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Research Paper

User-Centered Design and Evaluation of an Interactive Dashboard to Support Leprosy Monitoring and Control in Brazil

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Abstract. Leprosy remains a significant public health issue in Brazil, with a high number of cases reported annually, posing challenges in monitoring and control. Data-driven strategies are essential for enhancing disease surveillance and supporting the goals outlined in the Global Leprosy Strategy 2021-2030. Current tools to monitor leprosy in Brazil have several limitations and there is no documentation on the user requirements and empirical evaluation results of such tools. This can compromise leprosy monitoring effectiveness, timely response and data-informed decision-making in public health. This study presents the specification, development and evaluation of an interactive dashboard that leverages data from Brazil's Disease Notification System (SINAN) to provide a detailed visualization of leprosy cases. The dashboard includes critical metrics on patient demographics, geographical distributions, and disease progression, facilitating data-driven decision-making. The process ensured that the final dashboard aligned with the specific needs and tasks of health professionals managing leprosy cases. The dashboard supports data analysis and trend visualization, empowering users to track leprosy patterns, manage cases more effectively, and anticipate resource needs. Usability tests indicated that users were able to complete analytical tasks using the dashboard with satisfactory degree of success. This work demonstrates the value of data visualization in public health information systems, providing a replicable model for tracking leprosy. The attributes, tasks and visual representations proposed can be reused by other researchers and practitioners to build similar tools. Also, by offering rapid access to actionable insights, the tool can enhance response capabilities and resource planning for leprosy and similar health challenges.

Keywords: Leprosy, Data Visualization, Dashboards

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1 Introduction

Leprosy is a chronic infectious disease caused by the bacterium *Mycobacterium leprae* [World Health Organization, 2023]. This disease primarily affects peripheral nerves, but can also involve the skin, mucous membranes of the upper respiratory tract, and eyes. When not adequately treated, leprosy can result in deformities, sensory changes, loss of thermal and tactile sensitivity, as well as muscle strength reduction, especially in the hands, arms, feet, legs, and eyes, potentially leading to permanent disabilities. The transmission of leprosy occurs through respiratory pathways, such as the nose and mouth, requiring prolonged contact, over months, with an untreated person for the disease to be transmitted to healthy individuals.

According to the latest Epidemiological Bulletin from the Ministry of Health, published in January 2025, 247,139 cases of leprosy were reported in Brazil between 2014 and 2023 [Ministério da Saúde, 2025]. In Brazil, the Central-West region reported the highest number of notifications during this period, followed by the North region and, in third place, the Northeast region.

To combat the disease, the World Health Organization (WHO) implemented the Global Leprosy Strategy 2021-2030, with goals to reduce leprosy incidence, eliminate discrimination, and mitigate the effects of motor disabilities associated with the disease. One of the pillars of this strategy is the implementation of a national plan to achieve the "Zero Leprosy" goal, supported by effective surveillance and improved data management systems [World Health Organization Leprosy, 2021].

Dashboards have a crucial role in healthcare data analysis and visualization, as they enable professionals to gain an understanding from large volumes of information quickly. They help monitor key health indicators, identify patterns and trends, and facilitate informed decision-making [Carroll *et al.*, 2014]. The implementation of dashboards in healthcare systems can improve management efficiency and increase responsiveness to disease outbreaks, allowing users to benefit from clearer visualizations and more agile analysis.

In Brazil, the tools provided by the Ministry of Health for monitoring leprosy have limitations that may hinder the decision-making process. The first one is the limited use of visual elements to help users explore and draw insights from the data. The second one is the lack of empirically validated user requirements for building dashboards for leprosy data, which is crucial to ensure that the system will really meet the needs of healthcare professionals working in this domain [Munzner, 2009; Lam *et al.*, 2012].

Considering this gap, this work presents the results of an iterative design process of requirements identification, prototyping, implementation and validation to create a visual decision support system for leprosy data analysis in Brazil, aligned with the Global Strategy to combat the disease. The dashboard was tested with data from the Brazilian Information System on Diseases and Notifications (SINAN), which includes 967,903 records from 2001 to 2023. The goal is for this tool to support healthcare professionals and managers in decision-making and disease control.

2 Background

2.1 Leprosy

Leprosy is a chronic infectious disease caused by the bacterium *Mycobacterium leprae*, which primarily affects the peripheral nerves, upper respiratory tract, skin, and eyes [Talhari *et al.*, 2015]. Transmission occurs through close and prolonged contact with an infected person, primarily through respiratory droplets. Although less contagious than other infections, leprosy remains a problem in developing countries, where poor sanitation and malnutrition conditions favor its spread [White and Franco-Paredes, 2015], and it is classified as a Neglected Tropical Disease (NTD) [Feasey *et al.*, 2010].

The symptoms of leprosy vary depending on its clinical form, and may include loss of sensitivity, nerve damage, and skin lesions. In more severe cases, such as in the virchowian form, the disease causes physical deformities and affects various regions of the body, including the face and extremities [Walker, 2020]. Among the main complications are permanent nerve damage, leading to loss of sensitivity in the hands and feet and increasing the risk of injuries, infections, and even amputations. The disease can also affect vision and nasal mucous membranes, and cause significant psychological and social consequences due to the stigma that still surrounds it [Lau, 2019; Moonot *et al.*, 2005]. Since 2002, the Brazilian Ministry of Health has standardized the classification of Grade of Impairment Function (GIF) due to leprosy in three levels: GIF0 (mild), GIF1 (moderate), and GIF2 (severe) [Alves *et al.*, 2010].

In Brazil, leprosy treatment is free of charge through SUS (Unified Health System), offered via multidrug therapy, which includes a combination of antibiotics. After starting the treatment, the patient becomes non-contagious, helping to interrupt the transmission chain. However, there are still many challenges to the eradication of leprosy: early diagnosis, which is still rare and complicated; the lack of specialized healthcare professionals; and leprosy reactions, inflammatory episodes that may occur during treatment, worsening the patient's symptoms. Additionally, the stigma associated with leprosy generates social exclusion and makes it difficult to access diagnosis and treatment.

