Quality tools on service companies: a systematic literature review

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Abstract

A Systematic Literature Review (SLR) was conducted in order to study Quality Tools and Techniques applied in the management of Service Companies. It was possible to determined which ones are the most common in each subsector and if they really bring benefits to the company.

Keywords: Quality Tools, Service Quality, Service Companies

INTRODUCTION

During the past years, the service sector has been showing an increasing importance in the global economy and has been expanding at a faster rate than the manufacturing and the agricultural sector (Wirtz et al. 2015). According to *The World Bank (2015),* the service sector accounted for half of world GDP (Gross Domestic Product) in the 1980s, growing up to two-thirds by the mid-1990s and reaching 70.5% in 2013. Besides, the majority of high-income countries are post industrializing, relying more on services than on industry activities.

As proposed by Alter (2008), "services are acts performed for someone else, including the provision of resources that someone else will use". Differing from goods, services are characterized by three unique features: heterogeneity, intangibility and inseparability (Parasuraman et al. 1985). The heterogeneity refers to the fact that performance varies from producer to producer, due to the high labor content. Because a service cannot be inventoried, measured and tested before consumption, it's said to be intangible. Lastly, it's not possible to separate production and consumption of a service, characterizing its inseparability (Parasuraman et al. 1985).

In the absence of tangible evidences consumers depend on other cues to evaluate service quality. Some authors suggest, for example, the price as pivotal indicator (Parasuraman et al. 1985). For Davis and Heineke (1998), customer waiting time for service typically represents the first direct interaction between customers and most service delivery processes. Meeting customer requirements is essential to keep a competitive position in the market and, while helping on this

need, Quality Management became a really important issue for businesses (Carpinetti 2010). Lehtinen (1983 apud Berry et al. 1985) divided service quality into two components: "process quality" and "output quality". The former is related to the judgment made by the customer during the service, while the latter is the critical judgement made after the service is concluded. Davis and Heineke (1998) defined satisfaction in their research in terms of disconfirmation. According to the authors, customer satisfaction is the difference between perception and expectation.

A great amount of quality management techniques have been developed during the past years, mainly in the United States and Japan. In Quality and Operations Management, according to Carpinetti (2010), the most important techniques are the following: Quality Function Deployment (QFD), Failure Mode and Effect Analysis (FMEA), Six Sigma, 5S, Design of Experiments (DoE) and Statistical Process Control (SPC). In order to implement these techniques, some tools have been developed. They are divided into the categories of quantitative and not quantitative. The basic quantitative ones are statistical process control (SPC) tools and are often called "The Magnificent Seven", Pareto Chart, Histogram, Process Flow Diagram, Control Charts, Scatter Diagram, Check Sheets and Cause and Effect Diagram (Fouad and Mukattash, 2010). They are also known as the Seven Basic QC (Quality Control) tools, which were put together by Dr. Kaoru Ishikawa (Carpinetti 2010).

Most tools and techniques have been developed in order to reduce failures in manufacturing and translate customer requirements into technical specifications (Carpinetti 2010). They support the process improvement in organization; by helping employees to use their knowledge effectively (Gambi et al. 2015; He et al. 1996). The application or adaptation of concepts already proven in manufacturing is quite common in Service Operations Management (Heineke and Davis, 2007).

Considering the importance and growth of the service industry, this paper aims to provide a view of the best evidences available in the literature on how quality tools have been applied in the service industry, the benefits they brought and the frequency that they have been used by service companies from different sectors. Therefore, the specific question for this paper is: *What are the most used quality tools/techniques by service companies and how they relate to different service sectors?*

Over the past 30 years, mostly due to new journals being launched yearly and thousands of research papers being published, the amount of information made available for researchers have increased dramatically (Petticrew and Roberts, 2006). Following this information explosion, it became even more difficult to find relevant and reliable information. Grounded on this need of identifying, appraising and synthesizing relevant studies in order to answer a specific question, through methods that limit systematic error, emerged the idea of Systematic Literature Reviews (SLR), often called as systematic review (Petticrew and Roberts, 2006). A systematic review can be used when an overall picture of the evidence in a topic area is desired, providing clues that a phenomenon is robust and transferable (Kitchenham and Charters, 2007; Petticrew and Roberts, 2006).

Aiming to answer the specific question proposed above through a systematic review process, a method adapted from Tranfield et al. (2003) and Kitchenham and Charters (2007) was applied to come up with key scientific contributions on the application of quality tools to the service industry. According to these authors one of the contributions of SLR can be the assessment of the frequency or rate of adoption of a technology.

