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Challenges in Achieving Accessibility on Official COVID-19 Websites

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ABSTRACT

During the COVID-19 pandemic, powerful health promotion messages and reliable communication from local, regional, or worldwide health authorities stumbled. The World Health Organization (WHO) pointed this problem out, issuing the message "health for all," incentivizing health leaders to use ac-accessible and inclusive technologies, plain language, and diverse content to increase accessibility. This article presents the accessibility evaluation of a random sample of 21 websites from various health ministries and government agencies worldwide. We found that most of the websites tested did not meet the minimum AA accessibility level set by WCAG 2.1. Moreover, indicate that 29.9% violate the perceivable principle related to contrast errors. Our research reveals that web designers and developers should be aware of accessibility requirements and guidelines to comply with universal access during web designing.

Keywords: Accessibility, COVID-19, Human factors engineering, WCAG, Websites

INTRODUCTION

According to World Bank figures and World Health Organization (WHO) data reports, at least 15% of the world's population have some degree of special need or disability (World Health Organization (WHO), 2011). The prevalence of disability is significantly higher among developing countries (Gorgenyi-Hegyes et al., 2021). As COVID-19 has a large-scale impact worldwide [3], it is vital to note that those populations struggling with some disability issues are particularly accessing proper health services, inclusive schooling, transportation, and information.

Vulnerable populations, such as those with disabilities and physical limitations, are especially vulnerable to COVID-19-related complications. In that sense, all information related to COVID-19 prevention, protection and management actions must be easily accessible and available on the various official websites of national and international health agencies. However, not all official websites are inclusive and offer the minimum requirements for such

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populations (Acosta-Vargas et al., 2020a). These conditions are available within the guidelines suggested by the World Wide Web Consortium (W3C), which establishes the minimum requirements for public-use sites to have an adequate level of accessibility (World Wide Web Consortium, 2018). For this reason, in this study, we applied an accessibility analysis on a random sample of official websites that provides information on COVID-19 (Daniel, 2020).

This research applies a modification to the accessibility evaluation method (Acosta-Vargas et al., 2017) centered on the Website Accessibility Conformance Evaluation Methodology (WCAG-EM) 1.0. Also, to accomplish adequate access, we utilized the Web Content Accessibility Guidelines (WCAG) 2.1(World Wide Web Consortium, 2018), particularly for communities with incapacities.

The WCAG 2.1 includes the four principles (World Wide Web Consortium, 2018) related to accessibility 1) Perceivable to identify information and interface elements. 2) Operable the operator interface and the web of interacting and navigating. 3) Understandable the knowledge and procedures users operate with the web application. 4) Robust to be compatible with the technologies used by users, including assistive technologies.

The websites for this study were taken from the Geneva Foundation for Medical Education and Research (Sultana et al., 2018), which shares material to improve health education and research, that includes 195 websites containing official COVID-19 information.

To achieve an adequate level of web accessibility, we applied an automatic review method based on WCAG-EM 1.0, which consists of six stages. This research can promote 1) Future research associated with accessibility for other websites. 2) Designing a software application that includes artificial intelligence to help web experts and developers assess accessibility in websites with WCAG 2.1. 3) Applying the evaluation of sites with official COVID-19 information with end-users with disabilities.

The rest of the manuscript is constructed as follows: section two presents the background knowledge and related works; section three shows the method and the case study; section four contains the outcomes and analysis; and ultimately, section five includes the conclusions, limitations, and future work.

LITERATURE REVIEW AND RELATED WORK

During the COVID-19 pandemic, citizens turned to the public for information to assist them in comprehending the coronavirus crisis. This condition has highlighted the requirement to guarantee that everybody has access to official information. Organizations' scientific literature and guidelines have focused on proposing solutions; however, the same efforts are not making information accessible.

The authors (Alcaraz-Martínez and Ribera-Turró, 2020) argue that accessibility in statistical graphics on COVID-19 for people with low vision includes several accessibility issues, such as 1) The few text alternatives in both images and SVG graphics. 2) The absence of customization options. 3) The lack of a printed version for operators who use screen readers.

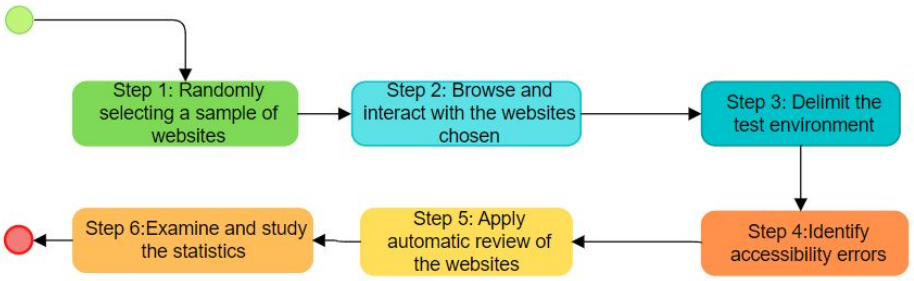

Figure 1: Evaluation of the accessibility.

