

# **Systematic Review of the Literature on Data Governance in healthcare institutions**

**Helien Parra Riveros**

Facultad de Ingeniería industrial  
Universidad Santo Tomás  
Bogotá, Cundinamarca, Colombia  
helienparra@usantotomas.edu.co

**Diana Yomali Ospina López, Ibeth Yasney Amaya Rueda and Luis Zambrano**

Facultad de Ingeniería  
Universidad Autónoma de Manizales  
Manizales, Caldas, Colombia  
Facultad de Ingeniería  
Universidad Ricardo Palma  
Lima, Perú

dianaospina@autonoma.edu.co, ibeth.amaya@ustabuca.edu.co, luis.zambrano@urp.edu.pe

## **Abstract**

In recent years, data governance has become a topic of great interest for organizations since it defines power relationships between the actors involved in management and the socio-technical guidelines that are established in order to generate value for the company. organization by understanding the data that reflects evidence of performance. For this reason, data governance refers more than to data management, to the decisions that are made with respect to them, establishing those responsible for decisions, the methodology for processing, the guidelines for access, distribution, storage and control of data in the organization.

Although there is no evidence that data governance adds value to organizations, data governance provides guidelines for exploiting the potential value of data in pursuit of organizational objectives, under the premise that good administration of data produces well-informed decisions, optimizes healthcare processes, and reduces the risk of privacy breaches

This article presents a systematic review of recent literature on the subject in healthcare institutions in order to identify the main trends which are; disease diagnosis and prediction, patient relationship management, and resource management. The main challenges in data management in the sector were also identified, which are; technological, legal and business.

## **Keywords**

Gobernanza de datos, servicios de salud, flujo de trabajo, sistemas de información.

## **1. Introduction**

Health service provider organizations face two major challenges that are: limited budget and high demands for medical care, therefore, to face these challenges and achieve high quality standards, hospitals have been increasingly aware of the Need for process improvement. Hospital processes can be classified into two types: clinical processes (care in surgery, outpatient consultation, hospitalization, emergencies, etc.) and administrative processes (customer service, billing, inventory, etc.). (Martin et al. 2020). The identification of opportunities for improvement in services is determined by the analysis of the data generated in the processes that make up the business model of hospitals, which

provide valuable information to decision makers, who based on their experience and business knowledge take the necessary steps to achieve organizational objectives.

By virtue of the aforementioned and taking into account the vertiginous growth of data in organizations in recent years, which have been catapulted thanks to information technologies, organizations have become interested in data governance, a concept that defines DAMA international as "the exercise of authority and control over data management", so that an effectively implemented data governance model leads the organization to develop competitive advantages in the market, because it provides the organizations of the corresponding guidelines for the management of data as an asset for decision making. (Al-Ruithe et al. 2019). Although there are still not many studies that show how organizations obtain social or economic value from big data, positive relationships have been shown between the analytical data culture, the decision environment, the maturity of the architecture business and the adjustment of tools, tasks and people. (Günther et al. 2017).

In accordance with the above, this document shows a literature review in order to recognize the main factors that influence data governance models for health centers. This review proceeds as follows. In the first place, the method used is explained, from planning to development, secondly, the analysis of the results of said search is presented and finally the conclusions are presented.

## **2. Methods**

The present study was carried out using the systematic review protocol and is based on two phases, the first one of planning the review, which consists of the background review, definition of information sources, definition of inclusion and exclusion parameters, and bibliographic manager selection; and the second, the development of the review, which covers the construction of the search equation, the bibliometric extraction and the screening of the references.

### **2.1 Review planning**

#### **2.1.1 Definition of sources of information.**

The databases used to search for the primary information were Scopus and Google Academic. To carry out the search equation, DeCS (Health Science Descriptors) / MeSH (Medical Subject Headings) terms were used, which are a controlled and hierarchically organized vocabulary produced by the National Library of Medicine used to catalog information related to the health. The search equation used was the following:

(work AND organization) AND (health OR healthcare) AND (information AND systems OR ict) AND (workflow) AND (data AND governance).

