



## Current status of information management of the Ultra Micro Analytical System Laboratory at the Provincial Center of Hygiene, Epidemiology and Microbiology of Pinar del Río

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### ABSTRACT

**Introduction:** in Cuban Public Health, progress would be inconceivable without the application of Science and Innovation. The results of scientific research directly impact medical practice and, consequently, the modernization of the population's health status and the quality of services. In the Health sector, computerization — that is, the use of new information and communication technologies (ICT) — constitutes one of the key elements of the Strategic Computerization Program of the Ministry of Public Health (MINSAP).

**Objective:** to determine the current state of information management of the Ultra Micro Analytical System Laboratory at the Provincial Center of Hygiene, Epidemiology, and Microbiology of Pinar del Río.

**Methods:** descriptive research. The theoretical methods used were historical-logical, analysis and synthesis, and literature review. Empirical methods included scientific observation and documentary analysis.

**Results:** the procedures that allow determining the current state of management of the Ultra Micro Analytical System Laboratory at the Provincial Center of Hygiene, Epidemiology, and Microbiology of Pinar del Río are described, achieving the definition of the artifacts to be modeled in the computerization process.

**Conclusions:** information management in this laboratory plays a fundamental role in the digital era, as it provides a solid basis for making strategic decisions, identifying opportunities for improvement, and optimizing processes; once computerized, these processes will allow for effective and efficient information management.

**Keywords:** Information Management; Suma Laboratory; Provincial Center of Hygiene, Epidemiology and Microbiology.

## INTRODUCTION

In Cuban Public Health, progress would be inconceivable without the application of Science and Innovation.

The results of scientific research have a direct impact on medical practice and, consequently, on the modernization of the health status of the population and the quality of services. In the Health sector, computerization, that is, the management of new information and communications technologies (ICT), constitutes one of the keys to the Strategic Computerization Program of the Ministry of Public Health (MINSAP). This program is applied in health processes by stages, which will include all institutions belonging to the sector (assistance, teaching, research, business).<sup>(1)</sup>

Information has become the most valuable asset of any institution, and most of these strive to maximize its value to adapt to change, become more flexible, and make more effective decisions for their users, so information management can be defined as the process through which basic resources (economic, physical, human, material) are obtained, deployed, or used to manage information within and for the society it serves.<sup>(2)</sup>

This information management guarantees that the institution, in this case of health, manages to overcome challenges, satisfy the needs of employees and patients, and improve the productivity and efficiency of this institution, with the purpose of offering mechanisms that allow acquiring, producing, and transmitting, at the lowest possible cost, data and information with sufficient quality, accuracy, and timeliness to serve the organization's objectives.<sup>(3)</sup>

A laboratory information management system or LIMS (Laboratory Information Management System) is a configurable system used to manage data generated in a laboratory, as well as to manage the different workflows associated with the operations performed, as it reduces costs and can be carried out in the extensive network of SUMA technology laboratories existing in the nation".<sup>(4)</sup>

According to Casas,<sup>(5)</sup> currently the use of laboratories is of great importance to be able to carry out scientific knowledge that helps solve different problems and above all an analysis of our reality.

The Ultra Micro Analytical System (SUMA) technology was developed in the early 1980s of the last century by a group of researchers, led by Doctor of Science José Luis Fernández Yero; it is a purely Cuban technology, and by using small volumes of samples and reagents, it is more economically sustainable. This procedure has wide use worldwide for the diagnosis of various pathologies.<sup>(6)</sup>

In this process, the Provincial Center of Hygiene, Epidemiology and Microbiology (CPHEM) of Pinar del Río has proposed the computerization of the SUMA laboratory, to achieve complete virtualization of the services it offers, in order to reduce information delivery times, thus guaranteeing better control of this process and improvement in the quality of services.

Information management emerged in the 20th century, in the 1960s, in the United States when Information Science emerged. It first appeared in the conferences held in 1961 and 1962, at the Georgia Institute of Technology. Countless studies have been carried out on this topic. One of the oldest was carried out by the scientist Bork (1968), who defines Information Science as an: "interdisciplinary science that investigates the properties and behavior of information, the forces that govern the flow and use of information, and the manual and mechanical techniques of the

information process for its effective storage, retrieval, and dissemination, which includes a theoretical level, of pure science, together with an operational level of applied science, in which all disciplines related to Library Science and Information Science are present."

The management of the information resource is specified in the 21st century, but since the 1980s of the 20th century it has been imposed as an important activity of information science. According to Faire-Wesseis (1997), it is an information-based revolution, because current technological advances allow processing, storing, retrieving, and communicating information in any of its forms—voice, texts, images—regardless of distance, time, or volume.

