of a header and footer. (7/7). In the header, elements of the company's identity are always displayed (7/7): the logo (6/7), the company name (6/7) and the slogan (2/7).

The search box of the site's global search engine is another element that frequently appears in the upper right part of the header (4/7), although sometimes the search system is enhanced within the body of the page (1/7) and in others even in the

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footer (2/7). There are two institutions studied that introduce the search box within their hamburger menu.

Most sites include features in the header to facilitate user interaction (4/7). Some of these features are: service for the physically disabled (icon), to social networks (icon), language change (icon), search engine, site map, contact, subscription to RSS service and email (text with link).

In the footer they are offered in most cases:

- - Features of the sites and are represented in textual, iconic or iconic-textual format (5/7). Some of these features are: to social networks, subscription to the RSS service, site map, contacts, search engine and language change. Likewise, information about the site developer is offered in textual format (5/7). In addition, usability and accessibility information is offered through linked text (4/7) and to sites of interest (4/7). To a lesser extent, contact information (3/7) was offered in textual format and in icon-textual format. Other noticeable elements were elements of the companies' identity (logo and slogan), news and elements of the navigation system in text form with to the contents.
- The current BioCen website (http://www.biocen.cu) has, like all the sites analyzed, a header and footer. The header, although poor, has identity elements such as the company logo, the global navigation system, which is displayed through a drop-down menu. Contact provision is also offered. However, it does not include access to social networks or language selectors.

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- The footer does not offer any content, only information about the developer, in this case corporate. It does not include related sites, contact information or an interactive map with the center's location.

REDESIGN PROPOSAL FOR THE INFORMATION ARCHITECTURE OF THE BIOPREPARE CENTER WEBSITE

Contents and structure of the main page

A translucent hero image will be presented with a general message about BioCen and the *One Page will be used.* The main or home page must have the following content, which will be located at a first level of relevance, and in turn, at lower levels:

1. 1) About Us.
    - Brief description of BioCen and image of the entrance to the center (link to About us section).
2. 2) Quality Certifications.
    - Abstract of the accreditations received to the Quality Management System (QMS) and images of the latest certificates obtained; in this case those of ISO9001: 2015 by *Lloyd's Register Quality Assurance* of Great Britain and the National Standardization Office of Cuba (link to Quality Policy).
3. 3) Our products.
    - Brief, concrete and general idea of the destination and benefit of BioCen products (link to the Products section) and a panel of translucent images of the products with the typology (link to each

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type): diagnostic means, antianemics and restoratives, vaccines allergens, immunomodulators.

4. 4) Our services.
    - Brief, concrete and general idea of the services offered by BioCen (link to the Services section) and a panel of translucent images of each service with the name of each one (link to the service): Manufacturing of active pharmaceutical ingredient, Production of parenteral low volume, laboratory tests for quality control.

Global Navigation System Categories

The global navigation system will be displayed in the header of all the pages of the site in a consistent manner and will be made up of 4 categories represented by textual labels: About us/ Products/ Services/ Research + Development.

Each category that makes up the global navigation system will display its contents concentrated on a single page. The “breadcrumb or Ariadne's thread” technique will be included, which consists of a line of text indicating the route followed and the way to return. In turn, the global navigation system will be displayed in a hamburger menu for *responsive versions.*

Organizational information

This information will be presented in text form with associated images:

- - Images of BioCen and the company's mission and vision.
- - BioCen audiovisual and shared values.
- - Interactive timeline with date, event and images.
- - Explanation of the organizational structure, photos and names and surnames of the managers and directors.

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- - Scientific-technical potential through a graph with statistical information that represents the number of doctors, masters, technologists and researchers.

Products and services offered

The products and services will be displayed through images accompanied by texts that describe them, and will be used to access all the content.

Regarding the services, it will be presented:

- - General and brief description of the services and their importance.
- - Each service will appear ordered by the mission of the center with brief information about the plants where they are carried out, the processes that are carried out and the technology that is used.
- - Image of services with competitiveness information.

Regarding the products, it will be included:

- - General and brief description of the products and their importance.
- - Name of each type of product, which will be arranged alphabetically with a brief explanation of the benefits.
- - In each typology, images of the products will be placed with a brief description of each of them and the link to the health registry.

The proposal for the Research and Development page is as follows:

- - General information about the Research and Development process at the center.
- Name of each R&D line, arranged alphabetically and with related image. Within each line, the titles of the projects organized alphabetically.

Header and footer

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The following utilitarian components and features are proposed to be located in the header:

- - Access to social networks where the center has an official profile (Facebook, Twitter, Instagram).
- - Global search box.
- - Language selectors.
- - Frequently asked questions (FAQs).
- - Contacts.

The following components are proposed for the *footer* or footer:

- - Elements of law and responsibility on the site and the update date.
- - Terms of use.
- - Privacy policies.
- - Homologous centers.
- - Contact information.
- - Interactive map with the location of the center.

CONCLUSIONS

In the websites of the BioCen counterparts analyzed, certain trends in information architecture are identified, among which are internal content that appears at different levels of depth, the use of *sliders or hero* images and the *One Page* . The global navigation system is represented by textual labels and information of an institutional nature, products-services and research predominates. In institutional information, the most common contents are elements of identity, mission and vision, news related to the company, history and structure. Products and services are promoted through images accompanied by texts that describe them, and are

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used to access all the content of each one. All sites have in common the presence of a header and footer with features, contact information and news.

The identified trends were not reflected on the current BioCen website, in the study of the homologous sites. Labels are included in the AI redesign of BioCen's website, according to peers; the definition of content, in the *OnePage* format ; the structure of the main page with different and few information levels; the use of images, in accordance with the texts; different navigation systems; changes to the header and footer components.

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