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Academic Medical Libraries and Accessibility Challenges: The Conformance of the Websites with the WCAG2.1

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ABSTRACT

Website accessibility is a key factor in meeting individuals' needs and expectations. Considering the lack of research on the accessibility of Iranian medical libraries' websites, the aim of the present study is to evaluate the compliance of the central library websites of Iranian universities of medical sciences using the latest WCAG2.1 guideline. The research includes all the 51 homepages of the central libraries of Iranian medical universities. The accessibility evaluation of each homepage performed using "Webaccessibility" automated testing tool. The Kruskal–Wallis one-way analysis of variance was performed to explore the association of the compliance score of libraries' websites among the three categories of medical universities. The findings of the present study revealed that none of the central library websites of the Iranian medical sciences universities are fully compliant with WCAG2.1, and the mean compliance score of accessibility was 77.26 ± 5.862 percent. The low accessibility of the library websites may result in making online information services and resources inaccessible and unusable to users who are disabled. Therefore, it is necessary for library managers and website designers to solve the accessibility problems and improve the accessibility of the websites to make them accessible for all users.

Keywords: Disability; Academic library; Website accessibility; Evaluation; Library website; Web content accessibility guidelines (WCAG) 2.1

1. INTRODUCTION

A disability is an impairment that can affect the vision, hearing, touch, movement, speech, or cognitive abilities, and it is possible to suffer from more than one disability. More than one billion people in the world, approximately 15 per cent, live with some form of disability, and this number is growing[1]. People with disabilities often face barriers when accessing online services[2] and as a result, web accessibility is an important aspect of website[3], which refers to the removing accessibility barriers as well as the creation of websites that can be used by people with any type of disability[4]. Thus, website accessibility is a key factor in meeting individuals' needs and expectations.

Libraries utilise web technologies to disseminate information and provide useful services to users. Most of the students use websites and library portals to look for information[5-6].

Therefore, the accessibility of libraries is not limited to the accessibility of their physical environment, but also includes the accessibility of virtual spaces, such as online resources, library websites, and online databases[7]. Library websites are communication channels between users and libraries, and many users access the libraries' resources and news through websites. All organisations, including academic libraries, have recognised the importance of the web not only as a tool for accessing information but also for disseminating information about activities, products, and services[8]. The accessibility of websites of academic libraries is of importance due to the increasing numbers of students with disabilities[9]. Since people with disabilities use assistive technologies, such as screen readers, voice recognition, and braille displays, to effectively access the web[10-11], when faced with non-accessible library websites, they would not have proper access to the required information due to the incompatibility of assistive technologies[4]. As a result, the library would not be successful in equally providing the necessary information to all audiences, and the students' participation in educational activities may be reduced due to the inaccessibility of information resources. Likewise, it may have adverse and irreversible effects on the quality of disabled students' academic performances and may even exacerbate their physical conditions. This will affect social justice in terms of equal access to education for individuals in society[12]. Organisations and website designers do not have a detailed understanding of either the number of people accessing their websites who have disabilities or their type of disability because many people with disabilities do not report it and generally do not need to do so. Therefore, due to the possibility of disabled audiences of libraries, they should design their websites using authoritative and comprehensive guidelines[13]. Moreover, those organisations should identify the accessibility barriers of these websites by carrying out web accessibility evaluation[11]. This can provide managers

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and decision-makers with an accurate view of the website's accessibility barriers and areas that need improvement, which would result in an accessible website for all users. In this regard, the World Wide Web Consortium (W3C) has provided guidelines for making websites accessible, the latest of which is the Web Content Accessibility Guidelines 2.1 (WCAG2.1). These guidelines include a comprehensive range of recommendations for making web content more accessible to a broader range of individuals with disabilities. Adhering to this guideline will make the websites more usable and accessible to users in general, especially for people with disabilities such as blindness, hearing loss, movement incapability, speech disorders, learning disabilities and cognitive problems. These guidelines address the accessibility of web content on a variety of electronic devices such as laptops, tablets, and mobile devices[14].

2. LITERATURE REVIEW

Heather Hill (2013) found that the focus of 25 per cent of library research on accessibility was on the accessibility of electronic resources. Research on accessibility in the field of librarianship addressed other issues, such as examining the challenges of users with disabilities, their use of electronic resources, and the accessibility of the user interface. Accessibility research has covered word processing software, databases, websites, and e-learning platforms such as WebCT, with the largest focus was on accessibility for people with visual impairments[7].

