

The Importance of Quality Tools in the Health Environment

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Abstract— Being education a fundamental factor to generate the welfare of society, together with research, which is a consequence of the first, a form of application of education and knowledge. Being these elements, generators of the progress and welfare of society, which is specifically important in areas such as health, in which the requirement of quality increases every day, since it is a sector in the service sector in the what quality is not optional and, yes, imperative, because it is tied to the well-being and life of your client, or patient. Thus, the objective of this work is to carry out an exploratory bibliometric research on publications made on the quality tools used in the hospital environment, from 2002 to 2019. In order to fulfill the objective of this work, a survey of articles available in two large databases - Scopus and Web of Science - was carried out using key words from the theme: "Quality tools & Health", then applied filters to determine characteristics to respect of these works. As results, a survey of the quality tools used in the hospital environment was obtained, as well as some characteristics aimed at counting publications of the works over the years.

Keywords— Bibliometric Analysis, Health, Quality Tools.

I. INTRODUCTION

The development of 21st century medicine is directly linked to the need to improve the quality of resource management processes, so patient safety and improved quality of health process management are linked to each other (ABUELSOUND, 2018).

For Abuelsound (2018), the main objective of quality improvement is to initiate incremental changes and measure the consequences of these changes over time, given that the changes made in the health area occur in conjunction with the health environment, society and, sometimes, some interconnected offices.

Such improvements in quality can therefore improve, on a large scale, different health settings (ABUELSOUND, 2018). However, health management is a complicated process in and of itself, since it involves interdependent steps, each with greater potential for failure than the other; failure that can result in harmful or even deadly outcomes for patients (Hughes, 2008).

Griffith et al. (2006) pointed out that 75% of 2500 public hospitals in their research did not have a significant improvement in nine performance indicators: (i) risk-adjusted mortality, (ii) risk-adjusted complication rate, (iii) patient safety index, (iv) length of stay adjusted for severity, (v) adjusted premium expense, (vi) change in the assisted community, (vii) profitability, (viii) cash

adjustment for debt and (ix) tangible assets by adjusted release.

In addition, Schoenbaum, Audet and Davis (2003) pointed out that the costs of health care and declining quality in hospitals are a growing problem in the United States, requiring urgent attention.

Thus, it is necessary to create mechanisms that integrate the best practices of quality management with the reality seen in hospitals today. In the literature it is possible to find quality tools that have great impact from the point of view of improvement in management, besides being easily applied, if taken into account by the hospital environment. However, the gap between current management in organizations, manufacturing or services, and academic literature is striking.

Therefore, one must create ways of integrating these two environments, promoting both sides. One form of integration is to make the literatures already proposed and established in the academy more tangible from the market point of view, using bibliometric studies. These studies can greatly facilitate not only the understanding of tools and concepts, but also the process of obtaining information.

Thus, the general objective of this work is to conduct an exploratory bibliometric research on publications made on quality tools used in the hospital environment, from 2002 to 2019.

It is hoped, at first, to survey the existing works that used quality tools in the Web of Science (WoS) and Scopus databases, highlighting details such as year of publication, journal and countries where they occurred and then analyzes oriented to the tools that were used in the applied works.

1.1 Theoretical Reference

The present theoretical framework was divided into two pillars: First, there is a discussion on quality management, focusing mainly on the characterization of the quality tools and at which levels they unfold, and then a survey of the current health situation and hospital settings.

1.1.1 Quality Management

According to Slack, Johnston and Chambers (1997), any process or operation inserted in a production or service can be improved, since the perfect one is unrealistic in practice, therefore a new state must be sought, obtaining a new standard every day that passes (MÉSQUITA; ALLIPRANDINI, 2003).

In view of the fact that today there is a high dynamism, encompassing several environments, such as markets, customers, techniques and methodologies, besides the constant changes, it is necessary to create a culture of constant improvement in the manufacturing and service environments (MESQUITA; ALLIPRANDINI, 2003). To that end, Juran (1990) points out that most quality improvement projects are obtained by the succinct adjustment of the process, rather than a drastic change, thus making the quality tools a valid contract to deal with problems in the process.

1.1.2 Quality tools

In order to improve the control of the industrial quality of the 60s, Kaoru Ishikawa organized the tools, so that he realized their possible use in procedures that involved quality control, aiming to detect problems and point the solution to them (CORREA; CORREA, 2008).

