Transparency of COVID-19 information: a comparison of open data transparency dashboards

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ABSTRACT

This paper aims to analyze the transparency features of COVID-19 dashboard created by Brazil, Germany, The Netherlands, and, United Kingdom governments. These dashboards are webpages that present data in different format, such as text, maps, graphs and tables, and can reduce information asymmetry between the government and people. This paper relies on a combination of varied literature to build a Dashboard Transparency Evaluation Framework: Open Government Data, websites transparency assessment, dashboard functionalities and information flowchart, and collaborative stakeholder participation in open government processes. Based on an exploratory approach this paper adopted the structured search and evaluation method to investigate and evaluate the dashboards portals. This paper concludes that data are shown in different formats in all countries and with different functionalities and thus can help people follow the evolution of the disease and also the policy decision. However there is room to improve transparency, such as the integration of dashboards with open data policies and access to information or the interoperability with legacy systems. Future research can advance in the analysis of the users demand, articulation between stakeholders, state technological capacity among others.

Keywords: dashboards; transparency; open government data (OGD); COVID-19.

INTRODUCTION

The Severe Acute Respiratory Syndrome coronavirus 2 SARS-CoV-2 or COVID-19 has already taken on pandemic proportions in 2020, affecting over 213 countries in a matter of weeks. Remuzzi and Remuzzi (2020) recommended a global response to prepare health systems worldwide to deal with the virus outbreak. Analysis and dissemination of information is an essential front in facing health emergencies like this.

The creation of the health system is heavily connected with Information Systems (IS) that can gather information from private and/or public hospitals. Apparently, in a major part of the countries the governments centralizes data collection, storage, processing and publication.

After statistical processing, such as anonymization of the patient (e.g. name, address, social security number), the data from this governmental centralized health system is published aiming for transparency (Freitas; Dacorso, 2014). The active transparency of this data is commonly labeled as Open Government Data (OGD) (Diniz, 2010; Gregório Filho; Agune; Bolliger, 2010). The passive transparency is commonly associated with Freedom of Information Act – FOIA (Pedroso; Tanaka; Cappelli, 2013), out of the scope of this paper.

The OGD allows the government, people and enterprises to use the disclosed data (Albano; Reinhard, 2015). Data can be used by the government to design and justify public policies and also promote transparency and accountability. Currently, since the need for transparency of COVID-19, governments have been creating webpages with updated data in text, maps, graphs and tables formats about COVID-19. These webpages were defined by this paper as "*dashboards*", since the dashboards combine all these formats to reduce information asymmetry between the government and people.

However, these dashboards do not have technical features and data needed by all stakeholders to properly account COVID-19, reducing the level of transparency of these dashboards. Taking into consideration these issues, this paper aims to analyze the transparency features of COVID-19 dashboard created by Brazil, Germany, The Netherlands, and, United Kingdom governments.

This paper is structured as follows: Section 2 discuss transparency dashboards evaluation methods, section 3 describes the research method, section 4 presents the findings and the international comparison between countries dashboards, and, last, section 5 gives the conclusions of this research. Section 6 contains all references used in this paper.

Transparency dashboards evaluation methods

The disclosure of governmental data gained strength in the last decade associated with the Open Government Data initiative that defined 15 key principles to ensure free data usage, reuse and redistribution and since then has been used as guidelines for data publishing practices and its evaluation (Correa; Souza; Silva, 2019).

In addition to making data available, a subsequent movement revealed an increase in the number of Open Data Portals (ODP), which are web based sites designed to contain data and with features that allow its selection, manipulation and also data crossing (Matheus; Janssen; Maheshwari, 2018).

In recent years, governments have made more use of dashboards that can be defined as "[…] *the visualization of a consolidated set data for a certain purpose, which enables to see what is happening and to initiate actions*" (Matheus; Vaz; Ribeiro, 2018, p. 2). The recent outbreak of the COVID-19 has made dashboards even more popular among governments all over the world in an effort to make available information about the disease.

To evaluate the transparency of COVID-19 dashboards, this paper initially adopts a slightly modified dashboard information flowchart proposed by Matheus, Janssen and Maheshwari (2018) that consist of four stages: (A) data collection, (B) data processing, (C) dashboard structuring, and (D) dashboard publishing. The inclusion of stage C represents an adaptation made in the original version, and other flows that are not part of this research were removed (**Figure 1**).