#### **2.1.2 Defining include and exclude parameters**

As an inclusion parameter, the concordance of the titles and keywords of the documents found in the databases with the search equation used was taken into account, the relevance of the summary of the files with respect to the topic of study was also taken into account. research. The exclusion parameters for the screening of the references were the duplicate documents, the articles focused on the health area but that were not related to data governance or data analysis, resulting in a delimited set of heterogeneous documents focused on the research on data analysis to improve efficiency in health processes

#### **2.1.3 Bibliographic manager selection**

The bibliographic manager selected for the development of this research was Mendeley® owned by Elsevier®, this because it is a program that allows you to manage the documents and share them with other research partners, read the files and cite easily in the text editor.

### **2.2 Development of the review**

#### **2.2.1 Bibliometric extraction**

The bibliometric extraction was carried out in .ris format to import the files found with the search equation to the Mendeley bibliographic manager.

A total of 1,259 publications on the subject of health data governance were found, of which 641 belong to Google Scholar and 618 to Scopus. As can be seen in figure 1. Publications per year, including the years (2010-2022), the

year 2020 was the year with the most publications by Google Scholar with a total of 61 documents, while for Scopus it was the year 2021 with 87. documents.

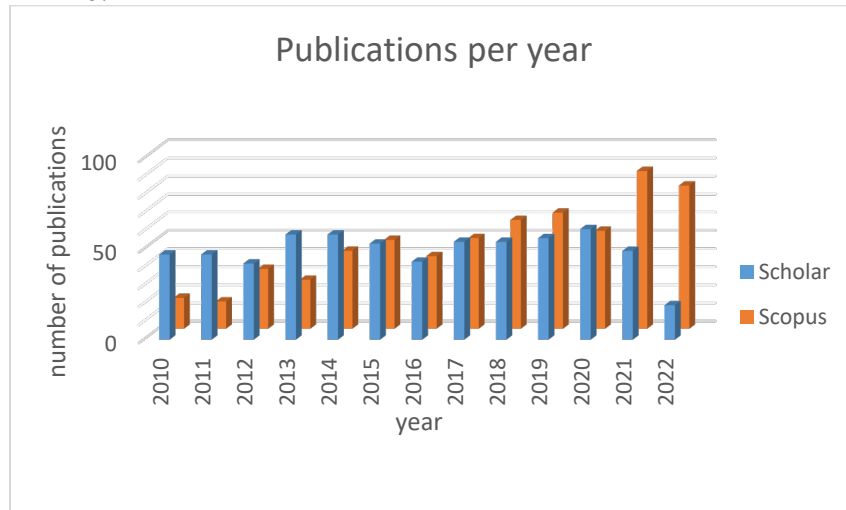


Figure 1. Number of documents published per year according to database in the period 2010-2022

More than 83 countries in the world have published on Health Data Governance. The countries with the highest number of publications are the United Kingdom, the country with 140 documents, followed by the United States with 139, China with 61, Australia 59 and Canada with 46, as it is illustrated in Figure 2 below.

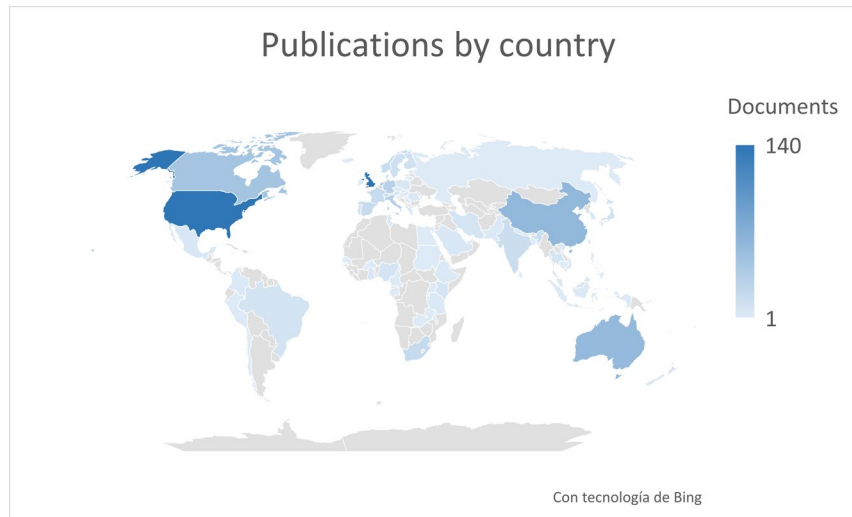


Figure 2. Number of documents published by country according to database in the period 2010-2022

Regarding the main authors, Scopus found 2,615 authors who carried out research on the subject, 973 of them published between 2010 and 2022, with Kaye, J., Bull, S. and Dahlberg, T. being the most active, while Google Scholar found 2,445 of which Tarafdar, M., Turel, O., and Van der Aalst, W. were the most prominent.