Brazil continues to record new cases annually, in 2023 22,773 new cases were reported, reflecting both the persistence of transmission and the difficulty in implementing effective and universal control measures. Combating leprosy in Brazil, therefore, requires an approach that goes beyond medical care, including community education, stigma reduction, and health policies focused on the most vulnerable populations. To this end, it is essential to employ data-driven approaches for decision-making, aiming to identify patterns and facilitate exploratory data analysis.

2.2 Data visualization

Data visualization is the practice of transforming complex datasets into visual representations, usually interactive, such as line/bar charts, maps, scatterplots, among many others, which facilitate the interpretation and analysis of the data [Munzner, 2014]. This approach allows patterns, trends, and relationships to become more evident and understandable [Aparicio and Costa, 2015] due to the high processing power and pattern detection ability of the human vision [Ware, 2019]. With the use of visualizations, large volumes of information can be explored in a more intuitive and efficient manner, aiding analysis and decision-making for expert or laypeople.

In healthcare, where large volumes of data exist, data visualization helps transform this data into understandable and accessible information, facilitating decision-making and the monitoring of health conditions [Dowding *et al.*, 2015]. The effective implementation of visualizations in healthcare allows doctors, researchers, and administrators to quickly interpret complex information, identify relevant patterns, and track patient progress in a dynamic and interactive manner.

Usability issues are the critical aspects in the development of tools for visualization and epidemiological analysis of infectious diseases. According to Carroll *et al.*, there is a preference for tools that assist users in evaluating disparate and complex high-quality data while preserving usability, interoperability, data sharing, and confidentiality. The use of dynamic and interactive graphics generates significant interest among users by enabling the review of data at different levels. This functionality allows users to explore data incrementally, assessing both the overall landscape and finer details. Other features valued include common interface functionalities such as zoom, pan, search, filter, save, undo, and work history [Carroll *et al.*, 2014].

2.3 Related Works

In current literature, some studies have proposed the identification of spatial patterns of leprosy cases to guide preventive actions. Ortuño *et al.* [Ortuño-Gutiérrez *et al.*, 2021], for example, employed a geospatial analysis to identify clusters of leprosy cases in Comoros and Madagascar, using spatial statistics to direct more effective public health interventions. Taal *et al.* [Taal *et al.*, 2022], on the other hand, focused their study on India, comparing methods to identify clusters of leprosy patients, combining statistical approaches and domain experts knowledge to define clusters more precisely.

Three other studies focused on the development of solutions aimed at analyzing spatiotemporal information from hyperendemic leprosy cities in the Northeast and North regions of Brazil. Queiroz *et al.* [Queiroz *et al.*, 2010] and Taal *et al.* [Taal *et al.*, 2023] applied statistical analysis techniques in conjunction with Geographic Information Systems (GIS) in the cities of Mossoró and Fortaleza, respectively, to facilitate the visualization of areas with higher epidemiological risk for leprosy, as well as the correlation of these areas with socioeconomic indicators. In the city of Fortaleza, data relating to COVID-19 and tuberculosis were also included in the study. Barreto *et al.* [Barreto *et al.*, 2014] conducted a similar analysis in the city of Castanhal; however, it included serological data from household contacts of individuals affected by leprosy and from schoolchildren in the general population.

In Brazil, the Ministry of Health provides three dashboards to explore public data on leprosy cases. The dashboard *Indicators of Basic Leprosy Data in Brazilian Municipalities* [1] uses 16 tables to present the number of new leprosy cases by age group, sex, race/color, education level, operational classification (only for the multibacillary class), GIF (only for the GIF 2 class), entry and detection modes, and cure proportion. In this dashboard, the only visual elements used to facilitate data visualization are bar and line charts, which show the evolution of data over time, from 2015 to 2023, extracted from the SINAN database.

The dashboard *Quality of Leprosy Data in Brazilian Municipalities* [2] uses 29 tables to present the number of new cases, their respective operational classifications (PB and MB), the therapeutic schemes used, the percentage of contacts examined relative to the number of recorded contacts, the clinical form of the disease, the result of the bacilloscopy exam, and cases with incomplete records of clinical and sociodemographic data. This dashboard does not present any visual elements to facilitate the data exploration and only covers the last three years avaliable in the SINAN database (2021 to 2023).

Although more comprehensive and employing various visual elements (such as maps, bar charts, line graphs, and age pyramids), the *Historical Series of Leprosy Indicators* dashboard[3] was not developed based on usability aspects validated by end users of the information. As a result, it is limited to a descriptive presentation of the data and fails to highlight important relationships among the displayed attributes.

Our work aims to overcome the limitations of existing systems by creating and documenting the requirements used in the development of a data visualization dashboard in the healthcare domain. The primary goal is to introduce a tool that enhances both data collection and analysis in the battle against leprosy.

3 Materials and Methods

Aligned with the *Design Science Research* (DSR) paradigm [Koskinen, 2011], which advocates that scientific knowledge can be obtained through the iterative construction and evaluation of artifacts to solve real problems, the method used in this work follows the steps proposed in the *Nested Model* [Munzner, 2009, 2014], a *framework* widely used by the Data Visualization community for the design and validation of interactive visualizations and *dashboards*.

The *Nested Model* advocates that the process of developing interactive visualizations should be conducted following four nested and interdependent levels of design and validation. In the first level, *domain problem and data characterization*, the focus is to understand the domain under analysis and the users' needs, identifying the problems to be solved and the characteristics of the data. The second level, *task and data abstraction*, involves mapping the problem and domain-specific data to abstract and generalized descriptions in the language of computer science. In the third level, *design of visual encodings and interaction*, the visual representations and interaction techniques necessary to communicate the data clearly and intuitively to users must be defined. In the final level, *implementation*, the visual encodings and interaction techniques should be implemented efficiently using some programming environment or language. Each level includes specific validation methodologies to identify and mitigate potential threats to validity, such as inappropriate visual encodings.