Matheus and Janssen (2013) proposed a two folded model for websites transparency assessment: interpretation and accessibility of data. The first dimension is related to data collection and the analysis that is possible to do, thus regarding characteristics such as easy of interpretation, information quality, data completeness and update frequency. The dimension of accessibility affects interpretation of data and involves aspects such as simplicity in language, data in an overload format, adherence to standards. In the collection topic, it is also important to considerer the data source to ensure its accuracy and integrity. However, this paper cannot point out if governments have high or low accuracy since there is no accountability of data provided, specially due to the urgency of processing basic statistics from data to publicize numbers of cases and deaths.

Dashboard structuring (Stage C) and Dashboard publishing (Stage D) are interconnected once decisions made about the structure – and its functionalities – will have direct effects on the next phase of data publication. Matheus and Janssen (2013) highlighted the relevance of adhesion to standards as well as a unified use of technology. So, it is relevant to consider the types of technologies used in the platforms, particularly the programming language.

In terms of dashboards functionalities, Matheus, Janssen and Maheshwari (2018) proposed some design principles: customize views, support different views – such as static texts, tables, graphs, and, maps –, clear presentation, interaction support – such as instruction manual, FAQ and any other related documentation –, provide overview and details in the supported views, and ensure institutional support.

Matheus *et al*., (2018) identified nine critical success factors for OGD publication, and three of them are relevant to dashboard transparency evaluation: (i) licensing, (ii) platforms, tools, and services for opening data, and (iii) accessibility, interoperability and standards. In their analysis of communication information in public and private organizations, Moreira, Riccio and Sakata (2007) identified a lack of pattern for information publication and a prevalence of

the formats PDF, HTML and doc, which limits data comparison by the general public. Some type of standardization is important not only to foster communication and data analysis, but also in language programing in order to promote interoperability. The 5 Star Linked Data Model proposes a deployment scale scheme to analyze the maturity of open data, which starts with a single star for PDF documents and that grows with unitary increment: XLS, CSV, RDF, and LOD (Segundo, 2015).

Viana and Toledo (2011) proposed a process flowchart to evaluate transparency portals and emphasized the limitation of written language in developing countries due to functional illiteracy, and also recommended analyzing portals accessibility based on W3C standard. These W3C standards could be easily tested using automatic web based technologies such as International accessibility checker[1].

Abreu and Gomes (2017) highlighted the importance of stakeholders and their collaborative participation in open government processes. For that to happen, government need to adopt an open innovation paradigm, in which stakeholders are called upon to contribute not only in the implementation or evaluation stage, but in the whole policy process (Freitas; Cardoso, 2014).