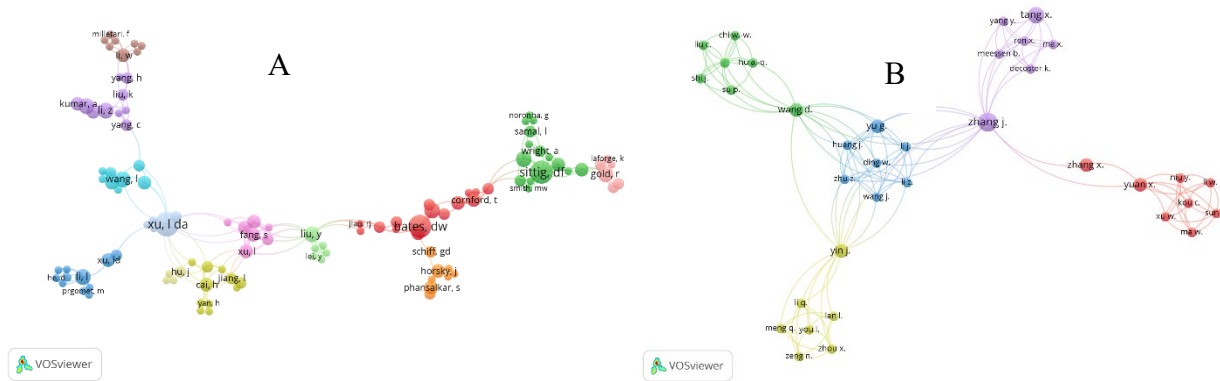


Figure 3. Level of cooperation between identified authors who published on data governance during the period 2010-2022 in Scholar (A) and in Scopus (B)

A co-occurrence analysis of the keywords was carried out with the VOSviewer software, in which eight clusters with related keywords were identified, showing a strong interrelationship between them. From Figure 3, governance can be identified as the keyword with the most co-occurrence, this being 156, followed by Clinical governance with 82 and data governance with 72.

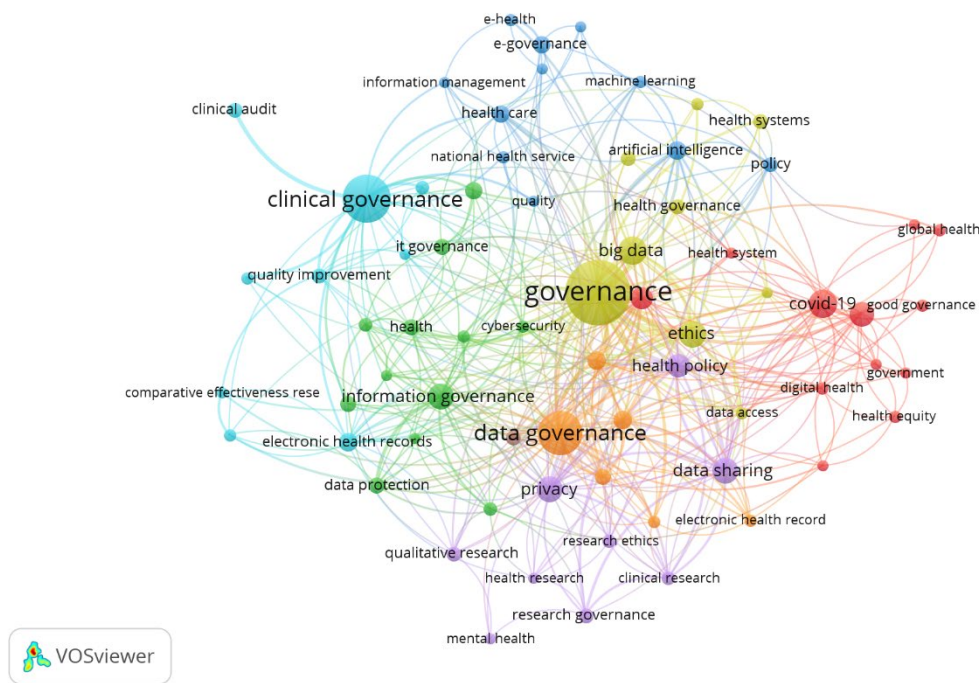


Figure 4. Clusters of keywords from studies on health data governance, period 2010-2022

