

# MODELING THE SCALE OF SATISFACTION AND THE VIRTUAL PLATFORM APPLIED TO THE EXPERIENCE OF SPECIALISTS AND USERS OF HEALTH SERVICES<sup>1</sup>

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## ABSTRACT

The index of people who evaluate public health negatively in Brazil reaches rates of 75% to 93% of dissatisfaction between 2012 and 2018. Moita (2019c) showed that the initiatives to measure quality and satisfaction in Brazilian health are incipient and that there is no validated scale for the national health system in Brazil (SUS), but that the Gespública initiative (Brasil, 2014) created the index had many similarities to the international SERVQUAL scale. Objective: Cross-cultural adaptation of SERVQUAL scale for the development of a virtual platform to capture the experience of SUS users. Methods: The research is observational, using a mixed method of evaluation (CAAE: 54972816.9.0000.5051). The 20 validated questions, 13 sub-dimensions and six macro-dimensions of quality/satisfaction were the basis for the development of a virtual platform (*Quality Saude™*) with online application in multicenter groups of SUS users. Flows and functionalities were structured for the development of a virtual platform pilot and its extraction, transformation and loading (ETL) processes, inserted in the Data Warehouse (DW) and BI of results visualization. Results: The scale (*Quality Saude™*) was validated with 2,574 users in 74 health units in Ceará, and the application used by 1989 users of the Eusébio (Brazil) health facilities, with easy handling and quick responses (< 4 min.). Answers were analyzed using the R software, version 3.6.3. P, Project R R (Team, 2019), through PostgreSQL-R (PostgreSQL, 2018; PostgreSQL-R, 2008). Conclusion: An innovative scale for evaluating health quality was validated, which allowed the creation of an online application (*QualitySaude™*) that analyzes the user's perception in contrast to their expectations, highlighting which points demand interventions from health managers.

## KEYWORDS

Quality, Access and Evaluation of Health Care, Health Care Quality Indicators, Business Intelligence

## 1. INTRODUCTION

The New Public Management (NGP), or the New Managerialism, has required from public health managers efforts to monitor results, control and account for expenses (accountability), in addition to ensuring delivery, effectiveness and adequacy to the needs of users (Moita, 2019a).

In Brazil, nationally based opinion polls pointed out the population's dissatisfaction in public and supplementary health that ranged from 54 to 93%, and, also, that high percentages of Brazilians assess public health as bad or very bad, which increased from 61% to 75% between 2011 and 2018 (Moita et al., 2021; G. F. Moita et al., 2019).

Another highlight is the initiative within the Gespública initiative for the creation of the Standard Research and Satisfaction Instrument (IPPS). There are no IPPS continuity records. (Brasil, 2014).

However, robust literature reviews (Machado et al., 2013; Moita, 2019a; Volpato, 2014) showed that quality assessment in health is an incipient topic and that there is no validated scale for the Brazilian health system whose acronym in Portuguese is Sistema Único de Saúde - SUS) (2019c). Also, the bibliographic

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review of the online platform for the assessment of quality and satisfaction of use relevant to Brazilian health was not located.

In the absence of quality and satisfaction measurement instruments, no SUS motive for a prior work of validation of the *Quality Saude*<sup>TM</sup> scale for or SUS (Moita & Moita Júnior, 2020; G. F. Moita et al., 2019). As a complement, this work is addressed to the elaboration of a web platform for application of the *Quality Saude*<sup>TM</sup> instrument, in addition to a use case of application in field research.

Therefore, the article develops the fundamentals of a virtual pilot platform of an online application (*Quality Saude*<sup>TM</sup>) to capture the experience of SUS users, in addition to data processing and application in a multicenter exemplary case, to generate support information to decision making.