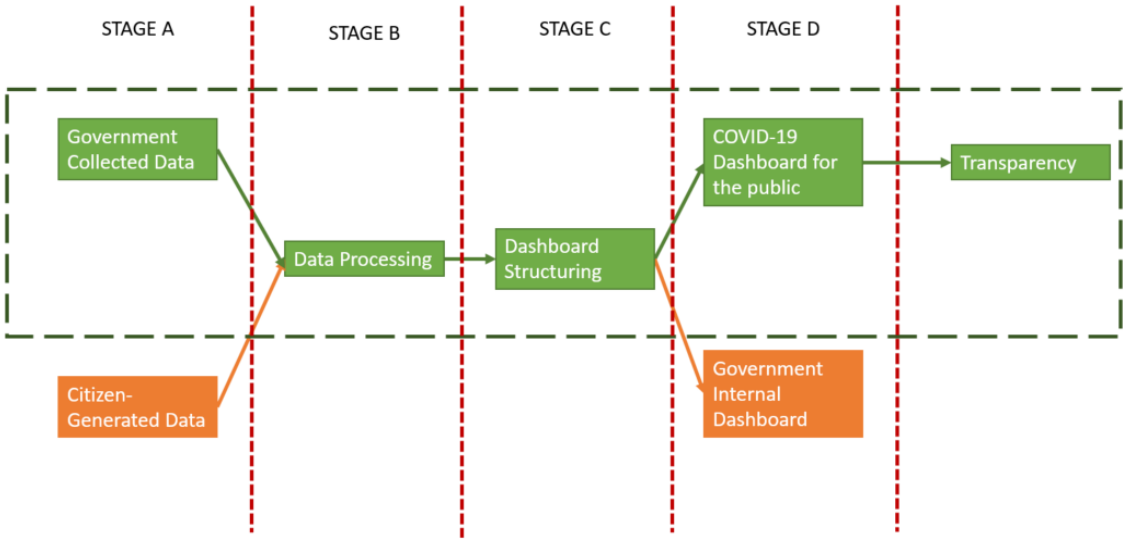
RESEARCH METHOD

This paper uses an exploratory approach (Stebbins, 2001) and the structured search and evaluation method (Matheus; Janssen; Maheshwari, 2018) to analyze the COVID-19 OGD transparency dashboards in Brazil, Germany, The Netherlands, and, United Kingdom. The criteria for these countries' selection are first the contextual relevance, since authors are Brazilian and Brazil can be compared with other countries that have been leading the electronic government transparency. All of them are fighting COVID-19, nevertheless, the pandemic arrived earlier in Europe than South America. Besides that, these countries represent different scenarios: Germany has been recognized for its hard policy to fight against the COVID-19, The Netherlands is one of the top ranked in the e-gov ranks, and the United Kingdom is one of the founders of Open Government movement (OGP).

The search and evaluation is based in the investigation of electronic portals (websites, dashboards, etc.) and its features aiming provide transparency to people. **Figure 1** describes the stages of evaluation proposed by Matheus *et al*., (2018). This paper selected the stages with green boxes, leaving out of the scope the orange boxes as they are related to data produced by citizens using web and mobile application. All the COVID-19 is highly regulated by governments and we considered all this data are governmental data.

1 https://achecker.ca/checker/index.php.

FIGURE 1 - Information Flow and Stages



Source: Adapted from Matheus et al., 2018.

After that, an evaluation is performed, being possible to compare similar transparency initiatives, for instance, different cities or international countries dashboards. All the green boxes contain dimensions of analysis. As an example, the stage C and D are influenced by features of a category called “Accessibility” that can be used to categorize the natural language of dashboards (Portuguese, English, etc.) and the level of accessibility recommended by W3C. This evaluation was created taking into consideration the base of Matheus *et al*., (2018) and other experts in the area, described in the section 2 and **TABLE 1** in the next section summarizes the selected attributes to evaluate the dashboards.

Proposed Dashboard Transparency Evaluation Framework

Table 1- Dashboard Transparency Evaluation Framework

Category	Description/Objective	Flow Stage Related	Source
A- Licensing	1- Identify types of license for the disclosed data .	Stage D- Publishing Dashboard	Matheus, R., Janssen, M., & Maheshwari, D. (2018). Matheus, R., Ribeiro, M. M., & Vaz, J. C. (2018).
B- Interoperability and OGD standards	This category aims to search and evaluate: 1- The level of OGD access based on the Linked Data 5-Stars 2- The level of OGD standards compliance based on the 15 Principles of Open Data	Stage A- Collecting Data Stage B- Data Processing	Alwan et al. (2020). Lourenço, R. P. (2015) Matheus, R., & Janssen, M. (2013) Viana, G. B., & de Toledo, M. B. F. (2011) Moreira, O., Riccio, E. L., & Sakata, M. C. G. (2007). Abreu, W. M. D., & Gomes, R. C. (2018).
C- Platforms and programming languages used	This category aims to search and evaluate: 1- The types of technologies used to create the transparency dashboards, such as programming languages (HTML, Javascript).	Stage C - Dashboard structuring	Matheus, R., & Janssen, M. (2013)
D- Functionalities to promote transparency	This category aims to search and evaluate: 1- The functionalities of the transparency dashboards, such as static texts, tables, graphs, and, maps. 2- Customized views 3- Support to different views 4- Interaction support (Manual, FAQ, Documentation) 5- Provide overview and details 6- Ensure institutional support	Stage B - Dashboard structuring Stage D- Publishing Dashboard	Matheus, R., & Janssen, M. (2013) Viana, G. B., & de Toledo, M. B. F. (2011) Moreira, O., Riccio, E. L., & Sakata, M. C. G. (2007). Abreu, W. M. D., & Gomes, R. C. (2018). Corrêa et al., (2019)
E- Accessibility	This category aims to search and evaluate: 1- The natural languages of the transparency dashboards, for instance, the mother language (Portuguese, German) and English for international audiences. 2- The level of accessibility recommended by W3C.	Stage C - Dashboard structuring Stage D- Publishing Dashboard	Matheus, R., & Janssen, M. (2013) Viana, G. B., & de Toledo, M. B. F. (2011)

Source: elaborated by the authors (2020).