In the next section, the methodology applied to conduct the Systematic Literature Review is explained. Thereafter, the results are presented and a discussion is conducted. Finally, the paper presents some conclusions and areas of future research.

METHODOLOGY

The use of systematic reviews for conducting evidence-based research needs to be done through a scientific and transparent manner, allowing its replicability (Tranfield et al. 2003). Even though the primary usage of systematic reviews occurred in medical sciences, the idea of finding the best available evidence to answer a specific question has migrated to other areas during the past years (Tranfield et al. 2003). So, the methodology proposed in this paper aims to bring up, through Systematic Literature Review, the best evidences available on the usage of quality tools by service companies. The stages used to conduct the Systematic Literature Review in this paper are divided in three phases and summarized in Figure 1.
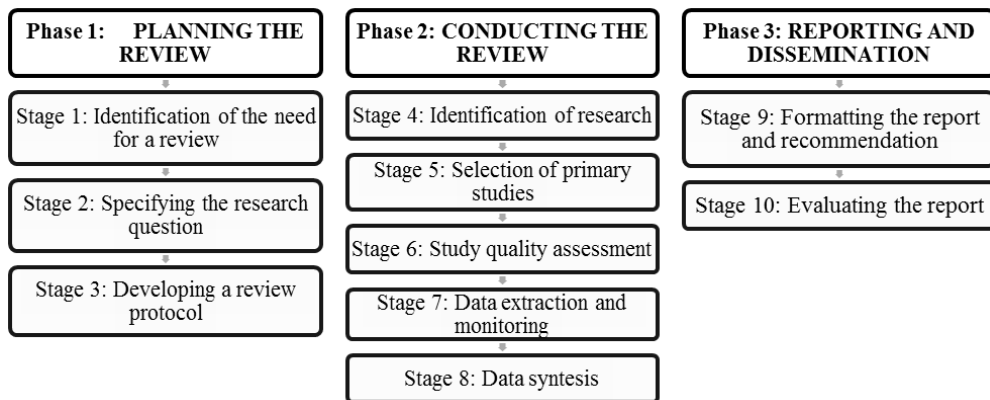

Figure 1: Stages of the Systematic Literature Review (Adapted from (Kitchenham and Charters 2007; Tranfield et al. 2003)

According to Jemmasi et al. (1994), quality issues started to become a critical aspect for the strategic planning of service companies, although little research had been done on that time toward the issue of service quality assessment. Thus, considering the recentness and relevance of the topic, the overall picture that can be constructed about the tools that have been used so far on service quality justifies the need for the systematic review provided in this paper. In addition, as stated in the previous section, the specific question is the following: *What are the most used quality tools by service companies and how they relate to different service sectors?*

As stated in Figure 1, the construction of a review protocol is required after the specification of the research question. The protocol summarizes the search strategy proposed for the systematic review for identification, selection and exclusion of relevant studies, together with other relevant information necessary to address the research question (Crombie and Davies, 1998 apud Tranfield et al., 2003). Figure 2 presents the protocol proposed for this paper.

Petticrew and Roberts (2006) proposed a helpful model to approach the research question, which consists of four viewpoints and is called PICO (population, intervention, comparison and outcomes). The *comparison* part of the model is related to what the intervention is being compared to. Since the main objective of this research is to identify the most used quality tools in each service segment, the *comparison* part has been taken away, resulting at three viewpoints