## 1.1 Quality Assessment and User Experience Satisfaction

There is no consensus in the literature on the scope and breadth of health assessment and monitoring, but many possible conceptual theoretical frameworks (Arah, Custers, et al., 2003; Arah, Klazinga, et al., 2003; Arah et al., 2006; Murray & Frenk, 2000). Arah et al.(2003) present a global comparison of the different theoretical and conceptual framework approaches of performance measurement systems in the United Kingdom (NHS), Canada, Australia, USA, from the World Health Report 2000 report (WHO, 2000), in addition to the 'Health at a Glance and OECD Health Data' publications of the Organization for Economic Co-operation and Development (OECD) (Development, 2001; Unit, 2001).

Vinagre (2008) emphasizes the complexity of measuring services due to the intangibility (absence of physical attributes) aspects of services (Oliver, 1980; Parasuraman et al., 1985, 1991b) and the fact that services are essentially processes, being affected by interactions and activities, that is, it depends on relational aspects between users and service providers (Grönroos, 1984, 1988; Grönroos, 1997; Oliver, 1989; Rust & Oliver, 1994; Westbrook, 1987; Westbrook et al., 1978).

In the evolution of these studies, psychometric scales for measuring perceived quality emerged, based on the *gap model* of satisfaction (Oliver, 1980; Oliver & Linda, 1981; Westbrook & Reilly, 1983), in which the position of the customer's perception of perceived service quality depends on the nature and extent of the discrepancy between service *expectation* and *perceived performance*.

Based on the *gap model*, the SERVQUAL scale was initially developed with 97 items, based on the 10 dimensions of quality (Parasuraman et al., 1988) which was validated in an instrument with 22 questions, in addition to redistributing the ten (10) dimensions originals for the current five (5) dimensions of the SERVQUAL scale (Babakus & Boller, 1992; Babakus & Mangold, 1992; Berry et al., 1994; Parasuraman et al., 1991a).

The initiative to create the Standard Survey and Satisfaction Instrument (IPPS) can be highlighted, with apparent similarities with the five proposed dimensions (Tangibility, Reliability, Responsiveness, Assurance and Empathy) and its 22 questions from the SERVQUAL scale (Parasuraman et al., 1991a). However, recent publications on the IPSS were not found, perhaps due to the discontinuity of the initiative.

Thus, the scales for measuring service quality and user satisfaction are consolidated in several fields and may be a field of interest in Brazil.

## 2. METHODS

The research is *observational, cross-sectional*, using a mixed evaluation method (Minayo et al., 2010). It was supported by a study of multiple cases, in a sample of informants selected for convenience, within the scope of the PhD of the University of Coimbra (CAAE: 54972816.9.0000.5051). The ethical rules of resolution no. 466/12 of the National Health Council (CNS - Brazil).

The scale had incremental validations with 195 professionals (from 10 Brazilian states) and 2,547 users from municipalities in Ceará, in which the answers were objects of descriptive analysis and of statistical significance. Twenty adapted questions, 13 sub-dimensions and six macro-dimensions of quality/satisfaction were validated (Moita, 2019a; G. F Moita et al., 2019), being the basis for the development of a virtual platform (*Quality Saude*<sup>TM</sup>) with subsequent online application with 1,589 users of health units in Eusébio (Brazil).

We have structured flows and functionalities for the development of a virtual platform pilot and its processes of extraction, transformation and loading (ETL), inserted in Data Warehouse (DW) and results visualization BI. An analysis of responses from software R, version 3.6.3. P. O Projeto R (Team, 2019) is a programming language with a focus on statistics and graphics; um project *General Public License* (GNU) which is under the license of open code and executes a wide variety of functions (Team, 2019). These research dice are structured in a relational data bank and, for this research, are established the PostgreSQL<sup>2</sup> (2018), or the PostgreSQL-R (2008).

In the field of *Design Research*, an existing artifact was studied (the perception of the management of organizations and health services, structured and in operation) and an improvement solution was proposed for the following stages: i. Define a data model that allows storing collected data in an organized manner; ii. Apply collected data extraction, transformation and loading processes; iii. Keep data in a relational database; iv. Produce solutions to visualize the collected data, presenting them in a way to accurately evidence the obtained results.