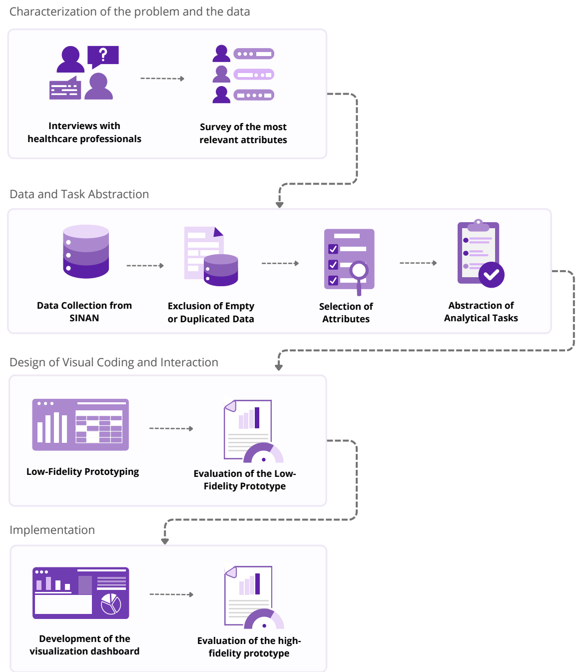

Figure 1. Design process, following the stages proposed by the *Nested Model*

Figure 1 illustrates the design process used in this work, organized according to the steps proposed in the *Nested Model*, which are detailed in the following subsections.

3.1 Domain problem and data characterization

In this stage, with the aim of understanding the context of the disease and the data, the needs of the users, and identifying the most relevant attributes for building the dashboard, we conducted semi-structured interviews with three healthcare professionals working in the leprosy field. Among the participants were two biomedical professionals and one nurse. The interviews were conducted individually and remotely with each participant through the Google Meet platform. We recorded the interviews in audio, which were transcribed and analyzed using Thematic Analysis [Braun and Clarke, 2012].

The interviews were structured in two stages. In the first one, focused on better understanding the domain, the professionals answered the following questions:

1. What are the main characteristics and symptoms of leprosy?
2. What are the stages of leprosy and how is it typically diagnosed?
3. What are the treatment options and their effectiveness?
4. What are the main challenges in controlling and eradicating leprosy, and what public policies have been implemented to address these challenges?

In the second stage, we asked the same professionals to rate the relevance of each attribute available in the SINAN

[1] `http://indicadoreshanseniase.aids.gov.br`
[2] `https://inconsistenciashanseniase.aids.gov.br`
[3] `https://www.gov.br/saude/pt-br/composicao/svsa/cnie/painel-hanseniase`

database[4], a national database that collects records of various notifiable health conditions in Brazil, including leprosy, for a monitoring system. The participants assessed each of the 83 attributes in the database using a scale from 1 to 5, where 1 indicates that the attribute is considered irrelevant and 5 represents a highly relevant attribute. Based on the scores received, 41 attributes were selected for the next stage (those that scored 4 or higher), divided into three groups: **Individual Notification**, **Investigation**, and **Contacts**, according to the SINAN data dictionary.

Finally, to better assess the relevance of the 41 selected attributes, we conducted a new round of evaluation through an online form, where six healthcare professionals, including the three professionals who took part in the first round, rated each of the 41 attributes using a scale from 1 to 5. The goal of this new stage was to identify only the most relevant attributes among those previously selected, thus reducing the data dimensionality. After this new evaluation, the 23 attributes that scored 4 or higher were selected for the development of the dashboard.

3.2 Data and task abstraction

In this stage, we collected and preprocessed the dataset, and also identified the user analytical tasks needs. The data was collected from SINAN and pre-processed to remove empty or duplicate records, resulting in a final dataset of 923,920 records and 81 attributes, covering the period from 2001 to 2023. From the original attributes, the 40 deemed irrelevant by the experts were removed.

The main analytical tasks that the dashboard should perform to meet the demands mentioned by the interviewed healthcare professionals were also documented. The selected attributes and tasks will be presented in Section 3.4.

3.3 Design of visual coding and interaction

This stage was dedicated to ideation and low-fidelity prototyping for selecting visual encodings, layout, and interactivity techniques to be used in the dashboard. Figure 2 illustrates the low-fidelity prototypes developed in this stage using the Canva tool. The screen division in the prototype aimed to follow the same division of attributes present in the SINAN manual and tabulation.

These prototypes were evaluated by the same three healthcare professionals who participated in the interviews conducted in the first stage. Their suggestions regarding the arrangement of visual elements, terminology, and layout were considered during the construction of the high-fidelity prototypes in the next stage.

3.4 Implementation and usability evaluation

Finally, in this stage, the final version of the dashboard was developed using the Microsoft Power BI platform, offering interactive visual elements based on the selected attributes and the user suggestions during the evaluation of the low-fidelity prototypes. The dashboard is available at: `https://dashhansen.dotlabbrazil.com.br`. The dashboard will be presented in detail in the next section.