For Fairer-Wessels (1997), information management is seen as the planning, organization, direction, and control of information within an open system. In this decade of the 1980s is when one can speak of the emergence of a new discipline in the field of information: information management, which reposes the labor market of the information professional and demands a professional with responsibilities in the design and development of information systems in organizations.

In the debates of the American Congress in 1980, information resource management then appeared, whose purpose was to offer mechanisms that would allow the organization to acquire, produce, and transmit, at the lowest possible cost, data and information with sufficient quality, accuracy, and timeliness to serve the organization's objectives.

From this moment on, it becomes evident that information is a fundamental resource for achieving the objectives of any organization and must be managed with criteria of economy and efficiency. From management in the industrial era to that applied today, there are no great conceptual differences; the meaning of the word management remains the same; what has changed is the content of what is managed. According to Woodman (1998), he considers that "information management is everything that has to do with obtaining the right information, in the appropriate form, for the right person, at the right cost, at the right time, in the right place, to take the precise action." While Ponjuán (1998), information management appears as a discipline, product of the evolution of sciences related to library, information, and management activities. This specialist in the topic treasures a diverse bibliography that has spread through scientific institutions. Rowley (1998), states that "the purpose of information management is to promote organizational effectiveness by raising the organization's potential to meet the demands of the internal and external environment under both dynamic and stable conditions."

According to Suárez Alfonso A,<sup>(7)</sup> information management can be understood as: "the set of projected and executed actions, supported by the information system, to formalize, structure, and promote the application of the information resource in order to support productivity and, therefore, make a company competitive in an environment increasingly based on information products and services".

In general, these authors agree that information management provides the good use of information at the desired time, allows raising the performance level of information professionals in the information system.

This research assumes the concept of Manso Rodríguez,<sup>(8)</sup> regarding the object of study: information management is the planning, organization, and control of information in an organization; adequate information management makes it possible to transmit and develop knowledge, then, the key phrase in an information institution is information management. At the center of information management is documentation management (information that is recorded in documents) and that can be of two types:

**Internal:** refers to documentation generated or received by the organization in the exercise of its functions, that is, documents that arise from the daily activity of that institution. In this group, there is both typically administrative documentation: accounting, correspondence; management documentation: reports, meeting minutes, work procedures; technical documentation that reflects the organization's own activity.

**External:** in addition to the documentation produced by the organization itself, this and the people who work in it often need to consult and handle external sources of information: books, magazines, databases (DB), public Internet; it is that documentation that the organization produces for the public, to communicate facts, activities, events, for example, reports, product and service catalogs, the web page.

Information management offers tools and methods to perform the necessary analyses. It encompasses a set of vital elements and processes within management in different dimensions for informational work in the institution.

In the world and in America, countries such as China, Venezuela, Brazil, Argentina, Mexico, and Colombia use our SUMA technology for the diagnosis of various pathologies.<sup>(9)</sup>

In Cuba, infectious diseases and acute diarrheal diseases showed sustained decreases and other causes of illness and death began to become evident. To face this new health problem, the establishment of an effective primary care system and the carrying out of large-scale studies were required, with the objective of detecting or preventing in a timely manner the diseases that in one way or another affect the quality of human life.

For our country, it was almost impossible to think about acquiring the technology available on the market to address this new health problem, hence the need to seek our own technological solutions, adapted to our conditions of economic and social development. Thus, in 1979, the development of a technique began that would allow studying a large number of samples, at the lowest possible cost, combining the advantages of ELISA methods (Enzyme-linked immunosorbent assay), but using ultra micro volumes (10 microliters of samples and reagents), this conditioned the emergence, development, and application of what would later be SUMA Technology as an integral diagnostic system, based on immunoassay techniques.<sup>(10)</sup>

It is of utmost importance for the country to be able to have a Cuban test with technological sovereignty, which reduces costs and can be carried out in the extensive network of SUMA technology laboratories existing in the nation.<sup>(11,12)</sup>

In Pinar del Río we have laboratories that use SUMA Technology, which covers hospitals, blood banks, and the Center of Hygiene and Epidemiology, destined to provide services to the general population.

The use of automated techniques in information processing is of great importance in the development of potential. They achieve greater work efficiency and better communication of information, obtained in order to optimize resources for solving problems, which is of special importance in health institutions.

**Scientific problem:** What is the current status of information management of the SUMA laboratory at the Provincial Center of Hygiene, Epidemiology and Microbiology of Pinar del Río with the use of technologies?

**Objective of this research:** Determine the current status of information management of the SUMA laboratory at the Provincial Center of Hygiene, Epidemiology and Microbiology of Pinar del Río.