### 3. ANALYSIS AND DISCUSSION OF RESULTS

In the analysis of the results obtained, 9,063 responses to each of the items of the scale were obtained in groups of 195 experts in pilot groups with responses from 10 Brazilian states: Bahia, Ceará, Distrito Federal, Goiás, Maranhão, Mato Grosso, Pará, Piauí, Rio Grande do Norte e Rondônia, in addition to 2,547 SUS users.

The 20 validated questions, 13 sub-dimensions and six macro-dimensions of quality/satisfaction (Moita, 2019b) were the basis for the development of a virtual platform (*Quality Saude<sup>TM</sup>*) with online application in multicenter groups of SUS users.

#### 3.1 The Construction of the Virtual Platform and Application of Business Intelligence

The *Quality Saude<sup>TM</sup>* screen functionality modeling flowchart, which synthesizes the logic and diagramming of the web application, developed for user interface (Moita & Moita Júnior, 2020).

In our research, the data obtained in the first moment were not able to transmit accurate information to the interested parties, as they are often disconnected and/or inconsistent, mainly due to the lack of standardization. To avoid these inconsistencies, it was necessary to standardize the data collected so that this information could be cross-referenced, and the results obtained from the application of the scale could be outlined, which proved to be efficient because significant data and great potential for analysis were collected.

In this way, the application pilot resulted in the encapsulation of the 20 *Quality Saude<sup>TM</sup>* scale questions in a responsive virtual platform (which adapted to various equipment of different models and screens). The treatment and analysis of the collected data, proposed in our study, were used as a technological support for applying the proposed models and later systematizing the results. In this case, innovation is the use of BI tools and techniques to support the application of questions.

On the initial screen of the questionnaire application, the respondent informs his basic and sociodemographic data (figure 1).

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<sup>2</sup> O PostgreSQL is an open source project coordinated by PostgreSQL Global Development Group, with support for hybrid object-relational model and Procedural Language in several languages (PL/pgSQL, PL/Python, PL/Java, PL/Perl) for Stored Procedures.

Figure 1. The Basic Data Entry Screen

From this flowchart (Moita & Moita Júnior, 2020), figure 2 shows the example of two of the screens of the virtual platform prototype for data collection of the responses of users of health services.

Figure 2. Selection of 12 types of services and professional teams and the model of the prototype's 20 question-scenarios screens *Quality Saúde™*

Techniques for gathering requirements and computer commands were used for the processes of extraction, transformation, and loading (ETL), insertion of data in the *Data Warehouse* (DW). For the treatment of the analyzed results, two BI tools (free license versions) were used: 1. Power Designer (Sybase, 2018) supports various activities such as business process modeling, data modeling, multidimensional data modeling, which stores and controls developed models. Power Designer brings impact analysis, design-time change management, and metadata management techniques to the user. 2. O QlikView (QlikTech, 2018), it encompasses BI techniques, allows an interactive visualization of information and can be defined as a tool for decision making.

The initial analysis demonstrated the need for data abstraction, placing the Institution table as the main entity in the model, as it ends up being related to all other entities. Subsequently, the ETL - Extraction, Transformation and Load processes were applied to the data, in the R programming language, where they were kept in the PostgreSQL database. Data extraction, data transformation imported with R, and data loading imported with R were presented in previous publications (Moita et al., 2018; Moita & Moita Júnior, 2020).

In another light, the interactive dashboards created with the QlikView BI tool (*Qlickview Personal Edition* free version 12.0.2), were aligned with the features *Gartner* (2017).

Thus, the BI platform made it possible to draw comparative graphs between service units, services and evaluated teams, putting results and performance into perspectives in the 20 adapted questions, 13 sub-dimensions and the six macro-dimensions of quality and satisfaction, as a management tool on a web platform with some graphs of 483 valid responses from the 506 responding users (figure 3).

