

ARTICLE

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Application for information and monitoring of Health Surveillance Strategic Information Centers

Proposta de aplicativo para informações e monitoramento de Centros de Informações Estratégicas de Vigilância em Saúde

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ABSTRACT

Introduction: The COVID-19 pandemic demonstrated the need to develop information systems to strengthen Health Surveillance through Strategic Health Surveillance Information Centers (CIEVs). **Objective:** This article reports the experience of developing an application for the CIEV at Corumbá, Mato Grosso do Sul. **Method:** The methodology was qualitative with experience report, with initial meetings with CIEV health professionals and subsequent validation with a group of experts from Leiria, Portugal. **Results:** In the end, it was observed that the application enabled improvements in the management and local monitoring of surveillance information despite the infrastructure difficulties encountered. **Conclusion:** Despite the improvements with the application, it was observed that for better integration of surveillance information, integrated action between the entities of the federation and the federal government is necessary.

KEYWORDS: Digital Health; Applications; Health Surveillance; Information Technology

RESUMO

Introdução: A pandemia de COVID-19 demonstrou a necessidade de desenvolvimento de sistemas de informação para o fortalecimento da vigilância em saúde e dos Centros de Informações Estratégicas de Vigilância em Saúde (CIEV). **Objetivo:** O objetivo deste artigo é relatar a experiência do desenvolvimento de um aplicativo para o CIEV de Corumbá, no Mato Grosso do Sul. **Método:** A metodologia utilizada foi do tipo qualitativa com relato de experiência, com reuniões iniciais conduzidas com os profissionais de saúde do CIEV e posterior validação do aplicativo com o grupo de experts de Leiria em Portugal. **Resultados:** Ao final foi observado que o aplicativo possibilitou melhorias na gestão e monitoramento local das informações de vigilância, apesar das dificuldades de infraestrutura encontradas. **Conclusão:** Apesar das melhorias com o aplicativo, foi observado que para uma melhor integração das informações de vigilância é necessário uma ação integrada entre os entes da federação e o governo federal.

PALAVRAS-CHAVE: Saúde Digital; Aplicativos; Vigilância em Saúde; Tecnologia da Informação

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INTRODUCTION

Global health surveillance aims to monitor emergencies related to international public health. In 2005, the International Health Regulations (IHR) came into force, making it possible to notify events that may constitute an International Public Health Emergency (IPHE)¹. Health surveillance is a set of actions involving the collection, analysis, and dissemination of information on events of public health interest, aimed at preventing and controlling diseases and health problems in the population².

In Brazil, the Strategic Health Surveillance Information Centers (CIEV) began operating in 2006 to detect, manage, and coordinate responses, together with state and municipal health departments and the Ministry of Health (MS)³. Currently, the CIEVs total 164 units throughout Brazil, of which 14 are at borders, 26 are in capital cities, 34 are in the Special Indigenous Health District (DSEI), 27 are at state level, 46 are strategic, 16 are regional, and one is national⁴. One of the biggest challenges for CIEVs is managing a large amount of information through systems that can help monitor the health of the population.

The use of information systems and applications in CIEVs is not new. Between December 2009 and November 2011, the Integrated Border Health System (SIS-Fronteiras), developed together with the local systems of the twin cities on the border between Argentina and Brazil, known as the Southern Arc Border, found difficulties in implementing improvements to the service networks as well as a lack of investment in the surveillance network⁵.

In the COVID-19 pandemic, the use of health information systems has been intensified worldwide to prevent contagion, monitor the disease, and determine the number of “cases” by region, thus making it possible to quickly and accurately report the disease situation⁶. In Brazil, one of the main difficulties is that the information is compartmentalized into different registration, surveillance, and laboratory systems⁷.

