

DIGITAL BARRIERS TO HEALTHCARE: WEB ACCESSIBILITY OF PUBLIC HEALTH INSTITUTIONS IN BULGARIA

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Abstract: The digitalization of healthcare has transformed institutional websites into essential gateways for accessing health information and public health services. Consequently, web accessibility has become a prerequisite for equitable access to healthcare rather than merely a technical feature of website quality. This study examines the web accessibility of public health institutions in Bulgaria through the perspectives of Disability Studies, digital ableism, and the right to health. Accessibility is conceptualized as an indicator of institutional commitment to equality and social inclusion rather than solely compliance with technical standards.

The study evaluates 271 official public healthcare websites using the WAVE accessibility evaluation tool based on the Web Content Accessibility Guidelines (WCAG) 2.1. The results reveal widespread accessibility deficiencies across the Bulgarian healthcare sector. Only 3% of the analysed websites contained no detectable accessibility errors, while 97% exhibited at least one accessibility barrier. The most common problems included insufficient colour contrast, missing alternative text for images, inaccessible navigation elements, and the absence of legally required accessibility statements.

The findings suggest that these deficiencies represent systemic institutional barriers rather than isolated technical problems. Inaccessible healthcare websites restrict independent access to health information and digital services, reproducing inequalities for persons with disabilities before any interaction with healthcare professionals occurs. The study argues that improving web accessibility requires not only technical compliance but also stronger institutional governance and the integration of accessibility into digital transformation and healthcare policy.

Keywords: web accessibility, healthcare, WCAG compliance, digital inclusion, right to health, Bulgaria

1. INTRODUCTION

The digital transformation of healthcare has fundamentally changed the way health systems provide information, services, and communicate with patients (Ramineni, 2023). Institutional websites and patient portals have become primary gateways to healthcare, enabling appointment booking, administrative procedures, access to health information, and communication with public health institutions (Charalambous, 2026). Consequently, access to healthcare is no longer determined solely by the physical availability of medical services but also by the accessibility of the digital environments through which these services are delivered (Lupton, 2017). At the European level, this transition is supported by Directive (EU) 2016/2102, which requires public sector bodies to ensure accessible digital services.

For persons with disabilities, however, digitalization may create new forms of exclusion rather than improve access. International studies consistently report low levels of compliance with the Web Content Accessibility Guidelines (WCAG) on healthcare websites (Acosta-Vargas et al., 2018; Macakoğlu & Peker, 2022; Moreno et al., 2022; Dror et al., 2021; Giummarra et al., 2025). Websites that cannot be effectively used with screen readers, keyboard navigation, or other assistive technologies become barriers comparable to inaccessible buildings or public transport. From the perspective of Disability Studies, these barriers are socially produced rather than individual limitations (Oliver, 1990; Shakespeare, 2014). Consequently, web accessibility should be regarded as an essential component of equitable access to healthcare rather than merely a technical feature of website design.

The importance of accessible digital healthcare is reinforced by international human rights frameworks.

The United Nations Convention on the Rights of Persons with Disabilities defines access to information and communication technologies as a fundamental right and obliges States parties to ensure that digital services are accessible to persons with disabilities (United Nations, 2006). Similarly, in 2016, the European Union adopted Directive (EU) 2016/2102, which requires public sector websites to be built and maintained in such a way that they comply with harmonised European accessibility standards. These requirements are primarily based on the Web Content Accessibility Guidelines (WCAG), which operationalise the principles of equality, non-discrimination and universal access (Wentz, Jaeger, & Lazar, 2011). Nevertheless, accessibility deficiencies remain widespread across public sector websites, including healthcare institutions, despite existing legal obligations (Acosta-Vargas et al., 2018; Macakoğlu & Peker, 2022; Moreno et al., 2022; Dror et al., 2021; Giummarra et al., 2025).