which, as stated by Kitchenham and Charters (2007), are those recommended for Medical systematic reviews. *Population* is related to application area, industry group, etc. *Intervention* relates to a methodology or tool that applies to a specific issue. *Outcomes* is related to any assessment of effectiveness Kitchenham and Charters (2007). The keywords proposed in this paper were organized based on those three viewpoints, as shown in Figure 2.
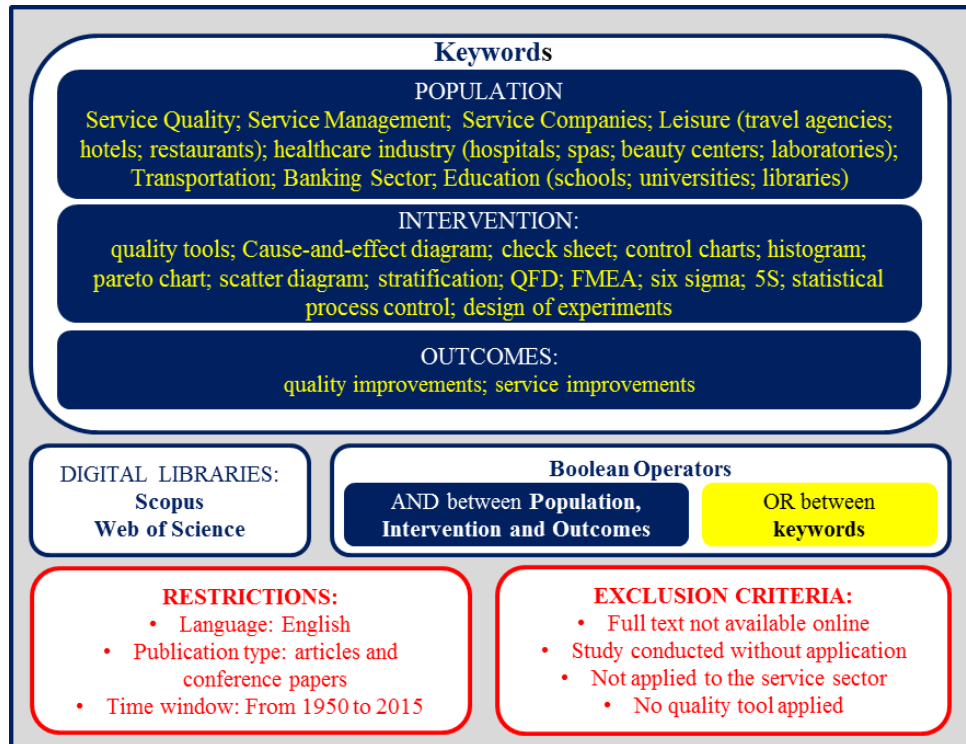

Keywords

POPULATION
Service Quality; Service Management; Service Companies; Leisure (travel agencies; hotels; restaurants); healthcare industry (hospitals; spas; beauty centers; laboratories); Transportation; Banking Sector; Education (schools; universities; libraries)

INTERVENTION:
quality tools; Cause-and-effect diagram; check sheet; control charts; histogram; pareto chart; scatter diagram; stratification; QFD; FMEA; six sigma; 5S; statistical process control; design of experiments

OUTCOMES:
quality improvements; service improvements

DIGITAL LIBRARIES:
Scopus
Web of Science

Boolean Operators
AND between **Population, Intervention and Outcomes**
OR between **keywords**

RESTRICTIONS:
• Language: English
• Publication type: articles and conference papers
• Time window: From 1950 to 2015

EXCLUSION CRITERIA:
• Full text not available online
• Study conducted without application
• Not applied to the service sector
• No quality tool applied

Figure 2: Systematic Literature Review Protocol

The following string was used for the literature search:

("service quality" OR "service management" OR "service companies" OR "travel agency" OR hotel OR restaurant OR hospital OR spa OR "beauty center" OR laboratory OR transportation OR bank OR school OR university OR library) AND ("quality tools" OR "cause-and-effect diagram" OR "fishbone diagram" OR "ishikawa diagram" OR "check sheet" OR "control charts" OR histogram OR "pareto chart" OR "scatter diagram" OR stratification OR qfd OR "quality function deployment" OR fmea OR "failure mode and effect analysis" OR "six sigma" OR "6 sigma" OR 5s OR "statistical process control" OR "design of experiments") AND ("quality improvement" OR "service improvement")

In accordance with what have been used in a systematic review on Multiple Criteria Decision Making techniques applied to service quality conducted by Mardani et al. (2015) and considering the amount of online articles available, the databases selected for this paper was *Scopus* and *Web of Science*. The string illustrated above was searched, on both databases, on Title, Abstract and Keywords. The Document Type was limited to *Articles* and *Conference Papers* and the Source Type to *Journals*. The *Time Window* was set from 1950 to 2015 to elucidate the recentness of the discussion on service quality, as stated by Jemmasi et al. (1994).

In total, 718 articles were found on the databases mentioned above during December 2015, 440 from *Scopus* and 278 from *Web of Science*. *Scopus* had one duplicate while *Web of Science*

had six. After removing those duplicates, a total of 711 articles were available. From those, 194 articles were available on both databases, resulting on a total of 517 articles to be analyzed.

After that, the exclusion criteria proposed on the protocol was applied while reading the articles' abstract. For a more precise quality assessment, articles which the quality tool application was not clearly stated in the abstract were marked for analysis among the authors and decision whether or not they should be included. This procedure resulted on a final selection of 190 primary studies that met the selection criteria proposed for this paper, which is around 37% of the total articles available to be analyzed. Figure 3 shows the distribution of both selected and total articles by publication year. As shown by Figure 3, especially after 1990, there was an increasing interest in the application of quality tools to the service sector.