Such tools are, and should be understood as the name itself, that is, tools, so it is known that they are helpful in solving problems and do not solve them by themselves, and however much their use seems simple, the great challenge is to identify the appropriate tool for each situation and apply it correctly (CORREA; CORREA, 2008).

Therefore, quality tools are considered techniques used to define, measure, analyze and propose solutions to the various problems that interfere with the good performance of organizational activities (CORREA; CORREA, 2008) and are divided into (i) basic tools of quality, (ii) new quality tools or quality management tools, and (iii) advanced quality tools.

There are 7 basic quality tools, which are described as follows:

1. Stratification: Divide a given group of data into subgroups according to the determined factors, known as stratification factors. The causes that act in productive processes create variations, therefore one can divide performance indicators, for example, allowing to observe if the variations are concentrated in a certain subgroup (WERKEMA, 2006);

2. Verification Sheet: Consists of a means of assisting, organizing and standardizing collections and records, for later analysis, so that it is optimized (WERKEMA, 2006);

3. Pareto Chart: This is a bar chart, where its bars are ordered from the highest to the lowest and thus a curve is drawn showing the percentage of each bar accumulated (WERKEMA, 2006) ;

4. Cause and Effect Diagram: It is used to show a relationship between a process result (effect) and process factors that, for some technical reason, may affect the result under consideration (WERKEMA, 2006);

5. Histogram: It is a bar graph in which its horizontal axis, divided into small intervals, presents the values assumed by a variable of interest, demonstrating the frequency of this variable for that interval (WERKEMA, 2006);

6. Dispersion Diagram: It is a graph that presents the type of relationship existing between two variables, through which one can identify the existence of correlations, tendencies, among other relations (WERKEMA, 2006);

7. Control Charts: Since processes can suffer variations in quality, control charts (or charts) serve to monitor this variability as well as to evaluate process stability (WERKEMA, 2006).

The Quality Management Tools, in turn, aim to provide managers and administrators with tools that enable the mapping of quality problems and the planning of efforts to design action plans. These tools were developed to address problems not solved by the Basic Quality Tools (CORREA; CORREA, 2008), and are presented below:

1. Affinity Diagram: Gathers a large amount of data of different natures and organizes them into groups, based on the natural / intrinsic relationship (Affinity) between each item, defining groups of items (CÉSAR, 2013);

2. Relationship Diagram: It takes an idea, a problem or a point considered central and, from it, constructs a map of logical relations of cause and effect between the variables described by the map (CÉSAR, 2013);

3. Tree Diagram: It shows in detail the wide range of paths and tasks that need to be covered in order to achieve

the main objective and each related sub-objective (CÉSAR, 2013);

4. Matrix Diagram: It is often used to organize large amounts of data, identifying and evaluating the relationships between them (CÉSAR, 2013);

5. Prioritization Diagram: Represents a tool of quantitative nature employed in those situations where there is a need to select, among several alternatives, those that can potentially contribute the most to the solution of the problem (CÉSAR, 2013);

6. Decisional Process Diagram: It is a tool that looks for probable events and contingencies that can occur in the implementation of a plan of action or a project. It aims to identify alternative measures / paths in response to problems that may arise during the implementation and / or implementation of a plan or project (CÉSAR, 2013);

7. Arrow Diagram: It is used to plan the most appropriate distribution of activities over time in order to carry out any complex activity / task and their respective developments (CÉSAR, 2013).

According to Gomes, Cisneiros and Vasconcelos (2017) there are several advanced quality tools, among which the following stand out:

1. Brainstorming: It is based on the meeting of multidisciplinary members seeking to find possible causes of a certain event or solutions for various types of problems, in general, members of the top management;

2. Benchmarking: It is a process of performance comparison. Both can occur from one company to another, as well as from one area of the company to another area. Normally, it is sought to measure how much its performance is inferior and which practices can be copied in search of improvement;

3. QFD: This is a method used in the product development process whose main purpose is to transform the product requirements defined by the market into product characteristics;

4. FMEA: It is a method of analysis of both products and processes in activities or in design, aiming to identify failure modes and determine their impact on the system;

5. Matrix GUT: It is a tool to aid in the prioritization of problem solving. It seeks to classify each problem by relating it to its gravity, urgency and tendency;

6. Kaizen: Refers to a practice of continuous improvement that originated in the Japanese quality model based on some principles. One of its main features is the fact that a great improvement is the result of several small improvements accumulated over time;

7. 5W1H: Refers to an action plan that allows you to consider the tasks that need to be performed objectively and ensuring their implementation in an organized

manner. The nomenclature comes from the English words "What", "When", "Where", "Why", "Who", "How", describing respectively what will be done, when will be done, where will be done, who will do it and how it will do it.