There is limited research on the accessibility of library websites. This research has been conducted in public libraries, the National Library, and academic libraries.

In several of these studies, library websites have been evaluated, and the websites have been improved based on the evaluation results. Billingham (2014) conducted a study that was aimed at assessing and improving the accessibility of the Edith Cowan University Library website for people with disabilities. The research community included 31 websites from the University of Edith Cowan University Library. The study found that the university's library websites did not meet the WCAG2.0 accessibility requirements, even at level A. Using the accessibility evaluation results from these websites, the Edith Cowan University library websites were improved, and all users were provided with access to the resources [15].

In 2011, Conway (2011) evaluated the accessibility of 29 Western Australian public library websites based on the WCAG1.0 and WCAG2.0 criteria. The study used automated evaluation tools, as well as a manual checklist and JAWS page reader software. The results showed that none of the libraries met these criteria[16].

The National Library of Australia's website and each of the state/territory libraries' websites were evaluated in 2012 by Conway *et al.*[17]. Automatic tools were used to conduct this research, as well as a manual evaluation by accessibility experts and assistive technologies experts. The results showed that none of the libraries met the WCAG2.0 accessibility requirements, even at level A. However, the results also showed that the websites of some of these libraries were close to the requirements, which means that the libraries could easily improve their website to conform with the accessibility guidelines.

In another study, the accessibility of digital special collections of 69 American academic library websites using screen readers was examined to discover whether the digitised materials from special collections libraries can be accessed using screen reader technology. The findings revealed that only 42 per cent were accessible by the screen reader technology[18].

The accessibility of 56 North American academic library websites was examined by Bobby 3.1.1. The survey showed that around 60 per cent complied with WCAG1.0[19].

The results of these studies are not comparable because they have been performed with different tools and samples. Also, the review of the literature shows that very limited studies have been carried out to evaluate the accessibility of academic libraries websites using WCAG guidelines and none of those studies have utilised the latest version of web accessibility guidelines i.e. WCAG2.1 to evaluate the intended websites.

3. RESEARCH OBJECTIVES

According to Iran's regulations and laws, the right to continue education in a higher education setting is recognised for people with disabilities. This law emphasises the right to education of the "whole nation", which includes people with disabilities[20]. According to Iran's welfare organisation, there are about 1.5 million people with disabilities in Iran, and this number is increasing every year. Of these, approximately 20 thousand people with disabilities are university students in Iran[21]. Due to libraries of the Medical Universities of Iran have many customers at different levels of education; thus, it is felt that the library managers need to be aware of the accessibility of their websites to meet the needs and expectations of their incapable clients, using a standard guideline. Considering the lack of research on the accessibility of Iranian medical libraries' websites, the aim of the present study is to evaluate the compliance of the central library websites of Iranian universities of medical sciences using the latest WCAG2.1 guideline. The specific research objectives are as below:

- To determine the compliance of the central library websites of Iranian universities of medical sciences with WCAG2.1 guideline.
- To determine the relationship between the affiliated university category and their compliance with the accessibility guidelines.

By evaluating the accessibility of those websites, one can identify the accessibility barriers of online services provision of a library to incapable students and provide strategic planning to elevate and improve the accessibility of the websites and online services.

4. MATERIALS AND METHODS

4.1 Sample

Iran has 51 medical universities. So, the research includes all the 51 central libraries of Iranian universities of medical sciences websites. The Ministry of Health and Medical Education of Iran has ranked and classified the medical universities of Iran into three categories (1, 2, 3) based on their

educational and research output. The universities in category 1 are the best in the country. To carry out the study, the name and the categories of these universities were extracted from the Ministry of Health and Medical Education of Iran's website[22]. Next, the URLs of the central library websites were extracted from the website of each university.

4.2 Measures

The accessibility evaluation of websites can be performed either automatically by applying web-based tools or manually by accessibility experts. Automatic evaluation tools are cost-effective measures, which help web designers to quickly identify potential accessibility issues[23-24]. Automatic tools can help designers with manual review by providing fully automated checks. One of the automatic online tools for accessibility evaluation is "Webaccessibility"[25]. This tool has been introduced and approved by W3C. It measures the compliance of each website with WCAG2.1 and determines how well each website complies with the criteria. It gives a compliance score from zero to 100 percent to show total compliance with WCAG2.1[26]. In this study, the homepages of the central libraries of Iranian medical universities were evaluated in January 2019 using the Webaccessibility automated online accessibility testing tool based on WCAG2.1.