At the Germano Sinval Faria School Health Center (CSEGSF) located at the National School of Public Health (ENSP) on the campus of the Oswaldo Cruz Foundation (Fiocruz) in Rio de Janeiro, the VigSaúde® application (<http://vigsau.de.ensp.fiocruz.br/>, patent BR512023000950-4) was developed for the prevention, care, and monitoring of COVID-19 patients. The app was later used in COVID-19 testing centers located in the Baixada Fluminense region, where it was adapted for cell phones⁸. The purpose of this article is to report on the experience of developing a surveillance module in the CIEV application, which began with funding from Fiocruz’s Inova program.

Initially, the team behind this project held meetings with health professionals from the CIEV in Corumbá-MS, to understand the needs of the information system and the monitoring of communicable diseases to make the necessary adaptations for use in the municipality. Subsequently, to improve the software, it was validated in terms of usability and design by a group of experts in Leiria, Portugal.

METHOD

The methodology used was qualitative, with an experience report on the development of the application in two stages: in Corumbá, Mato Grosso do Sul, with the group of users, and at the *Escola Superior de Arte e Design do Politécnico* (ESAD.CR) in the city of Caldas da Rainha, Leiria, Portugal with the group of experts.

In the first stage, the app’s prototype was developed using the Design Thinking process to gather the app’s requirements, through collaborative and creative work⁹, carried out through meetings where needs were quickly prototyped and tested^{10,11}. The meetings followed the steps of Design Thinking: Building Personas, defining the User Journey and constructing the Service Blue Print. This process enabled the application to be developed in an innovative way^{12,13,14} following the following steps: problem identification, idea, prototyping, and testing¹⁵.

In the second stage, the group of experts carried out a heuristic evaluation¹⁶: a review in which, at the end, a list of possible usability problems is presented^{16,17}. This evaluation is used to support the quality of software development, making it possible to decide on improvements to the system or the implementation of a software version and its allocation of resources¹⁸. The evaluation of the graphical interface was conducted according to design principles¹⁹. In the end, the aim was to assess whether the application developed could be considered a Minimum Viable Product (MVP), to meet the requirements during software development^{20,21}.

The application was developed by a team of information technology (IT) professionals - systems analysts, database administrators, and developers - who were awarded grants from the research project, and supported by a group of researchers (epidemiologists, doctors, engineers, etc.). (epidemiologist, doctor, software engineer).

RESULTS AND DISCUSSION

Stage 1: Corumbá-MS CIEV

To build the application prototype, each step of the Design Thinking process will be described below.

Personas (fictional characters)

Initially, the CIEV coordinator was identified, whose main need was to keep surveillance data organized and up to date, using control spreadsheets.

Journey mapuser (user experience journey)

During the user group meetings, we tried to identify the persona’s experience of working at the CIEV. It was identified that the two main activities were filling in spreadsheets relating to “rumors” (health surveillance news) and “cases” (diseases of importance to health surveillance and which had occurred



at health centers in the municipality). It should be noted that rumors are unconfirmed suspicions from news reports and cases are those confirmed in health units. For the rumor situation, the main objective was to verify the veracity of the information and the need to trigger an alert about the situation.

Service Blueprint (user service model)