1.1.3 Current health picture

The panorama of Brazilian health institutions is not the most positive, according to a survey made, about 829 Brazilians die daily in public and private hospitals due to failures that, for the most part, could have been avoided. Thus, three Brazilians die every five minutes (INSTITUTO DE ESTUDOS DE SAÚDE SUPLEMENTAR, 2017).

The failures occupy second place in the ranking of deaths most common in Brazil, losing only to cardiovascular diseases, responsible for the death of approximately 950 Brazilians per day. Even so, hospital failures are still far from other common causes of death, such as cancer (from 480 to 520 deaths / day), violence (164 deaths / day) and traffic accidents (129 deaths / day) (ASSOCIAÇÃO BRASILEIRA DE CARDIOLOGIA, 2017).

In addition, Brazilian hospitals have a problem of size, suffering, therefore, with a shortage of beds. Of the 6,774 hospitals in the country, 88% contain less than 150 beds (ASSOCIAÇÃO BRASILEIRA DE HOSPITAIS PRIVADOS, 2013). For Pedroso (2013), a hospital is operationally infeasible when it presents less than this amount.

Thus, asset management in health environments can contribute, among other aspects, to a better managerial performance, is it in equipment, people or capital, as well as greater precision to detect failures in operations (HEALTHCARE MANAGEMENT, 2019).

So, any assistance from the academic point of view is welcome in this scope, since the hospital panorama is worrisome and there is no expectation of imminent improvement for the next years.

II. MATERIALS AND METHODS

This research, according to Turrioni and Mello (2012), can be classified as applied in its nature, containing an exploratory bias and a qualitative approach, by using number of articles and analysis of terms present in the works.

The methodology of the present work was divided into two stages: (i) selection and (ii) analysis. In the selection part, the following steps were followed:

- Search for the term "Quality tools & Health" in the Web of Science (WoS) and Scopus databases with the time interval filter from 2002 to 2019;

- 36 papers were found in WoS and 134 papers in Scopus;

- After a brief reading of the summary of each paper, it was possible to see that not all articles found fit the theme, obtaining 33 articles in WoS and 110 articles in Scopus;

- Once obtained, a comparison was made to see if there were no repetitions between the bases. Thus, there were 26 equal articles, totaling 117 papers on the subject.

After this first step, the second step consisted of a deeper analysis of these articles in two parts:

1. After surveying the total number of articles, comparisons were made on: (i) years of publication, (ii) countries of origin, (iii) higher education institutions involved, (iv) published journals, and (v) most cited publications in the given time interval;

2. Finally, an individual analysis of all articles was made, in order to determine the main applications and, thus, survey the quality tools used in each of them.

III. RESULTS AND DISCUSSION

3.1 Selection

As explained in the methodology, a priori a search was performed with the term “Quality Tools & Health” in the chosen databases. After applying the filters and obtaining the 117 articles, it was necessary to read the full content of each one to know if they were within the theme.

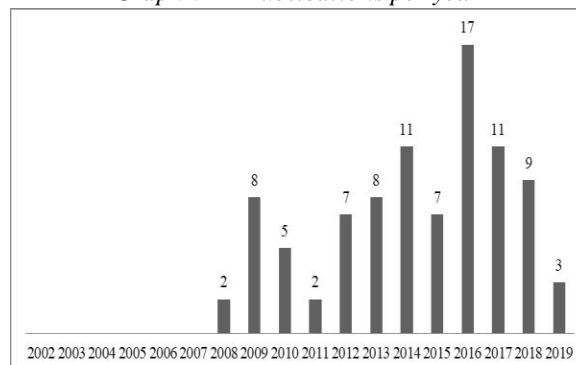
After this reading filter, 27 articles were still not in conformity with the theme and were discarded, obtaining a definitive total of 90 papers. It is noteworthy that articles that addressed the theme, ie, did not necessarily talk about the application of tools, but made mention of them in the health environment were kept, because they are aligned with the objective, even indirectly. After this initial survey, it was possible to continue the work by classifying the articles found.

3.2 Articles Analysis

3.2.1 Publications per year

A priori, the works were distributed over the years of publication, between 2002 and 2019. Graph 01 shows their occurrence, according to the number of publications expressed in that year.