The selected articles were analyzed considering the tools applied and from each service sector it belonged. As stated in the review protocol (Figure 2), the sectors proposed for this paper are the following: Leisure; Healthcare; Transportation; Banking; Education and Others. The field *Others* was built to compass cases that didn´t match with the other five sectors proposed. The next section will go through the results reached by the systematic literature review implemented in this paper.
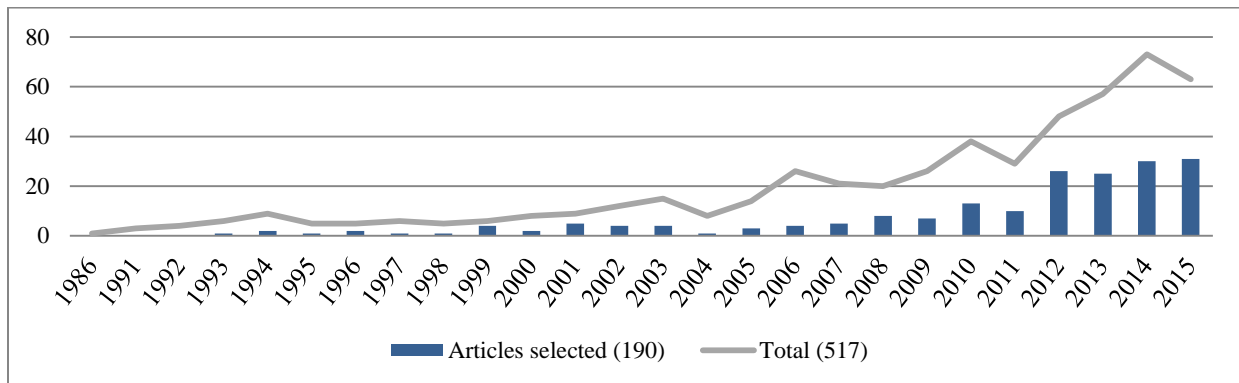

Figure 3: Distribution of Selected and Total Articles over time
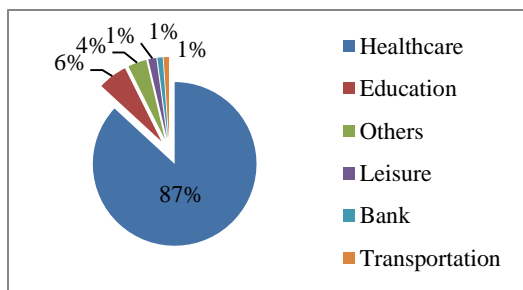
RESULTS AND DISCUSSION

Figure 4: Articles distributed by sectors

This section is intended to synthetize, analyze and discuss the data generated by the Systematic Literature Review. The successful use of quality control tools in the service sector is doubtful, although the number of institutions implementing such tools in this sector is growing (Houshmand and Lall, 1999). Thus, in addition of identifying the most commonly used quality tools by service companies, this paper aims to illustrate how they´re related to different service sectors. Figure 4 distributes the selected articles by the different sectors proposed for this paper. It can be noticed that the Healthcare sector leads the amount of articles selected.

As shown by Figure 5, through an 80/20 analysis, 81.8% of the selected articles within the Healthcare subsector dated from the time period 2008 – 2015, showing the recentness of those