## METHODS

Descriptive study based on Marxist-Leninist philosophy, assuming its dialectical materialist method. From this approach, research methods, procedures, and techniques were used, both theoretical and empirical, according to the concept given by Leticia Artiles.

### **Theoretical level methods used in the research:**

**Historical and logical analysis:** It allowed explaining the history and evolution of the SUMA laboratory management process at the Provincial Center of Hygiene, Epidemiology and Microbiology of Pinar del Río with the purpose of discovering trends.

**Analysis and synthesis:** It was applied throughout the investigative process for the decomposition of its parts or elements that make up the management of the SUMA laboratory at the Provincial Center of Hygiene, Epidemiology and Microbiology of Pinar del Río, delimiting the essential elements that constitute it, as well as the existing links between them and their most general characteristics.

**Bibliographic review:** Used in the study of documentation related to the object of research.

### **Empirical level methods used in the research:**

**Scientific observation:** it was used with the intention of describing and interpreting the object of study, for its exploratory study and in the diagnosis of the current status of the management of the SUMA laboratory at the Provincial Center of Hygiene, Epidemiology and Microbiology of Pinar del Río.

**Documentary analysis:** it was used for consulting computer applications that will allow the diagnosis of the object of study, the demonstration of the problem, as well as proposed solutions to it.

## RESULTS

The main result of this research is to improve a computer prototype for the management of the SUMA laboratory at the Provincial Center of Hygiene, Epidemiology and Microbiology of Pinar del Río.

### **Description of the entity where the research is developed**

The research was developed in the city of Pinar del Río, at the Provincial Center of Hygiene, Epidemiology and Microbiology, which is the institution where the Control, Surveillance, Epidemiology, Environmental, State Sanitary Inspection, Non-Communicable Diseases, Promotion and Health Education Programs are directed, implemented, and evaluated, with projections in the field of Scientific and Technical Research, Teaching, and Health Standardization in order to continuously improve quality of life.

It was also designed to advise, supervise, and evaluate the institutions that are subordinate to it. Such as in Epidemic Control, Program Management, Surveillance of events and risks that affect health, Evaluation of services and technologies, Hygienic-Epidemiological Assurance of the province, and Microbiological and chemical-sanitary assurance of laboratories.

This center is also characterized by excellence in the services it provides, having a group of committed workers to obtain superior results, in addition it maintains as a premise the improvement of hygienic-sanitary conditions, and all this places it as a reference center in the province; which guarantees a favorable environment and style with better quality of life in the population and a high degree of satisfaction of the people in general.

### **General structure of the entity**

The Provincial Center of Hygiene, Epidemiology and Microbiology has health promotion and disease prevention services, Microbiology laboratory, control and prevention of vector-borne communicable diseases, prevention of animal diseases that transmit to humans (Zoonosis), care for patients with HIV-AIDS (Acquired immunodeficiency syndrome), control of Communicable and non-communicable diseases, epidemiological surveillance of food, water, as well as solid and liquid waste from all work centers, educational centers, and self-employed workers, state sanitary inspection and fiscalization, counseling service where psychological support is provided, guidance and information is provided, and healthy lifestyles are promoted. With a human potential of 117 workers, among doctors, nurses, technicians, workers, managers, and other personnel, distributed among the 21 departments currently existing, including the SUMA laboratory Department. The entity, composed of the Directorate, and three Sub-directorates, highlighting the location of the laboratories, among these the SUMA laboratory.

The Provincial Center of Hygiene, Epidemiology and Microbiology has technological equipment for network work in all areas, with internal connection between the institution's computing equipment. At the same time, it has navigation and internet service through the INFOMED network.