Findings from international comparison of COVID-19 transparency dashboards

The findings present the analysis of the COVID-19 transparency dashboards using the framework created (see **Table 1**) for selected countries and are summarized in **Table 2**.

Table 2 – Categories and Attributes of COVID-19 Transparency Dashboards

Category	Brazil	Germany	The Netherlands	United Kingdom
URL Dashboard	https://covid.saude.gov.br/	https://npgeo-corona-npgeo-de.hub.arcgis.com/	https://www.rivm.nl/en/novel-coronavirus-covid-19/current-information-about-novel-coronavirus-covid-19	https://coronavirus.data.gov.uk/?_ga=2.86816410.343590268.1587809501-1956150173.1587809501
A- Licensing	1- Licensing: None	1- Licensing: None	1- Licensing: None	1- Licensing: Open Government Licence v3.0
B- Interoperability and OGD standards	1- Level OGD access: 3 stars, CSV format. 2- OGD standards: CSV used has no metadata, however, it is structured and objective	1- Level of OGD access: 0 stars, no data to download. 2- OGD standards: N/A	1- Level of OGD access: 3 stars, XLS and CSV format. 2- OGD standards: CSV used has no metadata, however, it is structured and objective	1- Level of OGD access: 4 stars, CSV and JSON format. 2- OGD standards: There is no metadata, however, structured and objective.
C- Programming languages	1- Technology for dashboard: HTML and Javascript	1- Technology for dashboard: ARCGIS web	1- Technology for dashboard: Drupal, HTML and Javascript	1- Technology for dashboard: HTML and Javascript
D- Functionalities to promote transparency	1- Functionalities: Tables, Graphs, Maps 2- Customize views No customization. Static website, no filters or slices, no SQL query 3- Support different views: No other types of views. 4- Interaction Support No manual or any type of support. 5- Provide overview and details: Only for regional state level. Aggregated data. 6- Ensure institutional support: Not in the dashboard, but via mobile app.	1- Functionalities: Tables, Graphs, Maps 2- Customize views Interactive table selecting a region and changing all other features (maps/graphs), without filters or slices, with no SQL query. Maps pop-up of data from selected regions 3- Support different views: No other types of views. 4- Interaction Support No manual or any type of support. 5- Provide overview and details: Only for regional state level. Aggregated data. 6- Ensure institutional support: No institutional support.	1- Functionalities: Static Text, Tables, Graphs, Maps 2- Customize views Static with few links to sources. Low level of interaction, showing only the current number of hospitalized people 3- Support different views: No other types of views. 4- Interaction Support No manual or any type of support. 5- Provide overview and details: Only for local level (city). Aggregated data. 6- Ensure institutional support: No institutional support	1- Functionalities: Static Text, Tables, Graphs, Maps 2- Customize views Static text with summary of data. Static Tables with low level of interactivity. No filters or slices, or SQL query. Static Graphs. 3- Support different views: No other types of views.4- Interaction Support No manual or any type of support. 5- Provide overview and details: Yes, for country, regional, and city level. 6- Ensure institutional support: No institutional support
E- Accessibility	1- Language: Portuguese 2- W3C standards (WCAG 2.0): No problems (zero)	1- Language: German 2- W3C standards (WCAG 2.0): No problems (zero)	1- Languages: Dutch and English 2- W3C standards (WCAG 2.0): 7 problems, 598 potential problems.	1- Languages:English 2- W3C standards (WCAG 2.0): No problems (zero)

Source: Created by the authors (2020).

Dashboards inspection according to the categories provides basic information about the initiatives. It also allows raising some relevant questions about implementing transparency dashboards in health emergency situations.

Only the UK provides licensing information. The absence of this information in other cases may mean that more structured data opening policies lack enforcing capacity or those responsible did not take this category into account when developing the dashboards.