types of studies in Healthcare, although the first selected article dated from 1993. Within that subsector, 90% of the applications were in Hospitals, 9% in Laboratories and two were specific cases, in Telemedicine and Therapy Service, respectively. The Education sector came after Healthcare on the application of quality tools, totaling 11 cases, 8 of those applied to Universities and 3 to Libraries. Others included cases on Cellphone Companies, E-Service, Telecommunication Companies, Republic of Korea Army, Direct Selling Company and Human Service Organization. Leisure had one application on an Amusement Park and two in Hotels. Bank and Transportation had 2 applications each, the latter consisting of an University Bus improvement and a Logistics Company's case.
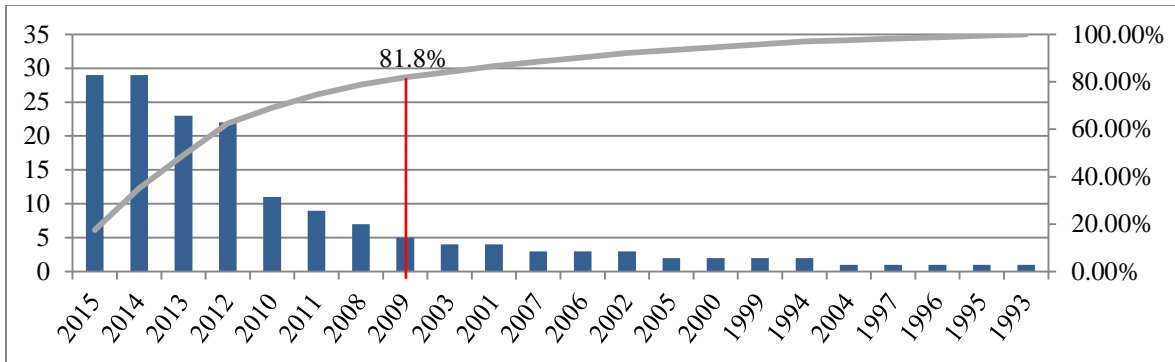

Figure 5: Articles selected within the Healthcare subsector, ordered by amount of publications

Going further on the data synthesis, the tools identified in each application were summarized in Table 1.

Table 1: Summary of the tools identified in the articles selected

Quality Tools	Bank	Education		Healthcare				Leisure		Others	Transportation		Total
		Library	University	Hospital	Laboratory	Telemedicine	Therapy Service	Amusement Park	Hotel		University Bus	Logistics	
Control Charts	1	1	3	85	7		1			1			99
Six Sigma	1	1		41	4	1			1	2			51
QFD		1	4	4				1	1	4	1	1	17
FMEA				14	2								16
Cause-and-effect diagram			1	12	2								15
Pareto Chart				12	1								13
Stratification				6									6
Histogram				3	2								5
5s				2									2
Design of Experiments				2									2
Scatter Diagram				2									2
Check Sheet				1									1

The number of tools identified exceeds the number of cases selected (190) because, for some cases, more than one tool was applied. Considering that the majority of applications found came from hospitals, this was the only subsector that had cases for all the tools proposed on this paper. Control charts and Six Sigma were the tools with the greatest number of applications, followed by a significant presence of QFD, FMEA, Cause-and-Effect Diagram and Pareto Chart. Among the Healthcare sector, Control Charts led the number of applications. As pointed by Berwick (1991), till that time, health care professionals were still relying on impression to interpret data, even though researches might have been demonstrating that the use of methods taught by Shewhart (1939) and others, such as statistical process control, could lead to a better interpretation of data and directions for future medical interventions.

Thor et al. (2007), through a Systematic Literature Review on the application of Statistical Process Control in Healthcare improvement, concluded that control charts can be really powerful to improve and understand healthcare processes. This can give clues for the Statistical Process Control tools standing out among the others in this subsector. Six Sigma also needs to be highlighted inside the Healthcare subsector, since it appeared in 27.8% of the Healthcare cases analyzed. In Healthcare, the tools that appeared the most being applied together with Six Sigma were Pareto Chart, Cause and Effect Diagram, FMEA and Control Charts.

Failure Mode and Effect Analysis revealed to be significantly applied within the Healthcare subsector. An interesting fact is that all of those applications occurred after 2009, especially in 2013 and 2014. Some of the tools that were applied the most together with FMEA were Six Sigma, Control Charts and Pareto Chart. In addition, initiatives aiming to reduce risk to patients through the use of FMEA have been being supported by the health care industry and the Joint Commission on Accreditation of Healthcare Organizations (Ookalkar et al. 2009). Thus, the use of FMEA in Healthcare has been growing in the past five years and it´s benefits as a quality improvement tool has been being supported by important organizations.

The data available in Table 1 needs to be interpreted with caution. The fact that the majority of applications appeared in the Healthcare subsector doesn't necessarily means that those tools works better or bring better results when applied to this service sector. This could be a consequence from the need of research dissemination on that field. However, since there are a lot of available evidences of successful applications of quality tools in the Healthcare sector, the adequacy of such quality improvement methodologies in the sector is no longer a mystery. Furthermore, physicians, hospital managers, researchers and others can take advantage of that information on the literature, looking for limitations, directions and success factors.
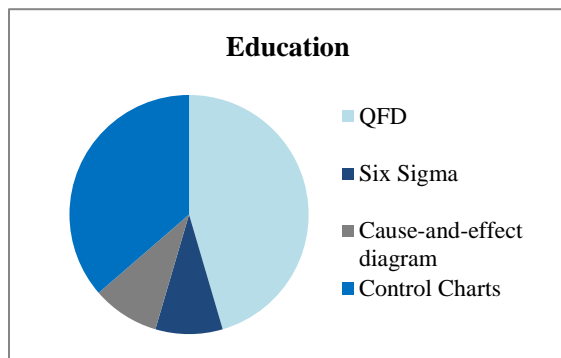

