

# Informing the Canadian public about health topics using dashboards:

## Examining the usability and identifying opportunities to improve dashboards for communicating health information

### INTRODUCTION

Dashboards and data analytics are widely used to inform decision-making across many fields, including healthcare. Dashboards refer to collections of data visualizations that collaboratively serve as tools to gain 'insights and understanding in a dataset, or more generally to amplify cognition' (Zuk et al., 2006). The ongoing COVID-19 pandemic has augmented the popularity and public awareness of dashboards and information visualizations include:

As dashboards become more common, usability factors appear to be increasingly important as poor design can often lead to false interpretations of data or only obtaining partially meaningful insights (Kellogg et al., 2017). According to LeRouge et al. (2017), some common usability concerns in dashboards and information visualizations include:

- Deceptive visual cues with graphs and labelling;
- Weak perceptual organization of connected information;
- Unconventional graphical formats with ineffective visual prioritization.

For this research, tuberculosis (TB) was chosen as the public health subject for dashboard evaluation and development. TB is one of the most common infectious diseases and is actively monitored by Canadian health agencies. Despite being classified as both 'preventable' and 'curable', the overall prevalence of TB has not decreased in Canada over the past decade, and potential co-infections continue to result in high mortality rates (Health Canada, 2022). To this end, this study first sought to evaluate a sample of public health dashboards using established usability principles. These heuristics and evaluation findings would then inform the design of a prototype dashboard.

### METHODS

Heuristic evaluation is a method of assessing user interfaces and reporting usability problems based on a defined list of heuristics or design guidelines (Zuk et al., 2016). Using a set of heuristics developed by Dowding and Merrill (2018), the evaluator assessed three public TB dashboards as described in Table 1.

To evaluate each dashboard, the evaluator presumed the role of a public health officer using dashboards to find answers for basic epidemiological statistics that influence TB management (e.g., overall prevalence, mortality, treatment, and prevalence of drug-resistant tuberculosis). Each usability problem identified was assessed using Nielsen's severity ratings: cosmetic, minor, major, or catastrophic (1994).

The respective strengths and weaknesses revealed for each dashboard through the heuristic evaluation process, as well as the usability principles themselves, guided the production of an improved prototype dashboard. The prototype was built with Tableau using publicly available datasets to illustrate TB in British Columbia (BCCDC, 2018).

Table 1 - Background summary of the chosen TB dashboards

Dashboard Name	Brief Description
USAID	Developed as part of the U.S. Government Global Tuberculosis Strategy to support the USAID TB priority countries.
StopTB	Developed by StopTB Partnership, including 1600 international organizations and patient groups. Administered by UN Office for Project Services.
Western Cape	Developed by the Government of the Western Cape province of South Africa.

### RESULTS

#### Part 1: Heuristic Evaluation

This evaluation revealed that USAID had the fewest number of usability issues (2) compared to StopTB (6) and Western Cape (6) (Figure 1). The majority of identified violations were rated as cosmetic and minor in severity level, with only one major usability problem identified. A summary of the strengths and weaknesses identified in the three TB dashboards is provided in Table 2 below.