[4]`http://portalsinan.saude.gov.br/hanseniase`

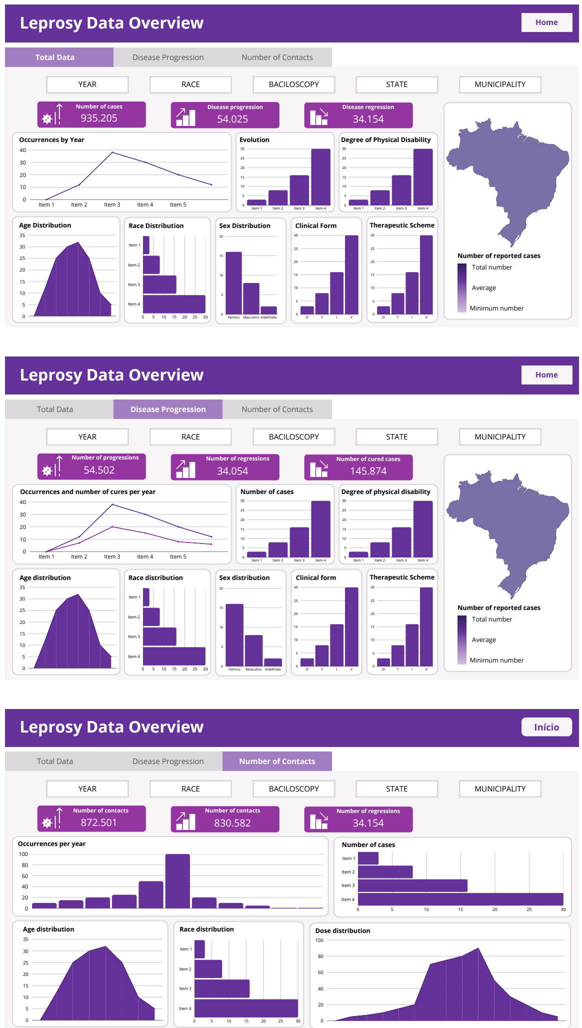

Figure 2. Low-fidelity prototypes used for initial validation

This version underwent a task-based usability evaluation [Lam *et al.*, 2012], which involved five healthcare professionals: three biomedical scientists, one nurse, and one nursing technician. Each evaluation was conducted individually and remotely via the Google Meet platform, following the protocol described below:

1. The participants accessed the dashboard, available online, from their own computers and were asked to share their screen during the interaction with the tool;
2. The facilitator asked the participant to complete the tasks described in Table 1, without assistance from the facilitator;
3. The sessions were recorded, and the data were analyzed both qualitatively (using deductive Thematic Analysis Braun and Clarke [2012] focusing on two categories: questions and difficulties raised during the execution of the tasks) and quantitatively (focusing on the task completion time and number of errors made).

In the next sections, we describe the results of the data and task abstraction (Section 4), the final version of the dashboard (Section 5), and the findings from the usability evaluation (Section 6).

4 Results of the attribute evaluations

Tables 2, 3, and 4 show the scores assigned to each attribute in the database across two rounds of evaluation conducted with experts, separated by SINAN form. As previously mentioned, only attributes with a final average score equal to or greater than 4 in the last evaluation were selected to build the dashboard.

We can notice from the scores on Tables 2 and 3 that from all sociodemographic attributes, only the notification year, diagnosis date, age, gender, and state were considered highly important; race, pregnancy status, occupation, and educational level, for instance, were left out, which may reveal the domain experts knowledge about the disease characteristics, but also some kind of bias or blind spots that automatic attribute analysis (e.g. via Machine Learning models) may reveal important. On the other hand, most attributes related to the anamnesis (Table 3) and almost half of the Contacts Form (Table 4) were considered important for epidemiological analysis.

This classification may contribute, beyond the scope of the present work, as a starting point for other researchers interested in developing tools using the same database, as it reflects the priorities of field specialists regarding the data collected by SINAN.

Table 5 lists the analytical tasks identified as relevant to the domain, based on interviews conducted with experts, as well as the required attributes and the visual encodings chosen to support each task. This mapping, as discussed by Munzner [Munzner, 2009], is important to justify the choice of visualizations and can be reused by other researchers in future work.

5 Final version of the dashboard

The final version of our dashboard, which is organized into three sections, is shown in Figures 3, 4, and 5. The following subsections describe each of these sections.

5.1 Overview Section

The *Overview* section (Figure 3) presents general data about the disease, such as the total number of registered cases, as well as highlighting the cases that showed regression and those that progressed to more severe stages. The visualizations available in this section are, from left to right:

- Bar chart showing cases by GIF status, categorizing patients into different levels, from GIF 0 (no disabilities) to GIF2 (neurological impairment), including a “Not assessed“ group.
- Bar chart representing the distribution of clinical forms of the disease (indicated by the letters D, T, I, V, and “Unclassified“), which contributes to the understanding of the most common manifestations.
- Choropleth map showing the distribution of cases by state in Brazil, offering a geographical view of the disease’s spread.
- Line chart “Occurrences per year“, representing the evolution of cases over the years, allowing the identification of peaks and drops in the disease’s incidence. The sudden drop in the last data point represents the current year, which is not yet complete in the dataset.
- Bar chart showing the number of cases according to the disease’s progression to more severe stages.
- Bar chart describing the most commonly used therapeutic schemes in treatment.
- Area chart representing the distribution of disease cases by age.
- Bar chart showing the distribution of cases by race.
- Bar chart showing the distribution of cases by gender.

5.2 Evolution Section

The second section, *Evolution* (Figure 4), focuses on the analysis of cases considering the different stages of the disease, classified by GIF. The visualizations available in this section, from left to right, are:

- Bar chart “Physical Disability Grade“, which shows the distribution of cases by grade.
- Sankey diagram “Distribution and Evolution of Evaluation Grades“, which represents the transition between GIFs throughout treatment, such as the number of cases that progressed to a higher grade, regressed or remained stable.
- Choropleth map similar to the one in the “Overview“ section.
- Stacked bar chart “Occurrences per Year“, which displays, from the total number of cases per year, the proportion that progressed to a more severe disability grade (darker purple) and the proportion that were cured (lighter purple).
- Distribution charts by age, race, and therapeutic scheme, similar to those in the “Overview“ section.

5.3 Contacts Section

The third section, *Contacts* (Figure 5), focuses on tracking the contacts that notified patients had with other individuals, an important factor for disease transmission control [Wang *et al*., 2020]. The visualizations available in this section, from left to right, are:

- Stacked bar chart “Occurrences per Year“, which compares the number of cured cases (darker purple) to other outcomes (lighter purple) over the years.
- Line chart “Registered Contacts per Year“, which shows the annual number of contact records. As in the “Overview” section, the sudden drop in the last data point represents the current year, which is not yet complete in the dataset.
- Bar chart “Number of Contacts Reported by Patients“, which details the distribution of the number of contacts reported by each notified patient.
- Area chart “Doses Received per Year“, which represents the history of doses administered over the years.

In addition to the visualizations described in the three sections of the dashboard, users can also use the filters at the top to filter data by race, bacilloscopy, federative unit, and year. All visualizations also support cross-filtering; for example: it is possible to select only patients with GIF0 in the *Overview* section by clicking on the corresponding bar.