### 2.2.2 Screening of bibliographical references

To start with the screening, the total number of documents found with the search equation in the different databases is taken into account, so that the first screening corresponds to 60% of the total files, the second screening to 30% and

finally the third screening at 10%. The method used was the PRISMA statement, since it has standard criteria for systematic literature review. The following figure illustrates the adaptation of the PRISMA method to this research work. (Urrútia & Bonfill, 2010)

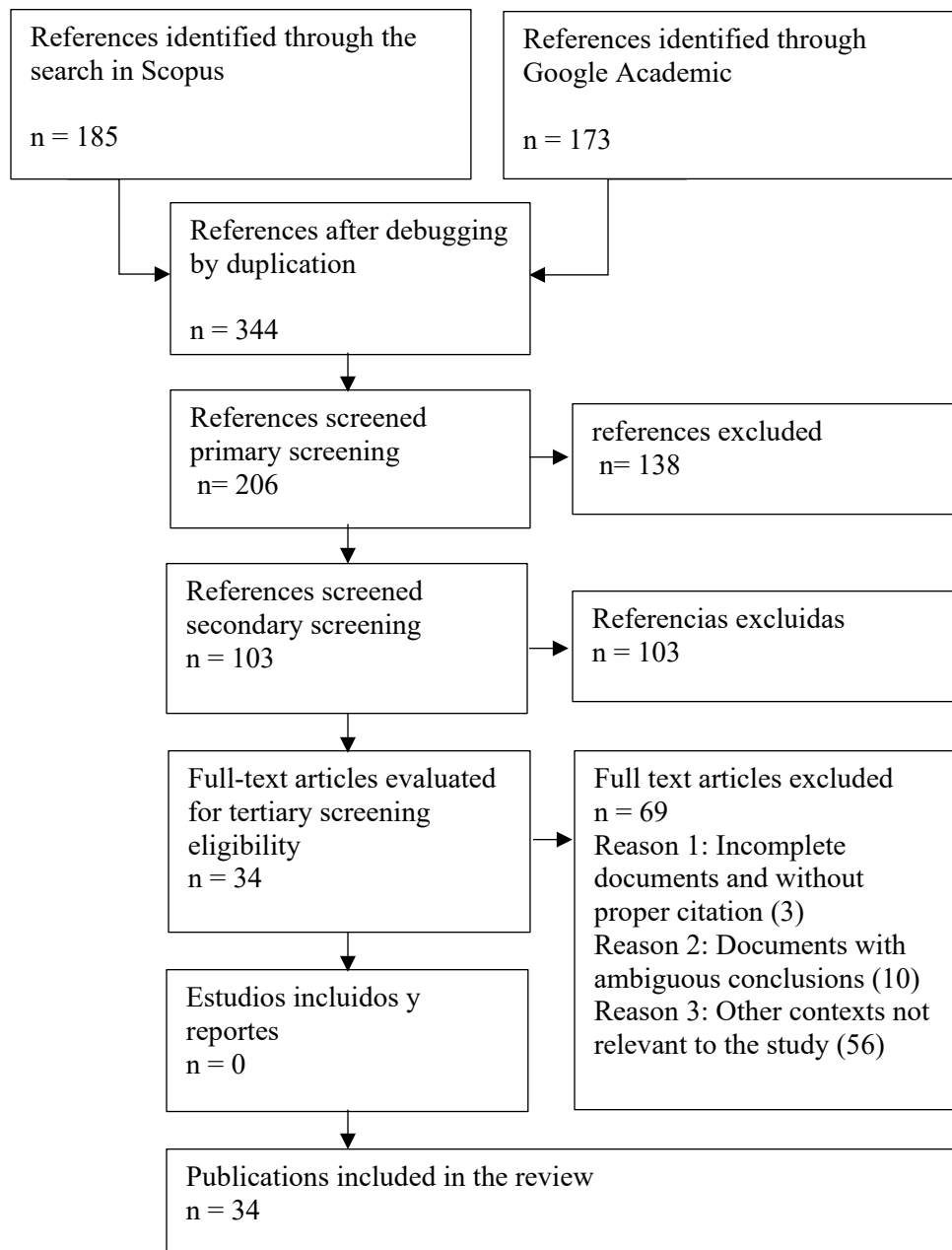


Figure 5. Screening of references

Once the 358 documents from the Scopus and Google Academic databases were consolidated in the Mendeley bibliographic manager, the inclusion and exclusion parameters were applied, leaving a total of 344 files to start the first screening, where it was filtered according to the relevance of the title. and the keywords with the current research project, leaving a balance of 206 documents, whose summaries were duly read in order to choose the 103 corresponding to the second screening and finally, a quick reading of these files was carried out to select the 34 documents that were duly analyzed for the writing of this study.

### 3. Results and Discussion

Although, once the selected documents were read, the heterogeneity of these was evidenced, which oscillate between reviews, models, methodologies, case studies, guides, etc. However, it is evident that these investigations aim to improve the efficiency of organizations through well-informed decision making, so data governance acquires research relevance. In the case of hospitals, data management plays a very important role in the diagnosis and prediction of diseases, the management of customer relationships and the management of resources (economic, temporary, human, inputs) which are examined using tools or techniques using patient-based, time-based, and resource-based approaches, as appropriate.

Table 1. Direction of the reviewed investigations

<b>Aim</b>	Improve efficiency through well-informed decision making based on proper data management.		
<b>Purpose</b>	Diagnosis and prediction of diseases (precision medicine)	Customer relationship management (understanding their needs to generate satisfaction)	Resource management (economic, temporary, human, inputs)
<b>Enfoque</b>	Patient	Time	Resources