### **Brief description of processes in the SUMA**

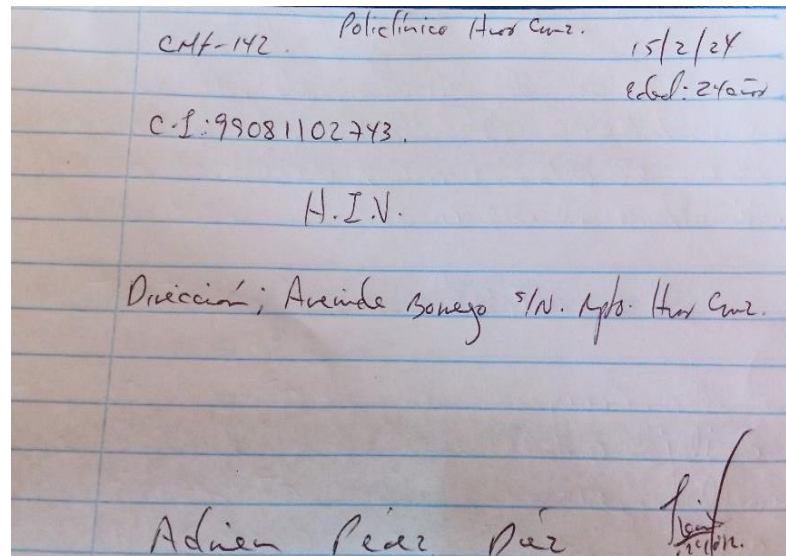
laboratory The entity has a laboratory with application of SUMA Technology, which has been oriented, fundamentally, to health programs or applications in two main lines of work: blood certification and epidemiological surveillance. It is the area responsible for processing the analyses performed on patients; these analytical results obtained in the laboratory, in general, are used for three fundamental purposes: disease prevention, disease diagnosis, and disease follow-up. Its essential objective is to guarantee the reliability of the results provided, achieving an accurate diagnosis of the pathology and adequate treatment for the patient.

This laboratory is led by a microbiologist physician and composed of a team of health professionals that responds to the different work directives, to achieve adequate efficiency in the development of its functions.

### **Business in which work will be carried out**

In the SUMA laboratory, as explained in the previous section, two main lines of work are present. The research will focus on the study, as an object of computerization, of the information management of said laboratory.

The process begins when the messengers carry out the transfer of the sample with their respective orders, from the clinical laboratories of the different polyclinics, to the SUMA laboratory of the Provincial Center of Hygiene, Epidemiology and Microbiology; said order is evidenced in Figure 1; each messenger must come with the analyses separated, packaged by type of analysis and identified with the date and the quantity performed in said health area. Health personnel will use personal protective equipment (gloves and laboratory clothing), being very careful to avoid falls or spills.



**Fig 1.** Order of analysis.

Analysis order First, the sample is received:

- Liquid sample of serum or plasma, it must be kept frozen ( $-20^{\circ}\text{C}$ ) and avoid successive thawing.
- Dry blood sample on filter paper kept under refrigeration ( $4-8^{\circ}\text{C}$ ) or in cool places.

Once said samples arrive, they are distributed in the different refrigerators and recorded in the laboratory registration book, according to the analysis performed, as can be seen in Figure 2.



## DISCUSSION

At the international level, bodies and organizations have promoted and generated countless applications for the health sector with the purpose of providing increasingly higher quality services; authors such as Christian Eduardo Rueda Clausen, Carlos Pedrotti, Anvesha Mishra, Laman Aliyeva, among others, refer to Electronic Medical Records, Telehealth and telemedicine, Health data science, Bioinformatics and Computational Biology, among others.<sup>(12)</sup>

The SUMA laboratory is a medical service that is responsible for carrying out the diagnosis, prognosis, and evolution of diseases through the use of different techniques; in this context, several laboratory applications were developed, among which are TIMLAB, developed by TIMSA Software, Care 2x developed by Elpidio Latorillez, CONLAB LIS-Laboratory, among others.<sup>(13)</sup>

The analysis carried out is vital to be able to improve a computer prototype for the management of the SUMA laboratory at the Provincial Center of Hygiene, Epidemiology and Microbiology of Pinar del Río, as it will allow breaking through in certain aspects and introducing new information and communications technologies (ICT), not only to standardize processes, but to improve timeliness in information, laboratory productivity, quality of results, often reduce costs, and facilitate daily work. Another element to take into account would be to be able to count on the future participation of other institutions with SUMA technology, to collaborate in research of this nature, to achieve greater efficiency of health personnel towards patients.

The elements described above coincide with the conceptual aspects reflected in research on the topic. In addition, we have health personnel with high-level professional training, which is fundamental to specify said research, recognizing the benefits provided by information management processes and their impact.

With this extensive information, it is possible to carry out extensive studies and statistical analyses that may result from the adequate management of the information contained in the system and that are currently not possible.

## CONCLUSIONS

Information Management in said laboratory plays a fundamental role in the digital era, since it provides a solid basis for making strategic decisions, identifying opportunities for improvement, and optimizing processes. In the research carried out, we can assure that with a computer prototype for the information management of the SUMA laboratory at the Provincial Center of Hygiene, Epidemiology and Microbiology of Pinar del Río, efficient implementation and operation of networks, hardware, and software is achieved, but it also helps users perform their daily tasks, providing them with appropriate computer solutions and tools.

### Conflict of Interest

The authors declare that there is no conflict of interest.

### Author Contribution

All authors participated in conceptualization, formal analysis, project administration, writing-original draft, writing-review, editing, and approval of the final manuscript.

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