Although Bulgaria has invested in the digitalization of public administration and healthcare, empirical evidence on the accessibility of public healthcare websites remains scarce. Existing studies focus primarily on municipalities or

the broader public sector, while comprehensive assessments of healthcare institutions are largely absent. This gap limits understanding of whether digital transformation has resulted in equitable access for persons with disabilities. This study examines the web accessibility of public healthcare institutions in Bulgaria. Using automated evaluation based on WCAG 2.1, it assesses the prevalence and distribution of accessibility barriers and interprets the findings through the perspectives of Disability Studies, digital ableism, and the right to health. The central argument is that poor web accessibility should be understood not merely as a technological deficiency but as a form of institutional exclusion that limits equal access to healthcare and reproduces digital inequalities.

2. THEORETICAL FRAMEWORK

This study draws on the interdisciplinary field of Critical Disability Studies, which conceptualises disability not as an individual medical condition but as the outcome of the interaction between bodily impairments and a socially organised environment (Oliver, 1990; Shakespeare, 2014). The social model of disability shifts the analytical focus from individual deficits to the physical, institutional, communicative and technological barriers that restrict participation. From this perspective, disability is defined as a product of inaccessible environments rather than as an inherent limitation of individuals. Digital environments, including the websites of public institutions, therefore constitute an important arena in which disability may be socially produced or institutionally reduced.

The accelerated digitalisation of public services has transformed websites into key interfaces through which citizens exercise their rights and gain access to information, administrative procedures and public services. In the context of healthcare, institutional websites function as portals for booking appointments, accessing hospital services, obtaining information about health insurance and patients' rights, and receiving public health communications (Lupton, 2017). Their level of web accessibility therefore directly determines the extent to which individuals can navigate contemporary healthcare systems independently, on an equal basis and without external assistance.

From the perspective of Critical Disability Studies, digital technologies are not neutral communication tools but complex socio-technical systems embedded in wider relations of power (Goggin & Newell, 2003). Website design reflects developers' implicit assumptions about the characteristics of the 'normal' user, including their sensory, motor and cognitive abilities, as well as the conventional ways in which they are expected to interact with digital interfaces. Inaccessible digital environments therefore reproduce, materialise and legitimise existing social inequalities within digital space.

This understanding is consistent with Goodley's (2014) argument that technologies should be analysed as structural components of broader systems of social inclusion and exclusion rather than as independent technical artefacts. Digital healthcare infrastructures shape in advance the opportunities available to vulnerable groups for participation. They consequently become key institutional arenas in which patients' fundamental civil and social rights are effectively negotiated, upheld or denied.

The concept of digital ableism provides a theoretical perspective for understanding why inaccessible healthcare websites constitute structural barriers rather than merely defects in technical design. Ellis and Kent (2011) argue that digital media routinely construct an idealised user who is sighted, cognitively typical, technologically literate and capable of rapid interaction through conventional input devices. These assumptions are embedded in user-interface design, navigation structures, multimedia content and the overall information architecture of digital platforms.

When such exclusionary assumptions characterise public-sector websites, web accessibility ceases to be a matter of individual usability and becomes an issue of institutional power. Mladenov (2016) demonstrates that ableism operates through institutional arrangements and structural practices that privilege normative bodily and cognitive capacities while systematically marginalising alternative modes of functioning. In healthcare, inaccessible digital platforms become administrative mechanisms of control that regulate and restrict individuals' ability to obtain information independently, book appointments, access services and make informed decisions about their own health. Digital exclusion therefore represents an extension of institutional ableism into virtual environments. Just as inaccessible hospital architecture restricts physical access, inaccessible websites restrict digital access to healthcare. The user interface itself becomes a primary structural barrier through which social inequalities are systematically reproduced before any direct interaction between patients and healthcare professionals takes place.

The normative foundation of this study derives directly from the United Nations Convention on the Rights of Persons with Disabilities, which establishes accessibility as a prerequisite for the exercise of all human rights rather than as a matter of social welfare policy (United Nations, 2006). Article 9 explicitly imposes a legal obligation on States Parties to ensure access to information and communication technologies. Articles 21 and 25 further connect accessible information with freedom of expression, access to information and the right to health.