Article (Acosta-Vargas et al., 2020b) argues that there are several webs, but not all of them are accessible, so it is required to create websites that comply with WCAG 2.1. The website is the one that has modernized the best with technical improvement and the pandemic; what was originally a scientific communication approach currently is the source of fundamental, instant, and financial information.

The opportunities for users regarding information are limitless; therefore, the web has become a brand new essential design tool for health specialists. The outcomes appear that the websites that offer information associated with COVID-19 require alternative text, empty links, form labels, and contrast errors. The websites examined in this research with WAVE (WebAIM, 2021) violated web accessibility requirements under WCAG 2.1 (World Wide Web Consortium, 2018).

Methodology and Case Study

We started from a total sample of 198 websites taken from the official site of the Geneva Foundation for Medical Education and Research. The sample was then divided into three groups of 66 websites, and seven websites were taken randomly by applying the Excel function "RANDOM.BETWEEN(1;66)" from each group; finally, we obtained a total of 21 websites. The unit of analysis is each website that meets the sample parameters and therefore is part of the population and the sample. In assessing accessibility, we applied an automatic review method based on WCAG-EM 1.0; the applied method is described in the six steps (see Figure 1).

Step 1: We randomly selected 21 websites and applied them as case studies.Table 1 contains the 21 websites evaluated, including the country, website domain and URL.

Step 2: We explored each of the websites selected in the stage; we navigated and interacted on the first pages of each website.

Step 3: We identify the functions performed on each designated website; the accessibility level applied was AA (World Wide Web Consortium, 2018).

Step 4: We listed accessibility barriers and related them to WCAG 2.1.

Step 5: We applied for automatic review with the WAVE tool (WebAIM, 2021) that includes the plugin component for Google Chrome, version 95.0.4638.69; three web accessibility experts participated in this stage. WAVE is a film set of assessment tools that helps developers make web

Table 1. Evaluated websites.

#	Country	Domain	URL
1	Argentina	ar	https://www.argentina.gob.ar/salud/coronavirus-COVID-19
2	Australia	au	https://www.health.gov.au/
3	Azerbaijan	az	http://www.health.gov.az/
4	Belgium	be	https://www.health.belgium.be/fr
5	Burkina Faso	bf	http://www.sante.gov.bf/
6	Canada	ca	https://www.hc-sc.gc.ca/
7	Cuba	cu	https://salud.msp.gob.cu/
8	Kuwait	kw	https://twitter.com/kuwait_moh
9	Lesotho	ls	http://www.gov.ls/ministry-of-health/
10	Malawi	mw	https://www.facebook.com/malawimoh
11	Monaco	mc	https://en.gouv.mc/Government-Institutions/
12	Netherlands	nl	https://www.government.nl/ministries/
13	Norway	no	https://www.regjeringen.no/en/dep/hod/id421/
14	Mexico	mx	https://www.gob.mx/salud
15	Portugal	pt	https://www.dgs.pt/
16	Puerto Rico	pr	http://www.salud.gov.pr/
17	Qatar	qa	https://www.moph.gov.qa/
18	Dominican Republic	do	http://digepisalud.gob.do/
19	Sint Maarten	sx	http://www.sintmaartengov.org/government/
20	Saint Vincent	vc	http://health.gov.vc/health/index.php/c
21	Saint Lucia	lc	https://www.covid19response.lc/

satisfaction more than accessible to persons with disabilities. WAVE helps recognize various accessibility errors by applying WCAG 2.1 and assists human assessment of web content.

Step 6: We recorded the dataset (Freire, Carlos; Rodriguez, Michelle-Abigail; Plaza Mendizabal, Ricardo; Acosta-Vargas, 2022) in an open access repository to explore and share the outcomes and find possible advancements.

Outcomes and Discussion

Table 2 includes the evaluation outcomes of the 21 websites assessed with the WAVE tool.

The most severe bugs need to be corrected urgently to help make the Web sites more accessible (see Figure 2).

The accessibility problems are related to the Errors and Contrast Errors variables, corresponding to the websites of Burkina Faso, Portugal, Azerbaijan, the Dominican Republic, and Sint Maarten (see Figure 3) reveals that the principle with the most barriers is perceivable with 790 barriers, equivalent to 61.9%; followed by robust with 270, which is 21.2%; then the operable with 209, is 16.4%; finally, the understandable principle with seven barriers and represents 0.5%.