4.3 Data Collection and Analysis

To carry out the study, the URLs of central library websites were entered into the URL box of the Webaccessibility tool. In this study, it was assumed that there is a significant relationship between the affiliated university category and their compliance with the accessibility guidelines. Since the distribution of the obtained data was not normal, to examine the differences in the compliance score of libraries' websites among the 3 categories of medical universities, the Kruskal–Wallis one-way analysis of variance was performed. An alpha level of 0.05 was applied for all statistical tests. The collected data were analysed using SPSS 18 software.

5. FINDINGS

The compliance scores for the central library websites for the three categories of universities are presented in Tables 1–3. It should be noted that the central library websites of Isfahan University of Medical Sciences, Fasa University of Medical Sciences, Kashan University of Medical Sciences, and Kashan University of Medical Sciences did not respond to the Webaccessibility tool.

The mean compliance score of accessibility for the central library websites using WCAG2.1 is 77.26 ± 5.862 percent. The central library of Birjand University of Medical Sciences showed the highest compliance with 89 percent, with the affiliated university being a category 2 university. Surprisingly, the lowest compliance score belonged to the website of the central library of Shahid Beheshti University of Medical Sciences with 70 per cent, of which the affiliated university is one of the category 1 universities.

The compliance scores of the central library websites of the category 1 universities are shown in Table 1. In this category, the highest and lowest compliance scores belonged

Table 1. The compliance score for the central library websites of category 1 universities*

Name of Universities	Compliance score
Tehran University of Medical Sciences	73
Shahid Beheshti University of Medical Sciences	70
Iran University of Medical Sciences	73
Shiraz University of Medical Sciences	88
Ahvaz Jundishapur University of Medical Sciences	73
Mashhad University of Medical Sciences	73
Isfahan University of Medical Sciences	-
Tabriz University of Medical Sciences	73
Kerman University of Medical Sciences	-
Mean	74.71

Table 2. The compliance score for central library websites of category 2 universities

Name of Universities	Compliance Score
Hamadan University of Medical Sciences	82
Urmia University of Medical Sciences	72
Baqiyatallah University of Medical Sciences	73
Lorestan University of Medical Sciences	74
Kashan University of Medical Sciences	-
Semnan University of Medical Sciences	88
Babol University of Medical Sciences	83
Zahedan University of Medical Sciences	88
AJA University of Medical Sciences	74
Shahed University	72
Zanjan University of Medical Sciences	77
Guilan University of Medical Sciences	80
Ardabil University of Medical Sciences	78
Tarbiat Modares University	73
University of Social Welfare and Rehabilitation Sciences	71
Arak University of Medical Sciences	78
Rafsanjan University of Medical Sciences	88
Mazandaran University of Medical Sciences	78
Qazvin University of Medical Sciences	73
Hormozgan University of Medical Sciences	74
Shahid Sadoughi University of Medical Sciences	86
Golestan University of Medical Sciences	73
Kermanshah University of Medical Sciences	77
Birjand University of Medical Sciences	89
Mean	78.30

to the central library websites of Shiraz University of Medical Sciences with 88 per cent and the central library of Shahid Beheshti University of Medical Sciences with 70 per cent, respectively. Out of nine library websites in this category, only one library's website showed more than 80 per cent compliance with WCAG2.1(Table 1).

Among the universities in category 2, the highest compliance of 89 percent and the lowest of 71 per cent belonged to the websites of the central library of Birjand University of Medical Sciences and the central library of University of Social Welfare and Rehabilitation Sciences, respectively. Out of 24 library websites in this category of universities, only eight library websites showed more than 80 per cent compliance with WCAG2.1 (Table 2).

Among the universities of the medical sciences in category 3, the highest compliance score belonged to the central library websites of Dezful University of Medical Sciences and Yasuj University of Medical Sciences with 88 percent. In this regard, the lowest compliance of 73 percent belonged to the central library websites of the Bushehr University of Medical Sciences, Qom University of Medical Sciences, Gonabad University of Medical Sciences, North Khorasan University of Medical Sciences, and Jiroft University of Medical Sciences (Table 3). Out of 27 library websites in this category, only four library websites showed more than 80 percent compliance with WCAG2.1 (Table 3).