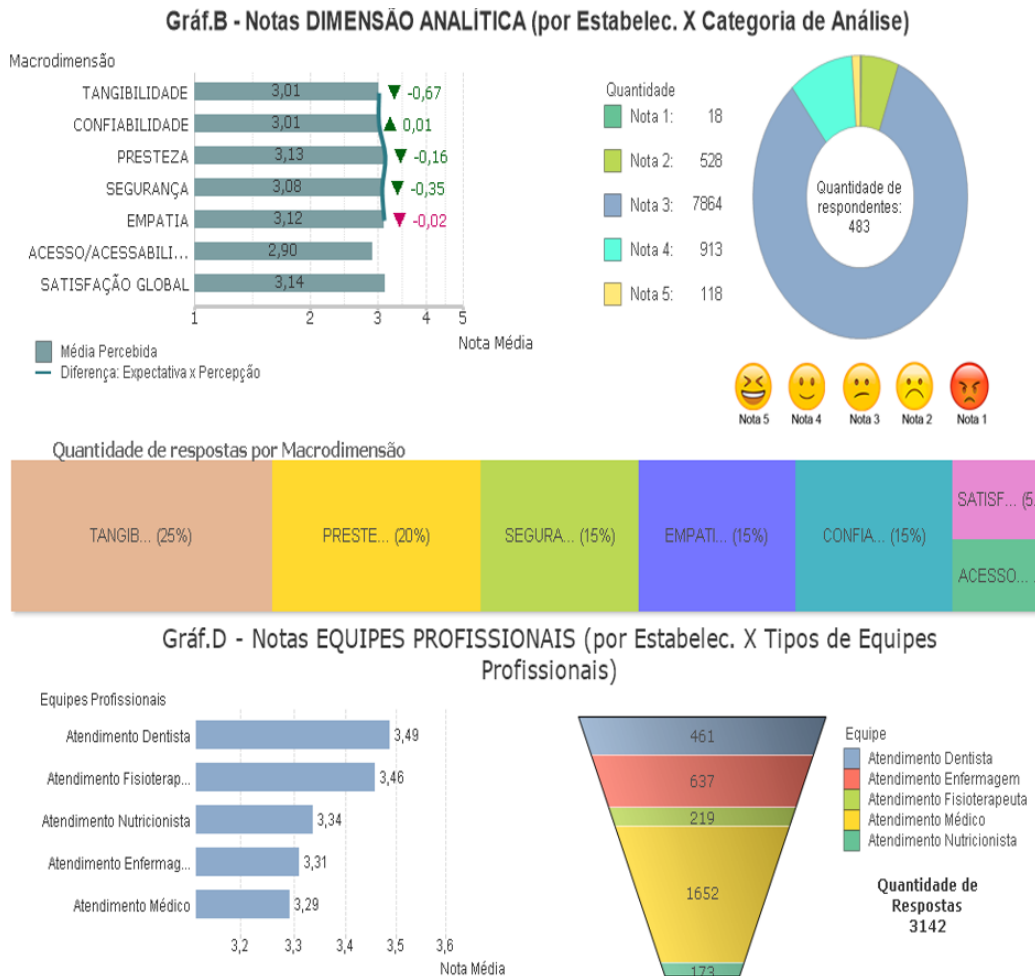


Figure 3. Comparative charts of unit results and team performance (proxy J)

In the central graph and smaller graph (figure 4), you can see the number of responses received grouped by grade, to provide a more detailed view of the data being analyzed. The home panel is the starting point for other views, functioning as an application, where the user can navigate from one screen to another using the buttons. After the initial analysis, where general data is looked at without a great deal of detail, it is possible to look at more specific data, using filters to achieve the goal. Various items can be selected in the filters, allowing the manager to view information about all institutions that interest him.



Figure 4. Dashboard 1 do QlikView – Dashboard by average obtained

Also in Figure 4, in the larger bar graph, it is possible to compare the average of grades received by institution or group of filtered institutions (overall average) in relation to the group to which it belongs, managing entity, micro-region and macro-region, grouped by macro dimensions (Tangibility, Reliability, Responsiveness, Assurance and Empathy, Access / Accessibility). The graph in the lower right corner is common to all screens as it allows you to see how many responses are being analyzed. The bar chart in the lower left corner shows the difference between grades and perceived expectations, the red line indicates this difference and represents a very important in original model of servqual (Berry & Parasuraman, 1991; Parasuraman et al., 1988, 1991a) kept in *Quality Saúde™*.