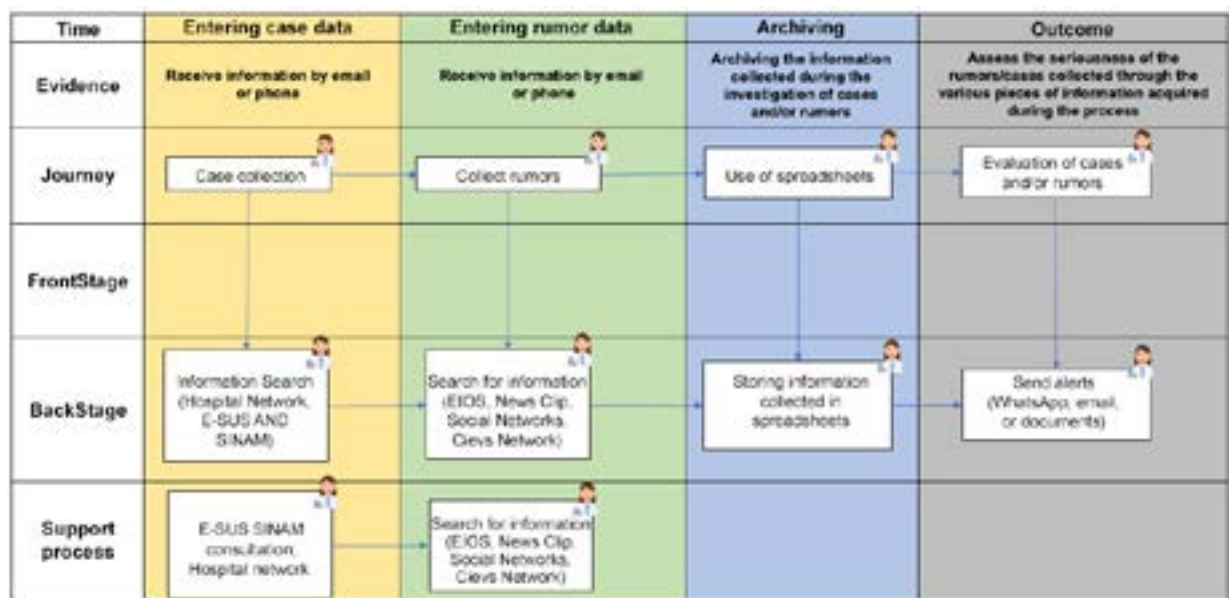
The Service Blueprint was divided into stages: cases, rumors, and archiving. In each of these stages we sought to identify the evidence, the user journey, the action on the front line, the action behind the scenes and the support processes. The evidence verified was the identification of cases and rumors filed in spreadsheets by the user. Subsequently, the behind-the-scenes actions seek to: examine the veracity of the information, identify the risk potential, verify the need to inform and further

investigate the situation. Finally, the supporting action was to investigate other sources of information, such as the municipal health surveillance notification report. Figure 1 summarizes the Service Blueprint (user service model).

Application prototyping

After meetings with the focus group of health professionals, the following needs were identified: controlling rumors, controlling cases, and visualizing data in dashboards. The Table summarizes the items contributing to the prototyping of the application.

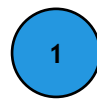
In the Table, three requirements were identified to be developed in the application, which was built: a screen for registering rumors with risk analysis, a screen for registering cases and a dashboard for graphical visualization of cases and rumors.



Source: Prepared by the authors, 2025.

Figure 1. Service Blueprint (user service model).

Table. Summary for prototyping.

Persona	Problem	Idea	Prototype	Prototype item
 CIEV Coordinator	The “case” data is entered in spreadsheets.	Build a screen for registering “cases” in a flexible way.	Develop a screen for registering “cases”, covering different types of diseases.	
 CIEV Coordinator	The “rumors” data is registered in spreadsheets.	Build a screen for registering “rumors” in a flexible way.	Develop a screen for registering “rumors”, covering different situations.	
 CIEV Coordinator	There is a need to visualize data using graphic panels.	Build a panel for graphical display of “cases” and “rumors”.	Build a panel to visualize the data.	

Source: Prepared by the authors, 2025.

CIEV: Strategic Health Surveillance Information Centers.



Case registration screen

The case registration screen was developed from the prototyping table with data from the user's spreadsheet. This screen contains a list summarizing the data, on the left-hand side it is possible to filter the data according to: date of occurrence, situation (true, false, unidentified), disease, source (email, telephone, web, WhatsApp, press, Eios, other sources). Epidemic Intelligence from Open Sources (Eios) is free software made available by the World Health Organization (WHO) for the detection and control of rumors²². Other necessary controls are the outcome (open, closed) and the Health Unit where the event occurred. At the bottom of the screen, the case can be detailed by filling in the form.

The form for detailing "Cases" was structured according to each disease (Ministry of Health ordinance²³). Figure 2 shows an example with diphtheria.