Graph 01 – Publications per year



Source: Authors.

It is noted that it is possible to distinguish these publications in three stages every six years, which are: (i) from 2002 to 2007; (ii) from 2008 to 2013 and, finally, (iii) from 2014 to 2019. Regarding the first block, there was no return of research results for the search in the indicated bases for quality tools in the health field.

This is because the issue of quality in the health environment was not widespread in the early 2000s and, as an aggravation, was not seen as a priority in the health system. Thus, it became difficult for any operational tactic to manifest itself in a hospital setting, and did not generate relevant publications, that is, according to Graph 01.

The second period, covering 2008 to 2013, is where we see this paradigm change, as we have the first publications in 2008. Even if not expressive, being only two throughout the year - representing 2.22% of all works found, already was enough to begin the process of integrating this service area with quality tools, culminating at the end of the year with eight articles in 2013, representing 8.88% of publications, closing this period with 35.55% of articles.

Finally, between 2014 and 2019 we have a greater appearance of works involving quality tools in health, culminating in 2016, which presented 17 papers, or 18.88% of the articles found. It is noteworthy that 2019 has a low count due to the date the survey was conducted, even before closing this year. This third block represents 64.45% of the articles found and shows a maintenance and possibility that the quality tools generate in this area, since most were above the average of 7.5 articles per year; however there was no detection of growth trends in this most recent period, so that it expresses a consolidation of the idea of quality tools in health.

3.2.2 Publications by country

After the annual analysis, it was possible to build the analysis by countries that make publications related to this theme. Table 01 shows the ranking of the five countries with the most publications.

Table 01 - Number of Publications by Country

Region	Publications	Percentage
USA	39	43.33%
UK	12	13.33%
Australia	11	12.22%
Canada	10	11.11%
Brazil	8	8.89%

Source: Authors.

As we can see, the United States leads this ranking with 39 of the 90 publications found on quality health tools, while the United Kingdom, Australia and Canada follow the ranking, respectively, with a percentage between 13.33% and 11.11% of the articles. And finally, we have Brazil, which has surpassed the other countries and is ranked fifth in the ranking with 8 out of 90 papers found, showing that the importance of quality in various environments is already present in the country, even if with less intensity than the others presented.

3.2.3 Publications by institution

Following, it was also possible to classify the five higher education institutions that are linked to the most number of publications in quality tools on health, shown in Table 02.

Table 02 - Higher education institutions with most publications

Institution	Country	Publications	Percentage
McMaster University	Canada	6	6.67%
Johns Hopkins University	USA	5	5.56%
University of Michigan	USA	5	5.56%
Brown University	USA	5	5.56%
School of Hygiene and Tropical Medicine	Portugal	4	4.44%

Source: Authors.

It can be seen that the institutions are directly linked to the countries in the ranking presented in the previous subsection, since Johns Hopkins University, Michigan and Brown are all American universities, totaling 15 publications, but do not align with the

order of countries, since McMaster University, with 6 publications, belongs to Canada, totaling 21 North American publications.

Fifth, the School of Hygiene and Tropical Medicine, which contains 4 publications, is located in Portugal, more specifically in Lisbon. Finally, it is observed that countries with Australia - third in the ranking - and Brazil - fifth in the ranking - did not have representative universities, which may indicate a scattering of publications in several institutions, not being sufficient to remain among the five universities.

3.2.4 Publications by journal

The publications by journal, in turn, were also collected according to the number obtained and exposed in Table 03.

Table 03 - Journals with the most publications

Journal	Publications	Percentage
Public Environmental occupational health	7	7.78%
Healthcare sciences services	6	6.67%
Health Police Services	5	5.56%
General Internal Medicine	4	4.44%
Medical Informatics	3	3.33%

Source: Authors.

Just like the institutions, there is also a process of dispersing articles in journals, since there are many that deal with often similar subjects, as well as the journal with the largest number of publications - Public Environmental Occupational Health - which had 7 out of 90 papers. There are only 4 articles from the fifth place that is Medical Informatics and their percentages, therefore, very little from one to the other.

However, an interesting analysis to be made is that of the theme of the journals, since all of them are focused on the health area. On the one hand, this is obvious, since the researched quality tools are interactive in hospital environments in these articles; however, among the five with the most publications, there were none focused on management or quality per se, which shows an adherence or greater need for health by tools than quality by services.