#### 3.1 Purposes of health data analysis

##### 3.1.1 Diagnosis and prediction of diseases

Data in the health sector are an important resource since they help improve the performance of the health system, the quality of services and contribute to scientific advances that improve medical treatments, so big data analysis represents a potential support for patient care, the prediction and treatment of diseases, since these allow analyzing traceability and results in favor of improving diagnoses through personalized attention that makes it possible to identify the best practices for each patient, managing to provide a service efficient and quality. (Colombo et al. 2020)

The application of predictive systems in medicine such as pancreascalculator.com (van Roessel et al. 2020) that integrate mathematical models and clinical attributes collected from medical routines, can guide surgical decisions based on patient-specific data resulting in the probability of occurrence of adverse events during the medical procedure. (Tsilimigras et al. 2019)

##### 3.1.2 Patient relationship management

Healthcare providers have resorted to different process analysis techniques in order to understand the priorities, requirements, behaviors and usage patterns of their patients to improve the relationship by predicting the healthcare products they would like to purchase; An example of this in the health industry are pharmaceuticals, which by knowing the needs of their customers improve business management and decision-making.(Shirzad et al. 2021)This vision focuses on the client as a consumer of a product that is good medical care and the focus has been mainly market intelligence.

Companies, in their need to know the experience of customers about the service offered, require the sharing and collaborative use of the information stored in the CRM (Customer Relationship Management) systems, however, due to the existence of business competition to lead the market, this data is susceptible to leaks and therefore could result in its misuse . (Rasouli et al. 2016)

##### 3.1.3 Resource management

The allocation of resources plays a very important role within hospital management, mainly decision makers, public bodies in charge of creating policies and private companies are the most interested in these processes, so they conceive

the importance of monitoring, evaluation and improvement of processes in relation to the implementation of resource planning systems.(Hatami-Marbini et al. 2022)

Companies that have not implemented data governance spend more time reacting to data-related problems, which in turn limits the time they should spend on issues such as business process improvement and management, as well as Implementation of these policies leads companies to reduce costs in data cleaning.(Barker 2016)