Rumor registration screen

The rumor registration screen was developed using data from the user's spreadsheet. On this screen, the data is presented in list form so that on the left-hand side it is possible to filter the data according to the following parameters: date of occurrence, situation (true, false, unidentified), disease, origin (e-mail, telephone, internet, press, Eios), and type of outcome (open, closed). For each rumor record, it is possible at the bottom of the screen to drill down into the situation by filling in the form. The form is shown in Figure 3.

Cases and rumors panel

The panel was built to make it possible to view the registered cases and rumors. At the top, the diseases were included; in the center, the total number of cases of the diseases; at the bottom left, a circular graph with the diseases and the percentage in relation to the total; on the right, the total number of

diseases represented in a bar graph in which the top bar represents the total number of cases. Figure 4 shows the cases and rumors panel.

Once the screens and forms had been built, the cases and rumors were registered according to the user's spreadsheet. The users validated each screen, and adjustments were made according to the tests.

It was observed that the site's infrastructure was inadequate, there was no room of its own for the CIEV, there were few employees and the internet failed frequently, i.e. there was a lack of adequate infrastructure at the CIEV, as noted by other authors²³. It was possible to identify a gap in the integration of data from different health systems that deal with surveillance and from these with the registration system, which hinders the analysis of health surveillance, as has been seen previously in the development of the VigSaúde® application⁶. The application made it possible to improve this aspect, but there were difficulties in obtaining data on the cases registered in the Ministry of Health's existing systems.

STEP 2. Design evaluation by experts

After the application was built, it was evaluated by design experts from the ESAD. CR in Leiria.

The main changes requested by the group of experts were: visibility of the system status (highlighting click feedback), error prevention (placing a character limit on each space), correspondence between the system and the real world (UX Writing as an information model), placing the VigSaúde clickable logo clickable at the start, helping users to recognize, diagnose, and recover errors and hiding the information available in the tabs that is not necessary.

Source: Prepared by the authors, 2025.

Figure 2. Case breakdown form.



RUMORES - FRONTEIRAS ATIVO

1 - Mês

2 - País?

3 - Estado?

4 - Município?

5 - Origem

Source: Prepared by the authors, 2025.

Figure 3. Rumor form.



Source: Prepared by the authors, 2025.

Figure 4. Cases and rumors panel.

CONCLUSIONS

The use of Information and Communications Technologies (ICT) in health has intensified since the COVID-19 pandemic, especially in the area of health surveillance. This article reports on the experience of developing the *VigSaúde* application at the CIEV in the municipality of Corumbá-MS with the aim of improving the management and monitoring of the large amount of information at this Health Surveillance Center. Initially, the *personas* were identified, then the user's journey (userjourney), then

the operation of the service (service blue print), prototyping, and testing of the application with users. Once the prototype had been built, tests and simulations were carried out on the data, making it possible to visualize it in an integrated way using graphic dashboards. Validations were then carried out by a group of design experts, in which new needs were identified and added to the application.

An important finding of this article was that the use of software in an information center is a fundamental tool for mitigating the



risk of spreading diseases and strengthening the surveillance system. It was possible to observe through the use of the application that information was managed more quickly and accurately, with better visualization and control of surveillance information, making it possible to carry out actions on the outbreak of diseases based on evidence, avoiding misinformation.

However, there were difficulties with infrastructure at municipal level, such as staff, computers, and the internet network. Finally, it was noted that the surveillance system as a whole requires integrated actions between states, municipalities, and the federal government to enable greater integration of information.

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Authors' Contributions

Teixeira Netto J, Andrade MKN, Rodrigues NCP, Silva MLB, Pernencar CAC - Conception, planning (study design), acquisition, analysis, data interpretation, and writing of the paper. All the authors approved the final version of the paper.

Conflict of Interest

The authors inform that there is no potential conflict of interest with peers and institutions, political or financial, in this study.



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