3.2.5 Papers with more citations

To raise the number of citations of these 90 articles, Google Scholar was used, entering each of them in the search and recording the number of citations of each. Following the pattern presented so far, the articles with the five highest numbers of citations are shown in Table 04.

Table 04 – Most cited papers

N	Paper	Journal	Year	Citations
1	Diet quality – what is it and does it matter?	Health Nutrition	2009	295
2	Routine outcome monitoring and feedback on physical or mental health status: evidence and theory	Evaluation in Clinical Practice	2010	205
3	Toward an Evidence-Based System for Innovation Support for Implementing Innovations with Quality: Tools, Training, Technical Assistance, and Quality Assurance/Quality Improvement	Community Psychology	2012	178
4	The role of quality tools in assessing reliability of the Internet for health information	Informatics for Health & Social Care	2009	86
5	Quality Indicators for the Prevention of Type 2 Diabetes in Europe – IMAGE	hormone and metabolic research	2010	65

Source: Authors.

As you might expect, all articles are part of the second block, because they are older, but the 2008 articles are not in this ranking, probably because they are more introductory and still do not have as good a development base as the papers they have succeeded.

3.2.6 Survey of the quality tools

Regarding the tools used, it was necessary to make a last filter to determine the works that demonstrated applications in the health areas with them, since, as said before, some articles addressed the theme, and were not exactly the applications and benefits that such tools brought.

Thus, with the 90 papers found, a selection was made to distinguish the applications from the other article formats. This division is illustrated in Fig. 01.

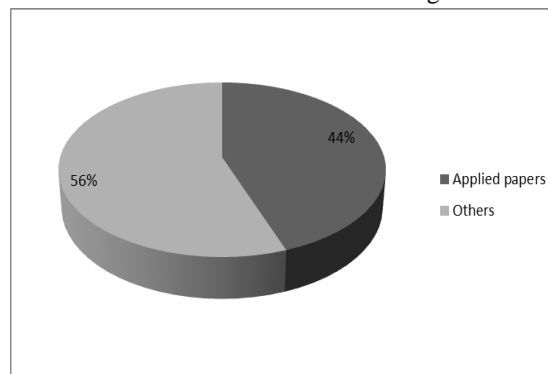


Fig. 1: Division between paper types

Source: Authors.

Thus, we can observe that 44% of the articles found are of applications of quality tools in health, which corresponds to 40 of the 90 articles, while the remaining 50 were in the other category. This category, in turn, encompassed the other types of studies, including systematic reviews, workshop summaries, surveys, and feasibility analysis.

Thus, the 40 articles were cataloged and their most important features were raised. Table 05 shows these papers, divided between authors and a brief explanation of each, explaining where the quality tools were used in the application.

Table 05 – Quality tools in health

Authors	Explanation
Khorfan (2008)	Implemented a daily checklist in the ICU of a hospital and obtained time reduction certain medical aspects.
Barnes <i>et al.</i> (2009)	It used checklists to improve the quality of information about bipolarity on the Internet, through a selection on various websites on the subject.
Aranha <i>et al.</i> (2009)	They identified a tool to better express a patient's length of stay in the operating room by applying a relationship matrix.
Tezak <i>et al.</i> (2009)	Used a prospective analysis to understand and improve the systematic errors of a hospital.
Nogueira Franco <i>et</i>	It used quality indicators in

<i>al.</i> (2010)	various areas of a hospital, from the perspective of nurses.
Kaufman <i>et al.</i> (2010)	Achieved quality control in the breast cancer segment by defining quality, suggesting methods for accurately assessing and measuring quality, and ultimately developing tools to improve breast care.
Kanashiro-Cussiol <i>et al.</i> (2010)	It used financial performance indicators to improve a laboratory clinic and, consequently, increase the quality of the number of tests produced.
Pajunen <i>et al.</i> (2010)	It used quality indicators to develop different strategies, such as risk prevention and screening in a hospital.
Quispe <i>et al.</i> (2011)	Developed a questionnaire to improve quality and customer satisfaction in a pharmacy.
Hilts <i>et al.</i> (2012)	It used best practices and quality tools, especially indicators, to improve first care in hospitals and, consequently, the other processes.
O'Reilly e Mccann (2012)	Desenvolveu uma ferramenta para auxiliar na qualidade da triagem dietética para uso em um ambiente de prevenção de doenças cardiovasculares.
Wandersman, Chien e Katz (2012)	Built a tool to improve research and practice in a health care environment.
Manylich <i>et al.</i> (2013)	It established the use of quality indicators to evaluate three types of organ donations: after brain death, after cardiac death and still alive donation.
Bruno e Nagy (2014)	He proposed a quality-oriented "toolkit" that encouraged organizational culture, teamwork, and appropriate choice of