### 3.2 Data management challenges

Table 2. challenges and techniques for data management

Title	Type	Challenge			Techniques
		Technological	Legal	Business	
A data-driven methodology for supporting resource planning of health services	Method	X			Process mining and TDABC: costing based on time spent per activity
A health data analytics maturity model for hospitals information	Model		X		maturity model
A modular approach to the specification and management of time duration constraints in BPMN	Model	X			BPMN modeling of time constrained processes, Petri Net.
A review on deep learning approaches in healthcare systems Taxonomies challenges and open issues	Review	X			ES-EL (unique deep learning) and HDL (hybrid deep learning)
A systematic literature review of data governance and cloud data governance	Review	X	X	X	Cloud data governance
An application of organizational input–output analysis to hospital management	Case Study			X	Application of the input-output model
Applications of data mining in healthcare area: A survey	Review	X	X	X	Data mining
Big data analytics for clinical decision-making Understanding health sector perceptions of policy and practice	Case Study			X	SRT (social representation theory),
Big Data Warehouse for Healthcare-Sensitive Data Applications	Model		X		Flexible three-tier data storage architecture for Big Data.
Blood Bank Management and Inventory Control Database Management System	Model			X	Blood bank management database using Microsoft SQL server.

Clinical data warehouse a review	Review		X	X	I2B2: informatics for integrating biology and the bedside
Data governance: A conceptual framework structured review and research	Review		X	X	Conceptual framework for data governance
Data life cycle management in big data analytics	Model		X	X	Data lifecycle model
Debating big data A literature review on realizing value from big data	Review	X	X		Mixed methods
Development of Project Document Management System Based on Data Governance With DAMA International Framework	Model			X	SDLC (System Development Life Cycle) and UML (Unified Modeling Language)
Emerging models of data governance	Review			X	Critical data services (CDS)
Examining the impact of health information systems on healthcare service improvement The case of reducing in patient-flow delays in a U.S. hospital	Case Study			X	Kaizen
Extending a fuzzy network data envelopment analysis model to measure maturity levels of a performance based-budgeting system: A case study	Case Study			X	CI (composite indicators) model based on DEA (data envelopment analysis methods)
Guía para gestionar procesos de negocio a través de minería de procesos	Guide	X		X	BPM and Process Mining
Health Information Systems, Electronic	Review		X	X	Electronic Medical Records (EMR) Software
Healthcare data warehouse	Model			X	ETL tools (extract, transform, load) and XML schema
Information Governance Requirements in Dynamic Business networking	Case Study			X	Dynamic Business Networks (BN)
Legal aspects of data cleansing in medical AI	Review		X	X	Artificial intelligence
Recommendations for enhancing the usability and understandability of process mining in healthcare	Guide			X	Process mining



Simulation of patient flow in multiple healthcare	Model			X	Discrete event simulation (DES) and queuing theory for patient flow simulation
Surgical data science – from concepts toward clinical translation	Guide	X	X	X	Standards to provide interoperability: HL7, IEEE 11073, American Society for Testing and Materials (ASTM), etc.
The Rise of Big Data How It's Changing the Way We Think About the World	Essay	X	X	X	Big data

From Table 2 it can be inferred that most of the documents reviewed belong to reviews, followed by models and case studies. The most used technique in these documents corresponds to process mining and the challenges faced by data management for governance can be classified into 3, technological, legal and business.

### 3.2.1 Technological

The adoption of data analysis in hospitals leads to technological challenges related to the architectures of data storage systems, such as the lack of capacity to deal with large volumes of data. Some health care services involve high-resolution live image data which varies from HD to 4K depending on the situation, so they can become very heavy for the technology that hospitals manage since it does not have the capacity to store files of this size. (Maier-Hein et al. 2022)

The data generated in medical care can vary from text, images, videos, etc. Therefore, incorporating such a diversity of data into information systems effectively complicates the models, making them difficult to query and less accessible. (Lehne et al. 2019) Because health information technologies are currently not designed to record and store such large files, so not all documents generated are digitized, much of it remains unstructured.

### 3.2.2 Legal

Ethical and legal conditions are mandatory to maintain the privacy of patients and protect their data. Patients should be informed about the use of their data for research and how to cooperate more with data entry. (Wiesenaue et al. 2012)

Currently, much of the information handled by health professionals such as reports, exam transcripts, treatment plans, letters from doctors, among others, are stored in their original form for legal reasons and are not structured, which prevents make it computer accessible. (Kilian et al. 2015)

Healthcare data has high economic value, therefore it is more susceptible to risks such as security attacks and information theft. The potential risk of violating health data limits the exchange of these inside and outside the facilities since the priority is to preserve their security.(Colombo et al. 2020)