Except in the German case, which does not bring data for download, the others take into account OGD standards, even if they do not publish metadata. It is possible to raise the hypothesis that the dashboards publication was an extraordinary and quick action, which caused the publication of metadata to be sacrificed either those metadata are available or not. Support services were not detected and this absence seems to be explained by the same factors as the lack of metadata.

Technological choices were based on widely used solutions, which demonstrate their suitability for dashboards of this nature and the presence of state capacity to mobilize these technologies quickly. Perhaps the use of other resources (e.g.) required technological capacities or time not available, given the context of urgency. Except for The Netherlands, the others had no problems with accessibility inspection.

The features adopted contribute to a certain extent to transparency, but with significant gaps. All have geolocation features, but only UK dashboard offers greater overview and details. It was not possible to identify whether these gaps are due to problems with availability or access to disaggregated data (e.g. data from legacy systems) or are just a design dashboard choice. In any case, this gap directly affects dashboards ability to promote transparency.

The four cases have low or medium degree of customization, not presenting, for example, features of SQL query. The dashboards do not have Linked Data features or APIs that allow users to customize queries and slices merging robust databases, like COVID-19 incidence and prevalence and government expenditures data.

Much of the content, except in the case of Germany, is presented in a static manner. Low interactivity is directly related to this characteristic, and German dashboard presents more powerful interactivity features, which can also be explained by the main technology adopted, once (ARCGIS) guarantees greater resources for data geolocation and consequent interaction capacity.

CONCLUSIONS AND FUTURE RESEARCH

Based in the four countries dashboards analysis, this paper identifies some limits and possibilities for the use of this tool in promoting transparency in emergency health situations.

Dashboards are simple and have room for development. They use technologies already widely used that are capable of offering reasonable solutions within the reach of governments. The use of more powerful resources, such as interoperability with legacy systems, may encounter technical difficulties or these related to data governance, reducing its availability.

Relevant obstacles may arise from aspects related to the integration of dashboards with open data policies and access to information, such as the publication of metadata and the offer of support.

Dashboards design suggests that, apparently, transparency is not emphasized or given as *pro-forma*. Many possibilities for increasing the level of transparency could be raised, in

addition to those presented above. However, the trade-off between quality and pressures for speed of response is a strong issue in health emergencies, which can influence the design of dashboards, forcing managers to make more modest and faster choices.

For the same reason, this paper did not propose a fully comprehensive analysis of the use of dashboards for transparency in the case of COVID-19. Otherwise can be a start of an international comparison and provide help to developers to create more transparent websites. Several new research questions and possibilities for future studies can be identified:

a) Dashboards features and usage

For learning how improve dashboards to make them more effective for COVID-19 and new pandemic events, is needed to know if the dashboards offer the most necessary information. Analyzing the dashboards from the point of view of supply, deepening this work, can be complemented with research from the point of view of demand, as transparency level evaluation analyzing data from dashboard usage by different types of users. These studies can offer answers that help design dashboards that meet the multiple needs of users regarding access to epidemiological, managerial and budgetary information.

Another category of questions concerns the context: it is important to know how features and usage of dashboards are influenced by country-specific contexts.

b) Technical issues

Decision makers can benefit from answers to several questions about technology choices, such as: What are the technologies that can enhance current dashboards and are not applied yet (e.g. Artificial Intelligence)? Legacy systems are a relevant source of data for dashboards? If yes, how their limits impact dashboards performance and design?

Interoperability is also a major issue and is related to both technology selection and data formats.

c) Management issues

Data governance is a decisive aspect for the success of dashboards. It will be important to analyze methodologies and policies for data collection, data workflow, metadata and data validation.

The approach of state technological capabilities can support studies in this field, identifying the demands and mechanisms for mobilizing capacities for the process of building dashboards. Analyzes can include decision making in the assembly and feeding of dashboards and interorganizational collaboration mechanisms.