	metrics and goals within a hospital.
Burrows <i>et al.</i> (2014)	Proposed tools to evaluate and improve the quality of pediatric diets recommended by nutritionists.
Levitt <i>et al.</i> (2014)	Validated indicators and established a framework created for a hospital in Canada.
Kim <i>et al.</i> (2014)	Evaluated the effectiveness of a smartphone-based health app for glucose control and patient satisfaction in a hospital.
Nielsen, Peschel e Burgess (2014)	It used real-time documentation feedback to improve compliance with practical improvement standards in an emergency department.
Armijo-Olivo <i>et al.</i> (2014)	Determined relevant items to assess quality and risk through qualitative tools in physical therapy.
Vijay (2014)	It used 6Sigma and DMAIC to reduce patient discharge time.
Bouras (2015)	Proposed tools to measure the quality and effectiveness of communication between surgeons and physiotherapists.
Marcelli <i>et al.</i> (2015)	Used checklists to improve quality in hemodialysis sessions.
Cathy Coleman (2015)	Used quality tools to improve hospital culture, as well as stimulate employees.
Arkaravichien, Wongpratate e Lertsinudom (2016)	Developed a quality tool able to assist accessibility and quality improvement in pharmacies in Thailand.
Armstrong <i>et al.</i> (2016)	Created a framework for establishing quality metrics through patient voice.
Kuwaiti e Subbarayalu (2016)	It used 6Sigma and DMAIC to reduce patient fall rates in an academic hospital center.
Kantelhardt, Giese e Kantelhardt (2016)	Created checklists with follow-up measures, such as

	standards accessible online, as well as training of hospital staff on these updated metrics.
Killaspy <i>et al.</i> (2016)	Created a quality tool to evaluate mental health facilities that provide long-term care.
Crawshaw <i>et al.</i> (2017)	Created a quality tool to validate and measure the quality of a hospital's surgical activities.
Silva <i>et al.</i> (2017)	Used a checklist in eye surgeries to identify their compliance.
Maronna, Souza e Montes (2017)	It used quality indicators in the diagnosis of people with tuberculosis at the National Reference Laboratory.
Abujudeh <i>et al.</i> (2017)	Introduced basic concepts about quality tools in radiology of a hospital.
Diedhiou <i>et al.</i> (2017)	Implemented a safety checklist to improve surgical quality at a hospital in Senegal.
Chwang <i>et al.</i> (2017)	Used quality tools to reduce functional risk in hospital workflow.
Wimmer <i>et al.</i> (2018)	Evaluated responses to a health questionnaire for quality improvement through medical treatment tools.
Kasap (2018)	It used 6Sigma, FMEA, QFD, among other tools to improve public health awareness about diabetes in young people.
Abuelsoud (2018)	Developed a quality project for the child care service in hospital, focused on medicines.
Bortolini, Maucieri e Borin (2018)	Stipulates parameters for building a water quality assessment tool.
Ganz <i>et al.</i> (2018)	It outlined an approach to selecting high quality quality tools for use by veterans in healthcare administration online.

Houston <i>et al.</i> (2018)	Gathered information on current data quality and clinical testing tools and procedures to develop monitoring procedures.
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Source: Authors.

IV. CONCLUSION

The article built a bibliometrics that consisted in raising the quality tools used in health environments, from 2002 to 2019, using the bases of Scopus and Web Of Science, thus achieving its objective.

Also, it was possible to expose some years in which there was no research related to the theme, specifically from 2002 to 2007, showing how this importance is relatively new, given that the first article is dated ten years ago. In addition, it was possible to expose other aspects, such as countries, journals and institutions that prioritize these tools in the health field.

Regarding the tools themselves, they have maintained a constant over the years, considering the 40 final articles exposed, noting that, even with this large amount of work, the tools practically fall into two groups that are the basic and the proposals as new in each situation, showing the immaturity of this issue in the health environment.

Thus, as future works, we recommend more works applied in the area, as well as a bibliographic research to explore improving these nuances and the evolution of tools over the years.

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