Table 2. Assessment of the accessibility of the 21 websites.

#	Domain	Errors	Contrast Errors	Alerts	Features	Structural Elements	ARIA
1	ar	1	3	7	42	35	13
2	au	1	0	14	13	28	10
3	az	47	44	73	14	35	0
4	be	15	3	8	17	76	53
5	bf	559	23	636	60	55	2189
6	ca	11	4	1	6	1	0
7	cu	5	128	76	27	84	73
8	kw	11	14	10	18	8	277
9	ls	22	44	27	16	50	0
10	mw	10	8	13	14	24	366
11	mc	2	71	153	13	54	3
12	nl	2	2	3	10	28	3
13	no	3	0	19	11	55	39
14	mx	15	1	22	15	36	21
15	pt	128	28	204	48	75	14
16	pr	7	4	22	8	46	55
17	qa	3	0	137	86	77	220
18	do	27	15	13	6	30	2
19	sx	25	3	55	11	28	13
20	vc	10	14	18	5	21	5
21	lc	5	17	165	28	87	44

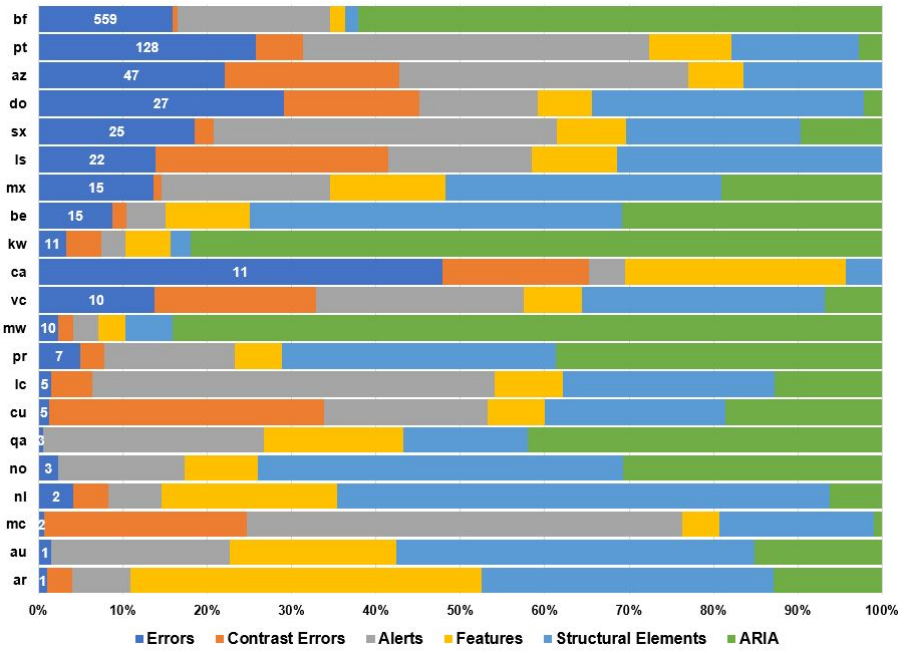

Figure 2: Evaluation with wave.

Table 3 includes the guidelines, success criteria, levels of WCAG 2.1, and the total barriers identified on websites that provide official information on COVID-19.

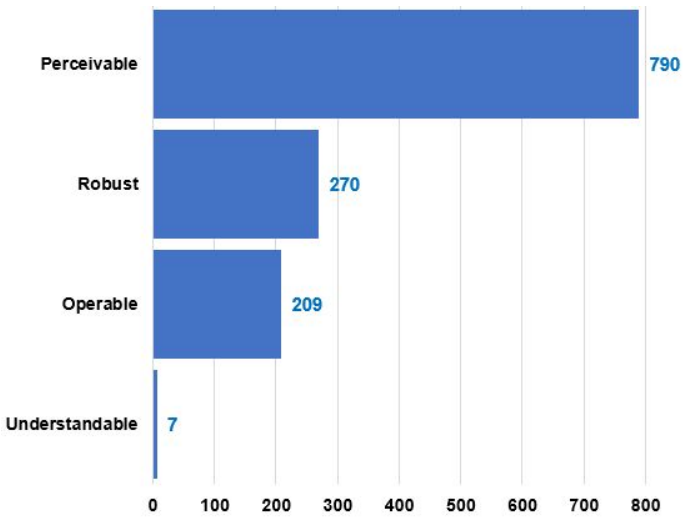

Figure 3: Accessibility principles.

Table 3. Guidelines of WCAG 2.1.