d) Social and political issues

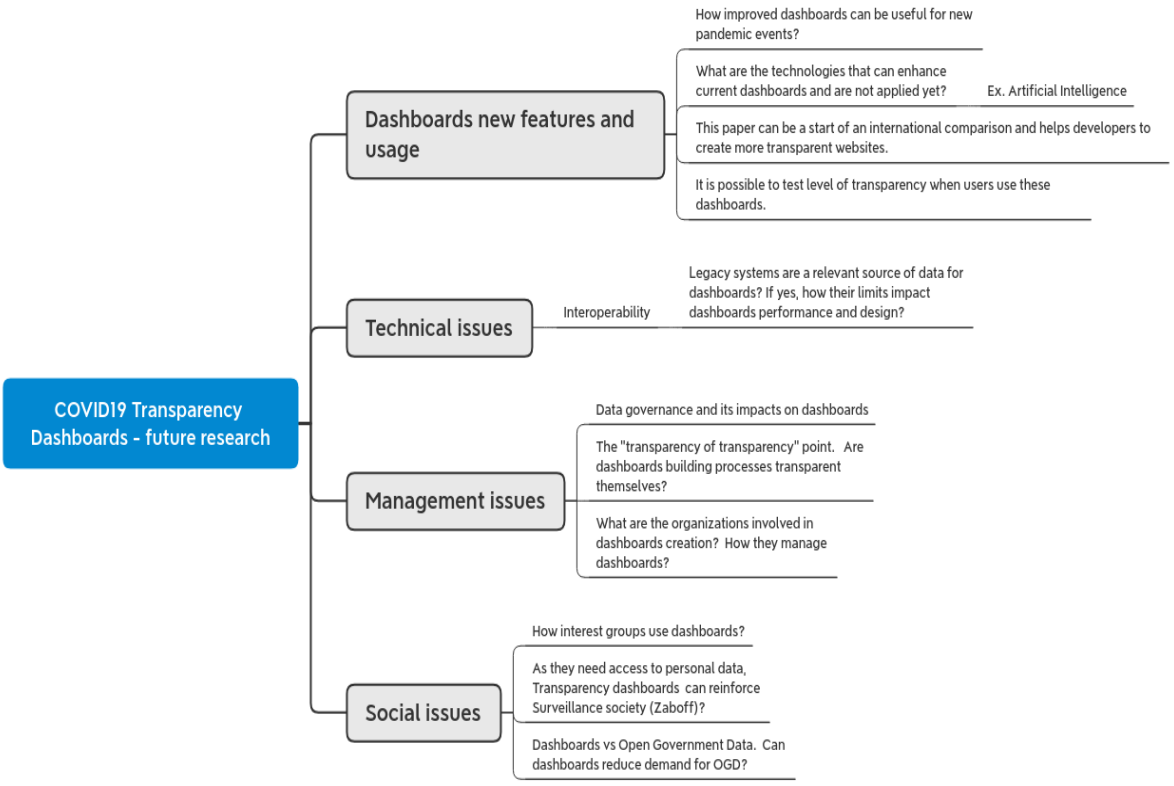
Assessing the impact of dashboards on promoting transparency can contribute to the applicability of this tool in contexts of health emergencies. Studies on impacts on specific groups and social actors can assist in the formulation of strategies by the government.

The relationship between dashboards and Open Government Data deserves further reflection. Is there an overlap between initiatives? What is the level of articulation between them? Can dashboards reduce demand for OGD?

Another issue is the “transparency of transparency”: are dashboards building processes transparent themselves? How do they take care of data protection? Once dashboards adopt Artificial Intelligence to provide more elaborated information, it will raise new questions about algorithmic transparency.

Finally, applied research is needed to explore new ways to increase the level of transparency of health emergency dashboards. As demonstrated in this article, this improvement in transparency depends on interventions in the various dimensions mentioned above and summarized in **Figure 2**.

Figure 2 – Future research about COVID-19 and transparency dashboards



Source: Created by the authors (2020).

Future research should bring us new resources for increasing impact of dashboards like these. Dashboards features and usages research should be useful to understand their relevance and help government and developers to enhance their impact on crisis management and provide more transparency. More research on technical issues, like interoperability also can contribute to create new dashboard technologies.

Management issues can help to create new techniques either for dashboards governance (transparency, decisions) or dashboard building and operation (team management, organizational structure).

There are many social issues related to dashboards which can receive research attention to foster conditions to better dashboard usage. Stakeholders and other relevant groups influence decisions and have their own needs and interests. Privacy and personal data protection is another important issue. We can ask if dashboards will contribute to right uses of personal data in our societies in order to prevent reinforcing surveillance paradigm.

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