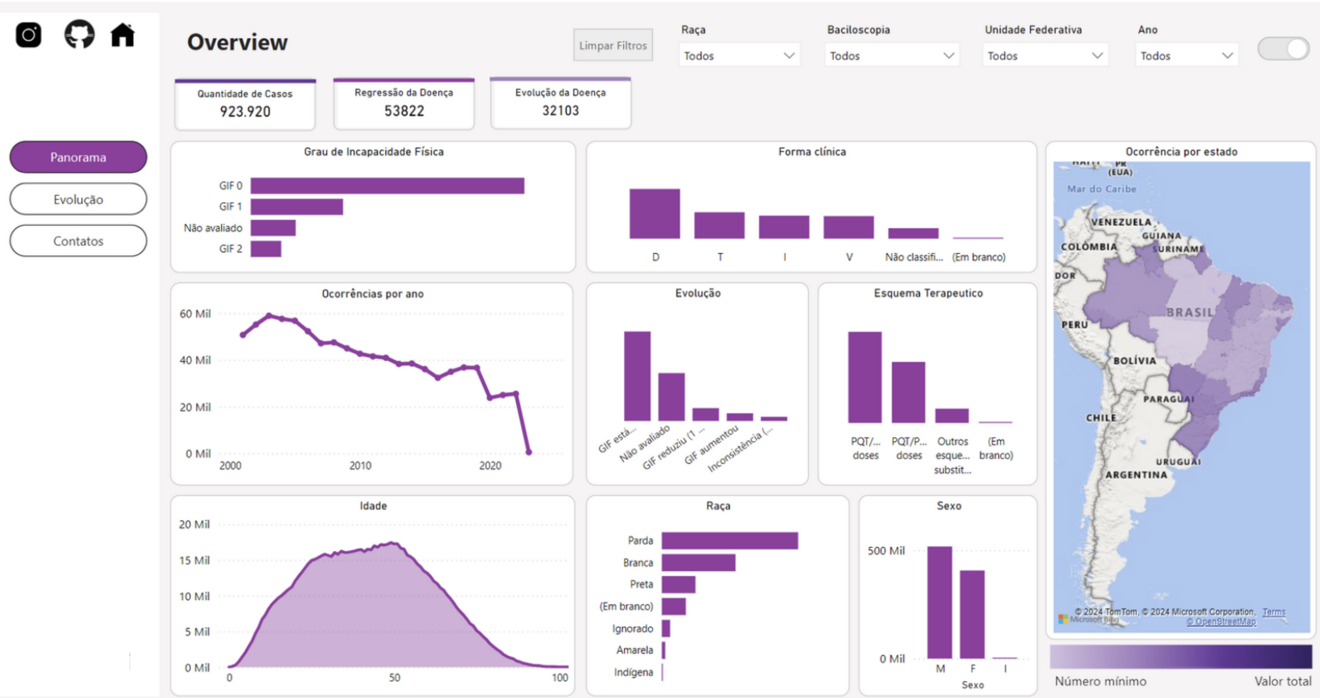

Figure 3. Final version of the dashboard, "Overview" section

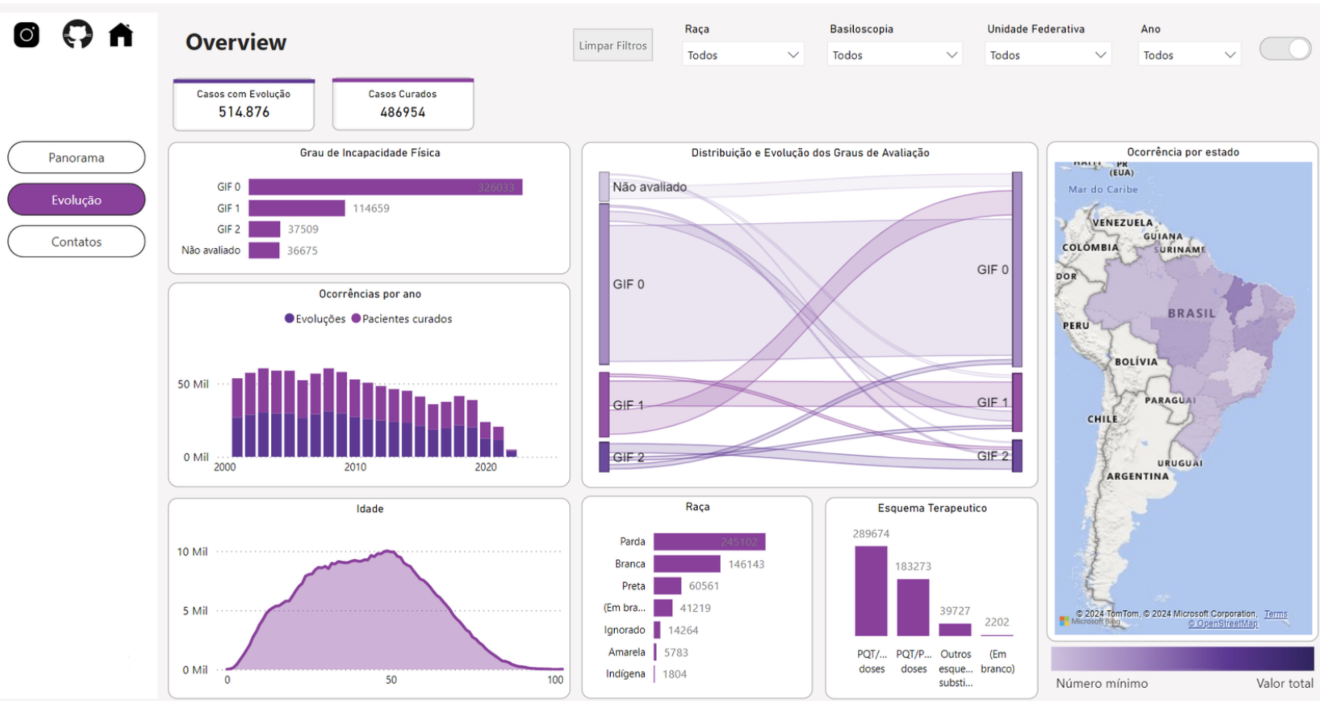

Figure 4. Final version of the dashboard, "Progression" section

6 Usability Evaluation

We performed a usability evaluation with the final dashboard based on analytical tasks. Figure 6 shows the distribution of time spent on the three tasks assigned to participants (cf. Table 1). In Task 1, related to the *Overview* section, execution times varied considerably among participants. Simpler subtasks, such as filtering and navigating between sections (e.g. subtasks 1.1, 1.6, 2.1, 2.3, 3.1, and 3.2), took less time as expected, suggesting that basic navigation through the dashboard did not present difficulties for the participants. However, tasks 1.3 and 1.5 showed greater variation in execution time, which may indicate different levels of ability among participants to interpret distribution graphs.

Regarding Task 2, associated with the *Evolution* section, subtasks 2.2 and 2.4 generally took more time to complete, while subtasks 2.5 and 2.6 were completed more quickly by all participants. For subtask 2.2, the various filters to be applied may have influenced the duration, while in subtask 2.4 the inherent complexity of the Sankey diagram posed greater interpretative challenges — two participants did not understand that it represented a disease progression flow chart.