One of the solutions to overcome security problems is the implementation of cloud storage technologies, which can ensure security, reduce costs, eliminate the need for physical protection, and provide a reliable platform.(Khalaf Hamoud et al. 2018)

The implementation of data governance in organizations reduces security and privacy risks, since through this risk mitigation strategies, policies and guidelines are established to control and monitor compliance with these. (Khatri and Brown 2010)

### 3.2.3 Business

Regarding information systems in the field of health, the lack of process-oriented data recording makes it impossible to structure the data in the system, which means that data from different sources cannot be correctly correlated. and

therefore, are not used for the improvement of processes. (Martin et al. 2020) Furthermore, collecting and synthesizing data from various contexts is a complex process involving many different stakeholders. This makes it difficult for organizations to ensure that the data they collect and combine is of high quality. The lack of quality can have serious consequences for organizations and society, especially when this data translates into faulty actions, which can affect the quality of products or services. (Clarke-Myers et al. 2019)

An important challenge that organizations that provide health services have is related to the standardization of data and its correction, since the erroneous elimination of accurate information could have great negative impacts of great medical importance. (Stöger et al. 2021)

Although algorithms are better able to connect data to find patterns at a higher level than humans due to the speed with which they process heterogeneous data sources, this would not be possible without human creativity, which plays a role. very important to define the linking and connection of data in order to extract knowledge. (Seddon et al. 2017)

A significant barrier in the field of health at the global level is the lack of a standard for sharing clinical data, which has prevented effective communication between the different actors at the global level to carry out the exchange of interoperable electronic records for the purpose of research, diagnosis, treatment and diseases. Therefore, to break down this barrier it is necessary to join efforts with a global coordination that involves a variety of stakeholders in both the public and private sectors. (Colombo et al. 2020)

#### **4. Conclusion**

Data management and analysis in the health sector is used either with a focus on the optimization of clinical processes such as the diagnosis and prediction of diseases, or of an administrative nature such as customer management or resource management ( temporary, economic, supplies and human), whose main purpose is the transformation of the data collected in the care processes offered by hospitals into knowledge, for decision-making that can improve patient outcomes and the operational efficiency of the hospital. organization.

The main challenges found for the analysis of data in the health sector are of a technological, legal and business nature, with the most delicate being of the legal nature when dealing with the processing of personal data and confidential information pertaining to the state of health of patients, which has limited research on many occasions precisely to preserve your privacy by restricting use and dissemination. On the technological side, large volumes of data represent a challenge when it is processed and stored, although technological advances have increasingly allowed data storage to be greater, the amount of data generated is abysmal, for Therefore, the data management cycle must be very precise so as not to exhaust the storage capacity with data that is not relevant or does not add greater value to the organization.

The healthcare sector processes and generates a large amount of data through its normal operation. If these data are well managed, they can be used for the continuous improvement of both clinical and administrative processes. Therefore, the implementation of a data governance model promises generates added value to companies by applying the guidelines and policies established for the correct handling of data, which are developed through the analysis of the processes that make up the health service in the institution, allowing decision-making based on data that accurately describe the reality of the company or the state of health of a patient.

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## Biographies

**Helien Parra Riveros** es Industrial Engineer from the Francisco José de Caldas District University with a Master's degree in Industrial Engineering from the National University of Colombia and a doctoral student from the University of Manizales. He is a research professor at the Faculty of Industrial Engineering of the Santo Tomás University in the area of data and process modeling and digital transformation.

**Diana Yomali Ospina López** es Ingeniera de Alimentos de la Universidad de Caldas, con estudios de Maestría en Ingeniería de Producción de la Universidad Federal de Pernambuco (Brasil) y Doctorado en Ingeniería Industrial y Gestión de la Universidad do Porto (Portugal). Trabaja como docente y coordinadora de la Maestría en Ingeniería de la Universidad Autónoma de Manizales. Área de interés principal: Investigación de operaciones y métodos cuantitativos aplicados a la gestión.

**Ibeth Yasney Amaya Rueda** es Industrial Engineer Cum Laude from the Santo Tomás University of Bucaramanga, Colombia. She is linked as a Young Researcher at the Autonomous University of Manizales through the + Woman + Science + Equity program of the Ministry of Science and the Organization of Ibero-American States OEI.