Figure 5 shows the visualization with a higher level of detail. On this screen, the averages of the grades are grouped by questions/constructions, where it is possible to see with a filter, for example, the number of grades 1 that the institution received or view without a filter.

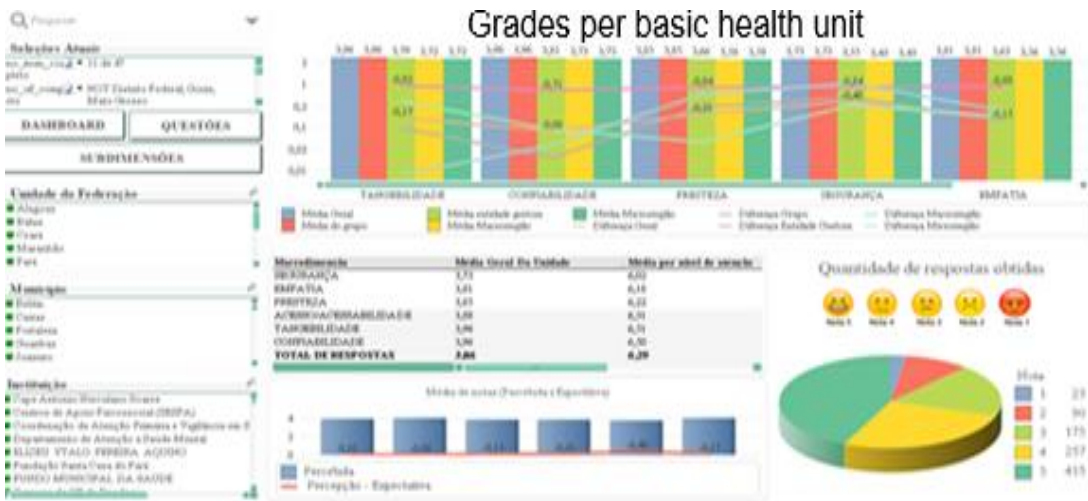


Figure 5. Dashboard 2 do QlikView - Dashboard by macro dimension

As the data refer to the number of responses for all units that belong to the stage and phase selected in the panel (figure 6), this table becomes useful when there is a greater number of responses being analyzed; in this work, with a restricted data sample, you can see a pie chart in the upper right corner, as an example.

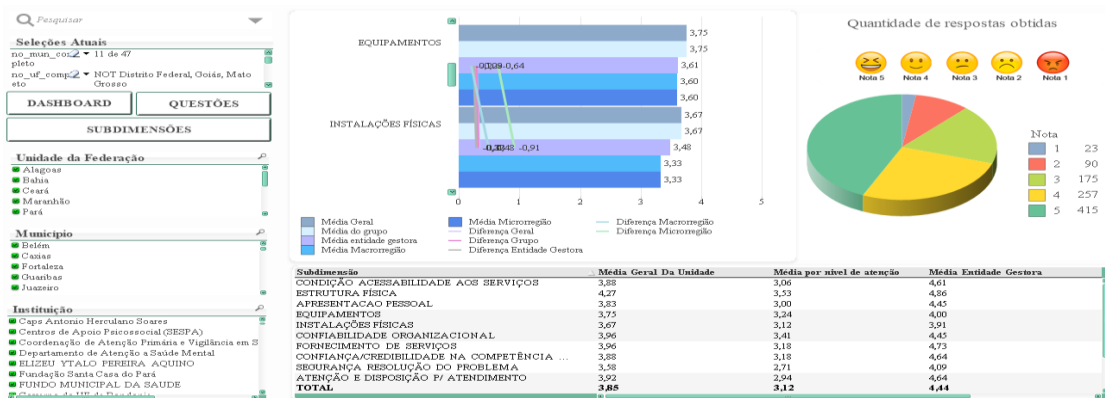


Figure 6. Dashboard 3 do QlikView - Dashboard by subdimension

In Figure 7, it is possible to observe an additional level of detail of the average grades and, in this case, the average grades obtained by one or more institutions grouped by sub-dimensions. The central graph and the table show the average of the scores in each sub-dimension, always comparing the institution with the group, managing entity, micro-region and macro-region to which the institution belongs.