Figure 6: Quality tools and techniques applied on Education Sector

Quality Function Deployment (QFD), which appearance had been modest in the Healthcare subsector considering the huge amount of articles identified, showed relevant presence in Education, being applied in 45,5% of the articles found within that subsector, followed significantly by Control Charts, as shown in Figure 6. Among those QFD applications identified, four out of five were in Universities, demonstrating that this tool might be appropriate for improving this type of service. Moreover, as stated by Qureshi et al. (2012), QFD is a commonly used method for assessing quality

in Higher Education Institutions.

Besides, QFD appeared two times within the Leisure subsector, applied to an Amusement Park and a Hotel. Within the category designated Others, Quality Function Deployment showed again it´s importance, being applied in more than 50% of the total for that category, including applications on E-Service, Retail Service, Telecommunication and in the Republic of Korea Army. Finally, QFD was the only tool which application was found within the Transportation subsector. Despite the fact that the Bank subsector had no QFD application and the modest appearance within Healthcare, it can be said that QFD demonstrated a relevant role in the analysis conducted, being significantly applied in important service subsectors, such as Education, Leisure, Transportation and others service companies. Bharadway et al. (2010) stated the same fact, pointing out that QFD has been used in service industries such as hotels, transportation, education, hospitals and professional services.

CONCLUSION

This paper aimed to study the application of quality tools and techniques in the management of service companies at the operational level, which is where quality improvement occurs (Gerolamo et al. 2014). The utilization of quality tools and techniques in service operations has increased in recent years. The SLR showed that only 14 articles met the criteria proposed for this paper till 2000, increasing to 54 between 2000 and 2010 and, from the time period between 2010 and 2015, which is very shorter than the others, this number jumped to 122 articles. Moreover, it was possible to elucidate the recentness of the discussion on service quality, as stated by Jemmasi et al. (1994), since no articles in this subject dated before 1993 were found in SLR. The increasing use of quality tools and techniques seems to be a trend, such as their integration. Many firms integrates basic quality tools such as cause-effect diagram, histogram, Pareto, scattering diagram with more structured methods, such as FMEA and QFD, and statistical methods (Miguel and Carvalho, 2012).

The results provided in this paper will help service companies from various sectors by presenting an analysis from several case studies and applications of different techniques and tools in various service industries. Most of the articles found with the SLR were related to Healthcare subsector, justifying the more detailed analysis provided within this segment. According to Niemeijer et al. (2011), the improvement of health care occurs by improving its delivery, which are the operating routines in hospitals and for this, many tools, techniques and approaches from quality management and processes operations have been used, implying a large number of articles inserted into the databases. Although there are not a big number of publications related to the others sectors, the information provided can give clues on what have been done till now on those subsectors and also states a tendency of continuous growth.

In the majority of the cases studied, the application of quality tools clearly brought benefits to the service entity, improving their service or helping them to understand their processes, customer needs, etc. Sometimes, improvements are not explicitly shown, because some tools, such as Pareto Chart, are more focused on identifying and prioritizing causes of problems, which, indeed, is a really important step, since quality improvement, can only be achieved by solving problems (He et al. 1996).

For future replications of SLR in this subject, a new exclusion criterion in the string is recommended: the exclusion of articles about Risk Stratification, which is a method applied in medicine that separates the patients into groups categorized by risk (low, high, rising, etc.) in

order to manage populations and to create models that can assist in prioritizing clinical workflow, reducing system waste, and creating financially efficient population management (Health Catalyst 2015). The point is that most of these studies has no practical application, these are very specific theoretical models and therefore do not contribute to other sectors.

The results provided are originated from a SLR and may not be used as real statistics, considering that a great amount of application that occurs within the sectors proposed for this paper are not documented in scientific databases. Another way for conducting this kind of research would be applying a survey.

Lastly, it is important to point out that since a great amount of articles were identified and selected, it turned out to be unfeasible the construction of a summary table containing all articles selected. Although, the detailed procedure on how the SLR was conducted gives clear directions on how to find those article on the databases mentioned.

ACKNOWLEDGMENTS

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