Guideline	Success Criteria	Level	Total
1.1 Text Alternatives	1.1.1 Missing alternative text	A	120
1.3 Adaptable	1.3.1 Info and Relationships	A	288
1.4 Distinguishable	1.4.3 Contrast (Minimum)	AA	382
2.2 Enough Time	2.2.2 Pause, Stop, Hide	A	2
2.2 Enough Time	2.2.1 Timing Adjustable	A	6
2.4 Navigable	2.4.4 Link Purpose (In Context)	A	191
2.4 Navigable	2.4.6 Headings and Labels	AA	10
3.1 Readable	3.1.1 Language of Page	A	4
3.3 Input Assistance	3.3.2 Labels or Instructions	A	3
4.1 Compatible	4.1.2 Name, Role, Value	A	270

Concerning level A accessibility, there are 814 barriers, equivalent to 69.3%, followed by level AA with 392, representing 30.7% (see Figure 4).

The results of the visual analysis show that the "success criterion" with the highest number of accessibility barriers belong to 1.4.3 associated with contrast with a total of 382 barriers, representing 29.9%; followed by criterion 1.3.1 related to information problems totaling 288 barriers, corresponding to 22.6%; then 4. 1.2 with name, role, value problems total 270, representing 21.2%; then 2.4.4 associated with link purpose problems with 191 barriers, corresponding to 15%; finally, the rest of the criteria present values lower than 10% (see Figure 5).

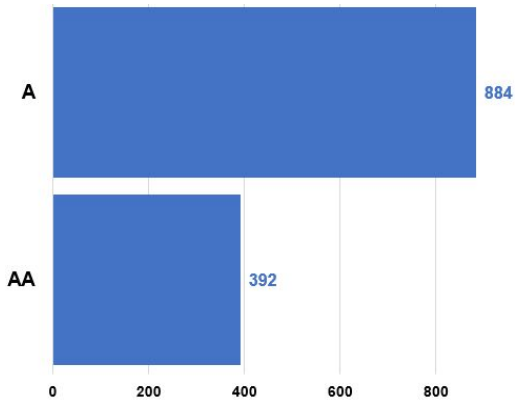

Figure 4: Levels of WCAG 2.1.

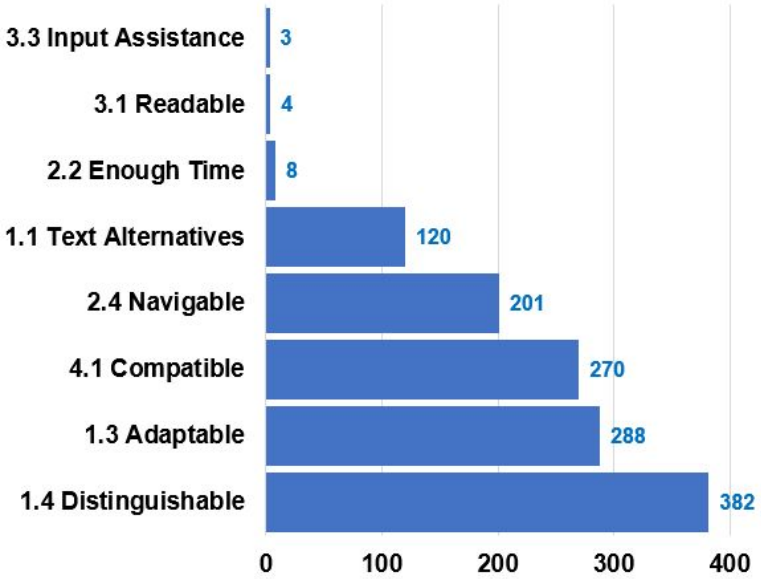

Figure 5: Success criteria.

CONCLUSION

According to the results obtained, it is considered that the evaluated sites violate the accessibility principles agreeing to WCAG 2.1. Among the furthermost distinguished errors are focused on the principles of perceivable and robust, which confirmations that they are essential variable quantity of communication since they are straight associated to contrast, textual alternatives, and compatibility with assistive technologies, especially for visually impaired users who use screen readers. Therefore, one of the characteristics urgently required to be enhanced is directly associated with these two principles. Regarding the limitations, it is worth mentioning that the study could be accomplished by evaluating a more significant number of websites with a combined (Salvador-Ullauri et al., 2020) or heuristic method (Acosta-Vargas et al., 2019) that would include both manual and automatic verification. As

for future work is recommended to consider the barriers found in evaluating accessibility in mobile applications. Our investigation can contribute to upcoming analyses associated with accessibility to apply digital ramps open to many users with disabilities. Design a software tool that includes artificial intelligence to support the development of more accessible websites.

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