Table 3. The compliance score for central library websites of category 3 universities

Name of Universities	Compliance Score
Alborz University of Medical Sciences	74
Bushehr University of Medical Sciences	73
Sabzevar University of Medical Sciences	74
Bam University of Medical Sciences	73
Jahrom University of Medical Sciences	73
Shahroud University of Medical Sciences	78
Dezful University of Medical Sciences	88
Qom University of Medical Sciences	73
Shahrekord University of Medical Sciences	75
Zabol University of Medical Sciences	78
Yasuj University of Medical Sciences	88
Gonabad University of Medical Sciences	73
Ilam University of Medical Sciences	74
North Khorasan University of Medical Sciences	73
Fasa University of Medical Sciences	-
Torbat Heydarieh University of Medical Sciences	87
Kurdistan University of Medical Sciences	80
Jiroft University of Medical Sciences	73
Mean	76.88

The Kruskal–Wallis test was performed to measure the difference between the mean accessibility compliance score of the surveyed websites and the category of universities (Table 4). Although the mean accessibility compliance score of the central library websites of the universities in category 1, was less than that of those in category 2, and category 3, this difference was not statistically significant, as p-value > .05.

Table 4. The mean compliance of the central library websites based on the category of the affiliated universities

Websites Accessibility	Mean ±SD			p-value
	Category 1	Category 2	Category 3	
Compliance score	74.71 ± 5.964	78.30 ± 6.026	76.88 ± 5.566	0.152

6. DISCUSSION

To our knowledge, this is the first study to evaluate academic medical library websites in terms of accessibility according to WCAG2.1.

The findings of the present study showed that none of the central library websites of the Iranian medical sciences universities are fully compliant with WCAG2.1. In general, the compliance of the central library websites of the Iranian medical sciences universities with WCAG2.1 is only 77.26 per cent. As a result, the central library websites of Iranian universities of medical sciences are in an undesirable situation regarding accessibility. Research on the accessibility of library websites has had results that are similar to the present study, and the library websites also had accessibility barriers[16,17,19,27,28]. There are several possible reasons for the existing accessibility barriers of library websites. Several studies have shown that one of the main problems is that many organisations, web designers, and web developers do not consider accessibility to be an important priority[29-30]. Moreover, some organisations and web developers are not aware of the importance of the accessibility of websites for the success and progress of the organisation[30]. Another reason is that organisations including libraries with a limited budget may not use professional designers to develop their websites[30]. Nevertheless, while conforming to the accessibility guidelines may increase the design costs by one to two percent, visitors to the website may increase by twenty percent[31]. Furthermore, some websites are created over a short period of time, which may result in a non-accessible website.

Based on the findings of the present study, and given that WCAG2.1 has the latest accessibility guidelines of the W3C, the central libraries of Iranian universities of medical sciences need to make a greater effort to adapt their websites to the accessibility guidelines. Consequently, these libraries will be able to ensure the accessibility of their websites for all users, including the users who are disabled.

The central library websites of the category 1 universities were expected to be more accessible than the others. Nevertheless, the findings showed that they have lower accessibility compared to the category 2 and 3 universities, although this difference was not statistically significant.

In this regard, the authors found that the complexity of the design of category 1 universities library websites was greater than the others. Non-textual content, such as images and multimedia files, with no alternative textual content, were more prevalent in the library websites of the category 1 universities compared to the other two categories. These could be the reasons for their lower accessibility, although this requires further investigation. It is recommended that accessibility issues should not be ignored when increasing the non-textual content and design complexity[32].

Considering the findings of the study, in order to increase the accessibility of the central library websites of Iranian universities of medical sciences, it is necessary to conduct research to accurately examine their accessibility barriers categories. This will lead to identifying the specific accessibility barriers category, which in turn, will lead to determining the barriers for each group of disabilities. Moreover, this will help the website designers to remove the accessibility barriers quickly as well as easily, and it will provide equal access for all users.

7. CONCLUSION

In this study, it was found that none of the central library websites of Iranian universities of medical sciences fully comply with WCAG2.1. The low accessibility of the library websites may result in making online information services and resources inaccessible and unusable to users who are disabled. Therefore, it is necessary for library managers and website designers to solve the accessibility problems and improve the accessibility of the websites to make them accessible for all users.

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