Finally, in Task 3, related to the *Contacts* section, the

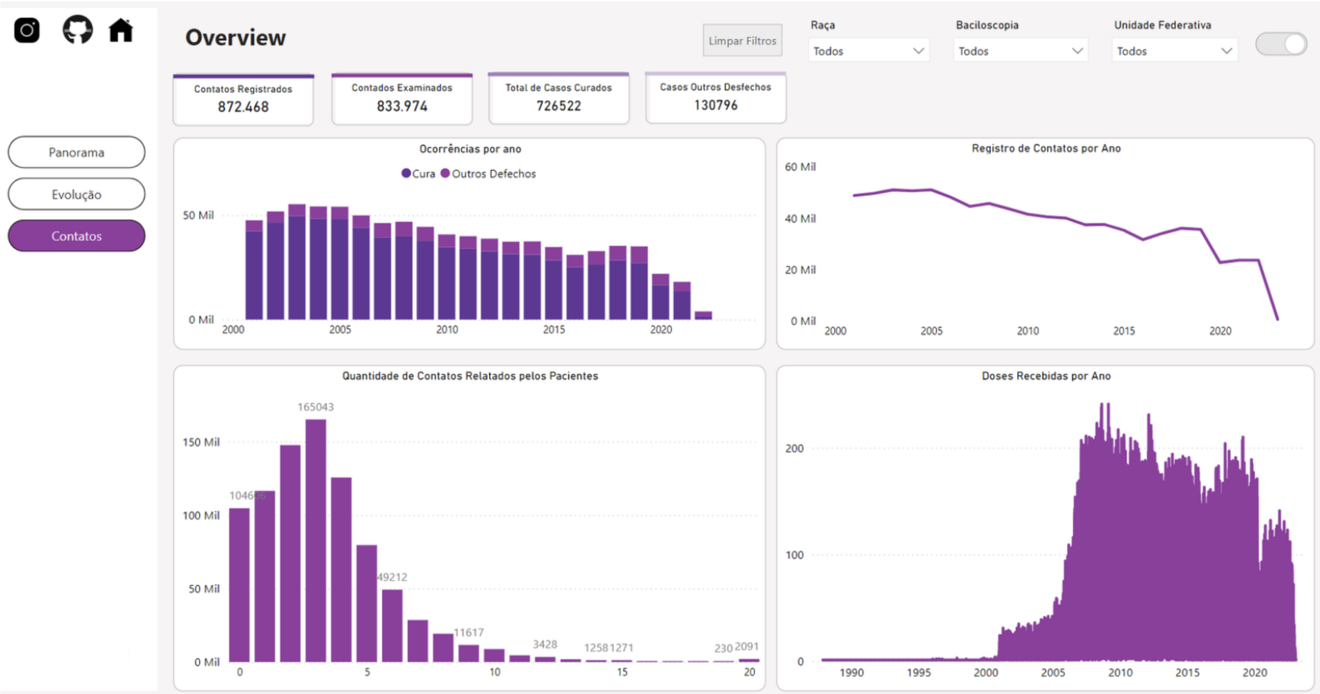

Figure 5. Final version of the dashboard, "Contacts" section

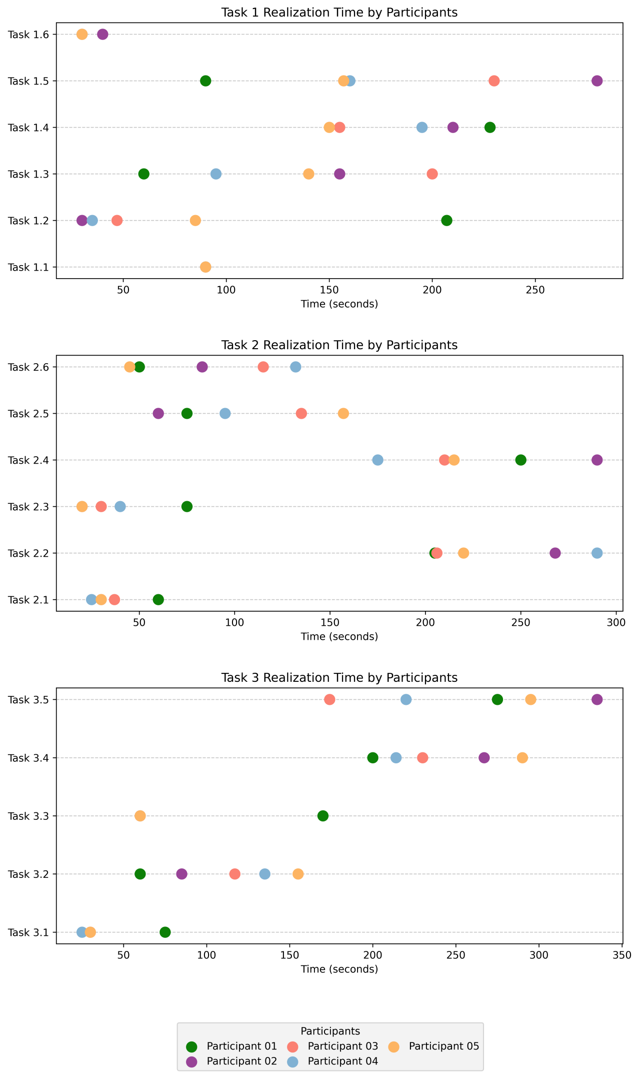

Figure 6. Task execution time by participants

most time-consuming subtasks were 3.4 and 3.5, which required analyzing the variation and number of contacts reported over the years. In subtask 3.4, despite using a simple visual representation (line chart), the concept of "contacts per year" may have made comprehension difficult, and one participant verbally expressed this difficulty. In subtask 3.5, none of the participants were able to correctly interpret the information represented by the chart; most assumed it was a distribution graph of another disease-related index, such as the number of registered cases.

We also analyzed the completion rates for each subtask, as shown in Figure 7. As previously mentioned, no participant successfully completed subtask 3.5. Subtask 1.3, which also had a higher average completion time (cf. Figure 6), was affected by some participants' unfamiliarity with the clinical form codes of the disease. Lastly, subtask 2.4, involving the Sankey diagram, also had lower completion rates.

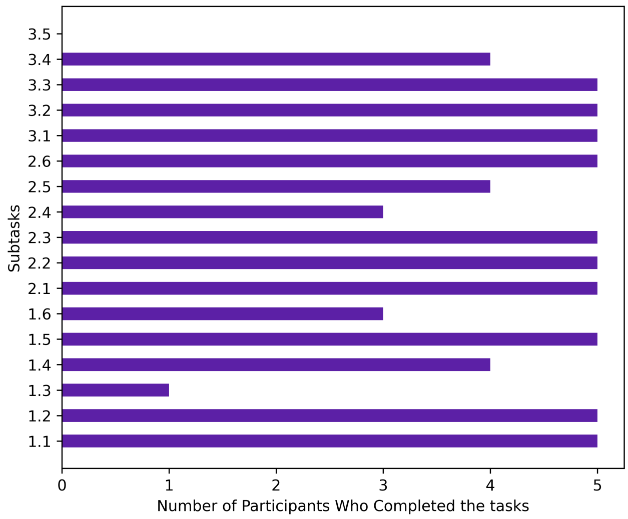

Figure 7. Task completion rates

However, the usability experiments indicated that some features, such as the application of specific filters and temporal analysis, still present complexities that affect the user experience, especially when analyzing multiple attributes. Although the dashboard meets most accessibility and clarity requirements, it can be improved to enhance navigation and make the experience more intuitive, particularly for professionals less familiar with complex visualization tools.

Some suggestions include adding explanatory legends and detailed descriptions to facilitate the understanding of acronyms and the visual structure of the charts, as well as making the "clear filters" button more prominent and accessible. The graphical representation of data on contacts was also reported as confusing, with a recommendation to restructure the chart and its legends to improve the interpretation of the information.

7 Conclusions and future works

The usability evaluation results suggest that, despite occasional difficulties with some visualizations, the dashboard was able to support healthcare specialists in exploratory analysis tasks of epidemiological data on leprosy, indicating its potential for use in decision-making support.