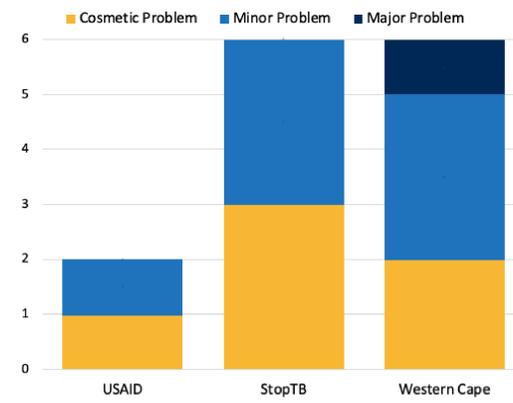


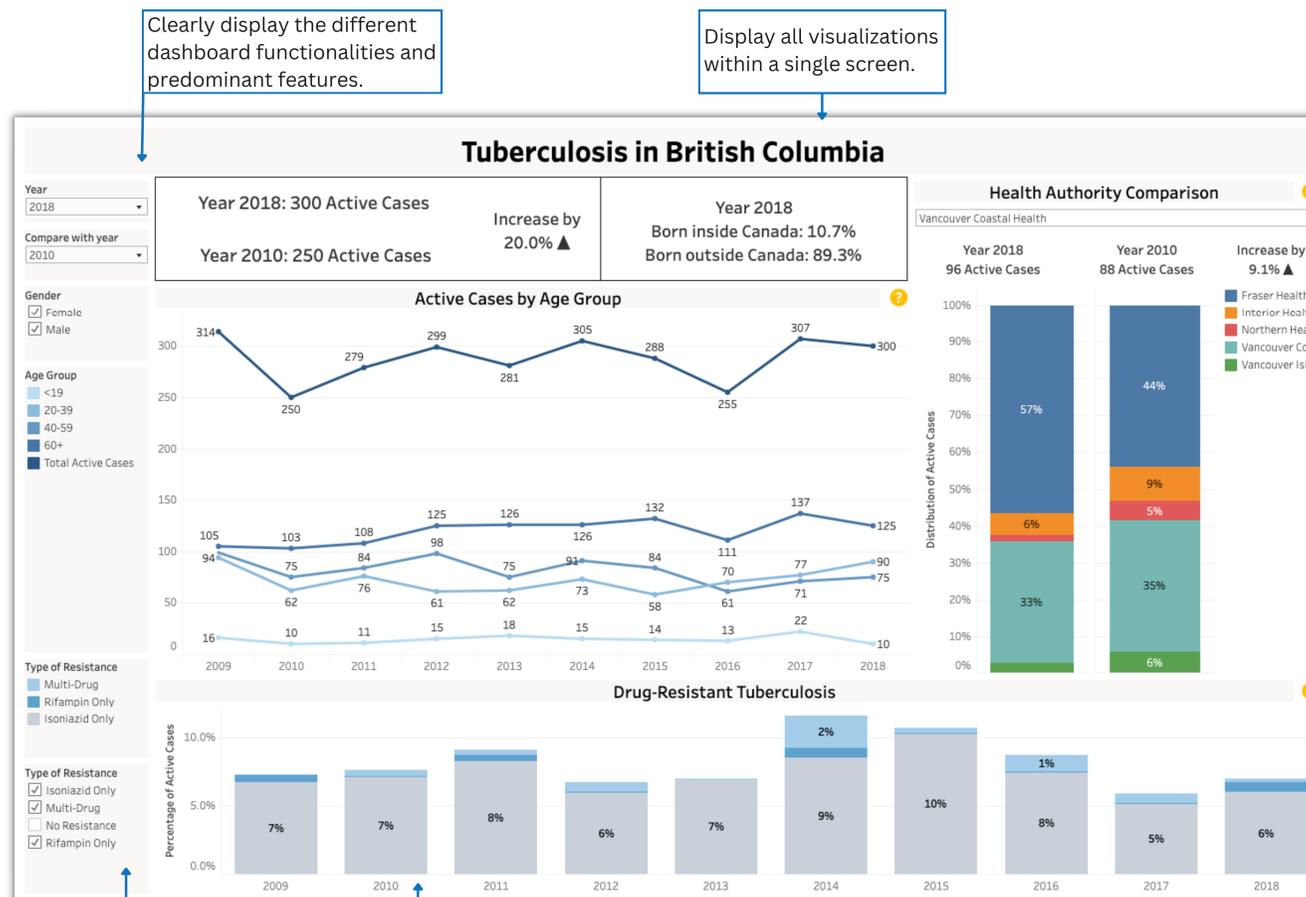
Figure 1 - Frequency of heuristic violation

Table 2 - Summary of strengths and weaknesses

Strengths	Weaknesses
Appropriate information coding with conventional characters and symbols.	Limited flexibility in navigating the dashboard content and central display.
Sufficient orientational contextual information to support the main content.	Contain extraneous information and redundant design features.
User-friendly language with familiar concepts and a reasonable logical convention.	Limited system visibility with data elements scattered across the page.

#### Part 2: TB in BC Prototype Dashboard

This prototype dashboard was informed by the results from the heuristic evaluation and adhered to the heuristics to effectively illustrate TB in British Columbia. Some outstanding characteristics of this dashboard are highlighted in the snapshot below.



Clearly display the different dashboard functionalities and predominant features.

Display all visualizations within a single screen.

Place relevant filters next to the corresponding graph and figures.

Use a consistent colour scheme on filters and graphs (for identifying different categories).

Use conventional design elements and effectively apply textual descriptions.

### DISCUSSION

The heuristic evaluation revealed that each dashboard had unique strengths and weaknesses that could either facilitate or hinder usability. The most commonly violated principles were those related to minimizing extraneous material and providing effective navigation tools. For example, the StopTB and USAID dashboards presented that offering flexible user navigation and filtering options while displaying key information on a web-based platform can be challenging.

The prototype dashboard served as an example of how the weaknesses of existing TB dashboards could be addressed and how adherence to heuristics could improve overall design and usability. Principles such as **recognition rather than recall** and **spatial organization** guided the placement of filters and legends to facilitate a more effective relationship between various dashboard components. Additionally, the use of question icons with embedded tooltips maintained an **aesthetic and minimalist design** while providing **orientational information** to users. These principles provided evidence-based recommendations for improving the design of public health dashboards to better inform data-driven decision-making.

However, it is important to acknowledge the potential limitations of the research, such as limited assessment of real-life data constraints on achieving certain usability principles during the heuristic evaluation process. Furthermore, the prototype dashboard was influenced by limitations in the data source, including data quality issues that resulted in deviations in total active case counts for different statistic groups. Additionally, a lack of connectivity between data groups restricted the ability to establish a more dynamic filtering mechanism using visualizations, which could have further improved user efficiency.

### CONCLUSION

As dashboards become a ubiquitous method of presenting health information, performing heuristic evaluation thus provides essential insights to inform dashboard design or guide improvements. Integrating usability design principles into the creation of health dashboards is crucial for realizing their benefits and obtaining the maximum number of insights possible. Despite pre-existing attempts at applying heuristic evaluation and usability principles to developing information visualizations, their application in healthcare remains limited. It is only by ensuring value and quality that the widespread adoption of dashboards among the Canadian public can lead to more effective communication of healthcare information and ultimately result in an optimal user experience.

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