Quinn (2009) argues that the Convention represents a paradigm shift by moving disability beyond the sphere of purely medical intervention and situating it within the framework of equal citizenship and inalienable human rights.

Within this framework, inaccessible digital public services should not be interpreted as isolated technical defects but as systemic institutional failures to provide the conditions necessary for equal participation.

This perspective is particularly relevant to healthcare, as the contemporary right to health extends beyond the provision of basic medical treatment and includes unhindered access to health information, the ability to provide informed consent and equal opportunities to obtain healthcare services (Chapman, 2017). As Mégret (2008) observes, individuals cannot meaningfully exercise their rights in the field of health if they are denied the capacity to independently retrieve and process the information required to navigate the administrative structures of healthcare systems. Inaccessible healthcare websites and portals therefore compromise and, in practice, restrict the realisation of the right to health before patients have entered a healthcare facility or interacted directly with medical professionals.

Although the Web Content Accessibility Guidelines (WCAG) are generally interpreted as technical standards, they may also be understood as a practical operationalisation of fundamental human rights principles. WCAG translates abstract legal and philosophical concepts such as equality, accessibility, non-discrimination, universal design and inclusion into specific, measurable and technologically applicable criteria that can be systematically and empirically evaluated (Wentz, Jaeger, & Lazar, 2011).

Accessibility research demonstrates that failure to comply with WCAG has tangible social consequences extending far beyond the basic usability of a website. Violations of these criteria on public-sector websites reduce users' autonomy, increase their dependence on intermediaries and third parties, restrict civic participation and limit equal access to public services (Lazar et al., 2015). In healthcare, these deficiencies have particularly serious consequences: they may delay access to timely medical care, prevent individuals from obtaining health information and severely constrain their capacity to make informed decisions. Compliance with WCAG should therefore not be regarded merely as an indicator of technical quality, but as direct evidence of a healthcare institution's commitment to equal access, social justice and digital democracy.

Building on these theoretical perspectives, the present study conceptualises web accessibility as a multidimensional phenomenon situated at the intersection of technology, disability, healthcare and human rights. Rather than evaluating healthcare websites solely through technical indicators, the study interprets accessibility barriers as manifestations of institutional practices that shape opportunities for participation in the healthcare system.

In accordance with this framework, web accessibility is analysed at three interrelated levels. First, at the technical level, violations of WCAG criteria serve as empirical indicators of non-compliance with internationally recognised web standards. Second, at the institutional level, these violations reflect the extent to which public healthcare organisations prioritise the principles of universal design and inclusive digital governance. Third, at the social level, accessibility barriers are understood as administrative mechanisms through which digital infrastructures reproduce inequality and institutional ableism by restricting autonomy and equal access to health information and services.

3. METHODS

This study employs a standardised institutional assessment of the web accessibility of public healthcare organisations in Bulgaria using automated evaluation against internationally recognised accessibility standards. Its purpose is to assess the extent to which the digital infrastructure of healthcare institutions enables or impedes equal access to information and services for persons with disabilities.

The sample comprised the official websites of public healthcare organisations in Bulgaria, listed in the Register of Hospitals, Mental Health Centres, Centres for Dermatological and Venereological Diseases, Comprehensive Cancer Centres, Homes for Medical and Social Care, Dialysis Centres and Tissue Banks by region, published on the website of the Bulgarian Ministry of Health.

The Ministry of Health Register contained 390 healthcare institutions. However, verification of their websites established that 38 institutions had ceased operating, 51 had no website, nine had non-functioning websites, and 21 were branches of, or duplicated, other healthcare institutions. The final assessment therefore covered the websites of 271 healthcare institutions. These institutions had official web platforms that were active and functional, available in Bulgarian, accessible without user registration or authentication, and used by citizens to obtain information, complete administrative procedures and access healthcare services. The analysed websites therefore represent the actual digital entry points to the Bulgarian healthcare system.