Among the limitations of this study is the small sample of participants in the usability test (which also made it unfeasible to use validated questionnaires to quantitatively measure aspects such as perceived usefulness and ease of use) and the lack of a evaluation on how the tool may impact the day-to-day activities of health professionals. In future work, we intend to improve the visualizations that presented greater difficulties during the evaluation; add more explanatory elements; conduct new tests with a larger number of participants, analyzing how the tool impacts the health professionals work on production environment; and incorporate predictive analysis functionalities, enabling health managers to anticipate outbreaks and allocate resources more effectively.

Declarations

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Authors' Contributions

RAD contributed to the Conceptualization of the study. ABS was the primary contributor and main Author, being responsible for the Investigation, Writing – Original Draft Preparation, and Methodology. HGVA and 4 PTE contributed to Writing – Review & Editing, providing critical revisions and improvements to the final version of the manuscript.

Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

Supressed for blind review The software (dashboard) generated during the current study are available at `https://dashhansen.dotlabbrazil.com.br` and the dataset analysed during the current study will be made upon request.

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Table 1. Tasks proposed to participants during the usability evaluation

Task	Provided instructions	Related dashboard component
1.1	Access the first section, called Overview.	None
1.2	What is the total number of registered leprosy cases?	Card 1
1.3	What can you observe about the distribution of clinical forms D, T, I, V over the years?	Clinical Form
1.4	In the 'Race' chart, compare the number of cases between the races Brown, White, and Black.	Race
1.5	Select 'Brown' in the Race filter and identify the distribution of cases by year for people with this profile.	Occurrences by Year
1.6	Clear the selected filters.	None
2.1	Access the Evolution section through the menu.	None
2.2	Select 'White' in the Race filter, 'Amapá' in the Federative Unit filter, and 'Positive' in the Bacilloscopy filter. Identify the total number of cases with progression and the number of cured cases.	All
2.3	Clear the selected filters.	None
2.4	What can you identify in the chart 'Distribution and Evolution of Evaluation Grades'?	GIF Distribution
2.5	How many patients reported as GIF 0 progressed to GIF1?	GIF Distribution
2.6	In the 'Age' chart, which age group has the highest number of cases?	Age
3.1	Access the Contacts section through the menu.	None
3.2	Select 'Black' in the Race filter, 'Ignored' in the Bacilloscopy filter, and 'São Paulo' in the Federative Unit filter. Identify the total number of recorded contacts.	Card 1
3.3	How many contacts were examined within these filtered characteristics?	Card 2
3.4	In the 'Contact Records by Year' chart, identify the variation in the number of contacts per year.	Contact Records by Year
3.5	What conclusions can you draw from the 'Number of Contacts Reported by Patients' chart?	Number of Contacts per Patients