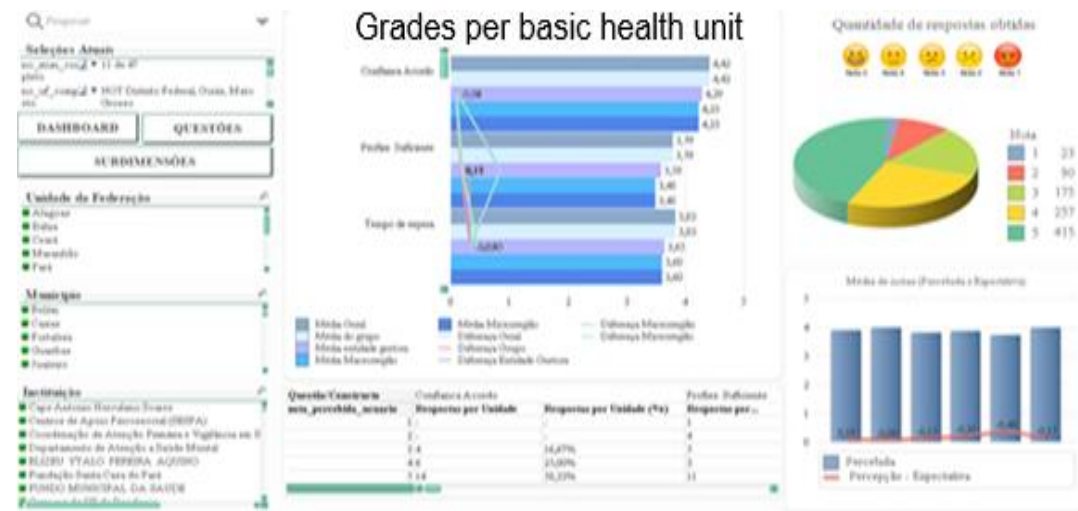


Figure 7. Dashboad 4 do QlikView - Dashboard by QualitySaude question

The artifact validated in this investigation intends to support a system of monitoring and evaluation in public health, based on results that provides crucial information about public policies or organizational performance - *results-based management* (RBM), como conceitua Morra-Imas e Rist (2009).

#### 4. CONCLUSION

Assessing the quality of services provided to the public is extremely important, but the incipience of instruments based on scientific methods makes it difficult to define strategies to improve services.

The present work developed an application on a virtual platform, in which the extraction, transformation and loading (ETL) processes were applied, which deal with the cleaning of data from various sources to be inserted in the *Data Warehouse* (DW).

The platform proved to be efficient in extracting a relational database, whose data can be consulted in an organized, fast and mainly without the unnecessary use of repeated data, bringing integrity. The application of BI on the platform enabled the visualization of data in an analytical and synthetic way, in micro, small and macro (large) data samples.

The adaptation of the Servqual scale generated an innovative scale (*QualitySaude<sup>TM</sup>*), which allows the user's perception to be seen as a counterpoint to their expectations, presenting results that really approach reality, highlighting which points require interventions by health managers (G. F Moita et al., 2019).

In this article, the foundations of a web platform were developed, in addition to the use-case application that generated a BI application on the data collected by the platform, which enabled the visualization of the data in an analytical and synthetic way, in micro, small and macro (large) data samples.

Based on the analysis of these data, it is possible, for example, to invest financial resources and in areas where the average assessment was below the user's expectation, in addition to instrumentalizing the decision of managers, presenting diagnoses and emphasizing critical points that can be improved and solutions where they really need priority attention. In addition, it is possible to analyze the data in a general and grouped way, comparisons between institutions, municipalities, managing entities, macro-regions, micro-regions, among other possibilities, can be useful to assist in decision making.

Among the potential advances is the adaptation to private health and expansion to other public services, further detailing the results and graphs obtained from the analysis of the panels presented here and generating alerts, in addition to others that can be created.

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