Table 2. Attribute evaluation - Individual notification form

Attribute	Average eval. 1	Average eval. 2	Selected (Y/N)
Aggravation	3	N/A	N
Notification Year	5	5	Y
Neighborhood	5	3	N
Phonetic Key	0	N/A	N
Notification Date	4	3	N
Data Entry Date	3	N/A	N
Date of Birth	0	N/A	N
Transfer Date from Regional Health	2	N/A	N
Transfer Date from Municipal Regional	2	N/A	N
Transfer Date from State Health Secretariat	2	N/A	N
Transfer Date from Municipal Health Secretariat	2	N/A	N
Transfer Date from Health Unit	2	N/A	N
Transfer Date from Municipal District	2	N/A	N
Diagnosis Date	5	5	Y
Soundex Description	0	N/A	N
District	5	3	N
Education Level	4	1	N
Return Flow	3	N/A	N
Pregnant	5	3	N
Age	5	4	Y
Micro Identification	0	N/A	N
Street Name	0	N/A	N
Horizontal Lot Number	0	N/A	N
Vertical Lot Number	0	N/A	N
Notification Municipality	3	2	N
Residence Municipality	4	1	N
Notification Number	0	N/A	N
SUS Card Number	0	N/A	N
Mother's Name	0	N/A	N
Neighborhood Name	0	N/A	N
Patient's Name	0	N/A	N
Street Number	0	N/A	N
Country	4	N/A	N
Race/Color	5	1	N
Received by Return Flow	3	2	N
Regional Health	2	3	N
Diagnosis Week	5	2	N
Gender	4	4	Y
Notification Type	3	3	N
State (UF)	5	4	Y
Notification State (UF)	5	3	N
Health Unit	5	2	N

Table 3. Attribute evaluation - Investigation form

Attribute	Avg. eval. 1	Avg. eval. 2	Selected (Y/N)
Patient number	0	N/A	N
Occupation	2	N/A	N
Number of skin lesions	5	4	Y
Clinical form	5	5	Y
Operational classification	5	4	Y
Number of affected nerves	5	N/A	N
Physical disability assessment in diagnosis	5	4	Y
Entry mode	5	4	Y
New case detection mode	5	4	Y
Bacilloscopy	5	4	Y
Treatment start date	5	N/A	N
Initial therapeutic regimen	5	4	Y
Number of registered contacts	5	4	Y
Identifies migration	0	N/A	N

Table 4. Attribute evaluation - Contacts Form

Attribute	Avg. Eval. 1	Avg. Eval. 2	Selected (Y/N)
Current service state UF	5	2	N
Current service municipality	4	3	N
Current notification number	5	N/A	N
Current notification date	5	N/A	N
Current service unit	5	3	N
Current residence state UF	5	3	N
Current residence municipality	5	2	N
ZIP Code	5	N/A	N
Current residence district	5	N/A	N
Current residence neighborhood	2	2	N
Last attendance date	5	4	S
Current operational classification	5	4	S
Physical incapacity evaluation at the time of cure	5	4	S
Current therapeutic regimen	5	4	S
Supervised dose count	5	4	S
Reactive episode during treatment	5	4	S
Treatment regimen change date	4	N/A	N
Number of examined contacts	5	4	S
Exit type	5	4	S
Discharge date	4	N/A	N
Linkage	3	2	N
Vertical transfer of investigation and Contacts	0	N/A	N
Address (street, avenue, etc.)	0	N/A	N

Table 5. Analytical tasks, associated attributes, and proposed visualizations

Visual representation	**Associated task(s)**	**Attributes**
Bar chart (Grade of Impairment Function - GIF)	Analyze the distribution of cases according to Grade of Impairment Function (GIF0, GIF1, GIF2) and identify possible trends.	Physical disability assessment
Bar chart (Clinical form)	Identify the most common clinical forms among patients and monitor their distribution.	Clinical form
Line chart (Occurrences per year)	Assess the temporal evolution of registered cases to monitor patterns of increase or decrease.	Year, Physical disability assessment
Density chart (Age)	Examine the predominant age group of affected patients.	Age
Bar chart (Evolution)	Monitor the progress of cases regarding clinical evolution, such as reduction or increase in GIF.	Physical disability assessment, Current physical disability assessment
Bar chart (Therapeutic scheme)	Check the use of different therapeutic schemes adopted.	Initial therapeutic scheme
Bar chart (Race)	Analyze the distribution of cases by race to identify potentially more affected groups.	Race
Bar chart (Sex)	Evaluate the prevalence of cases among male and female patients.	Sex
Heat map (Occurrence by state)	Visualize the geographic distribution of cases to identify the most affected regions.	Federal unit, Physical disability assessment
Stacked line chart (Occurrences per year - Evolutions and Cured Patients)	Monitor the number of cured patients and the evolution of registered cases over the years.	Year, Physical disability assessment, Current physical disability assessment, Discharge type, Admission mode
Density chart (Age)	Assess the predominant age group of patients with evolution or cure.	Age, Physical disability assessment, Current physical disability assessment
Sankey diagram (Distribution and Evolution of Evaluation Grades)	Track the transition between evaluation grades (GIF) over time to identify patterns of evolution or stagnation.	Physical disability assessment, Year
Bar chart (Therapeutic Scheme)	Examine the frequency of use of therapeutic schemes and identify which are most used in relation to evolution or cure.	Initial therapeutic scheme, Physical disability assessment, Current physical disability assessment
Line chart (Registered Contacts per Year)	Monitor the number of registered contacts per year to identify trends of increase or decrease.	Year, Number of contacts
Bar chart (Number of Contacts Reported by Patients)	Check how often patients report contacts, highlighting possible differences in different time intervals.	Number of contacts
Area chart (Doses Received per Year)	Analyze the distribution of doses received over the years to evaluate treatment or vaccination coverage.	Year, Doses received, Date of last visit