Evaluation Framework

Web accessibility was evaluated against WCAG 2.1, harmonised with the European standard EN 301 549 and the EU legal framework governing public digital services. Accessibility data were collected using the WAVE evaluating tool developed by WebAIM, one of the most widely used automated accessibility evaluation tools in international accessibility research. The tool was selected because it provides standardised measurement, a high level of reproducibility and comparability across large samples of institutional websites.

Each website was assessed using the same procedure: automated evaluation of the home page; identification of WCAG 2.1 Level A and AA violations, and recording of the type and frequency of all detected errors. The decision to analyse the home page followed the WCAG-EM methodology and established practice in international web accessibility research. Home pages are treated as broadly representative of the website as a whole because problems relating to structure, navigation and design are commonly reproduced across internal pages. The assessment was conducted in August 2025 using the WAVE Mozilla extension, version 3.2.7.1, released in September 2024.

Indicators

Accessibility errors were classified according to the four WCAG principles: perceivable, operable, understandable and robust. Each type of error was interpreted not only as a technical defect, but also as a potential barrier affecting persons with visual, motor, cognitive or sensory impairments when accessing health information and services.

The data were analysed at three complementary levels:

1. Technical level – the degree of compliance with WCAG 2.1;
2. Institutional level – the extent to which compliance reflects the organisation's commitment to universal design and the right of access;
3. Social level – the ways in which the presence or absence of accessibility signals structural inequalities and forms of digital exclusion, and how digital barriers on healthcare websites become barriers to healthcare access and to the exercise of the rights of persons with disabilities.

Limitations

Automated evaluation does not capture all dimensions of accessibility, particularly those requiring human judgement, such as cognitive and semantic barriers, the quality of content, the appropriateness of alternative text, the logical reading order, and the actual user experience. Only the home page of each website was evaluated, and no usability testing involving persons with disabilities was conducted. The findings should therefore be interpreted as indicators of structural accessibility barriers rather than direct measures of user experience. Nevertheless, automated WCAG evaluation provides a reliable and objective basis for large-scale institutional comparison and for identifying systemic patterns of digital exclusion.

Use of Previously Published Data

Parts of the empirical dataset have been reported in the author's previous studies on the accessibility of Bulgarian public-sector websites (Hristova, 2025a, 2025b, 2026a, 2026b), where they were analysed within the broader context of digital accessibility in the public sector. The present article reuses only the healthcare subsample and offers a new analytical contribution by interpreting the findings through the perspectives of Critical Disability Studies, digital ableism and the right to health. Rather than focusing on descriptive accessibility statistics, the study introduces a three-level interpretative framework that conceptualises WCAG violations as indicators of institutional practices shaping equal access to healthcare.

In accordance with good practices of research transparency, the present article describes only those methodological elements necessary for understanding the new analytical aims and interpretations. Detailed procedures for data collection and primary data processing are documented in the relevant earlier publications (Hristova, 2025a; 2026a; 2026b).

4. RESULTS AND DISCUSSION

The accessibility assessment indicates that the websites of healthcare institutions in Bulgaria demonstrate a low level of compliance with WCAG 2.1, placing the healthcare sector among the least accessible areas of Bulgarian public administration (Hristova, 2025a, 2025b, 2026a, 2026b). Across the 271 websites analysed, 8,853 WCAG violations were identified, corresponding to an average of 32 accessibility errors per website (SD = 40.32; median = 24; minimum = 0; maximum = 429). The highly skewed distribution indicates that, although a limited number of websites accumulate exceptionally large numbers of accessibility errors, accessibility deficiencies are widespread across the sector despite the existence of legal accessibility requirements, which is a pattern consistent with international evidence (Martins, Duarte, 2024; Giummarra et al., 2025; Acosta-Vargas et al., 2022).

Only eight websites (3.0%) contained no detectable accessibility errors. The remaining 97% had at least one accessibility barrier, suggesting that, for persons with disabilities, virtually the entire digital healthcare system in Bulgaria is structurally problematic at the initial point of access. This indicates that digital exclusion is the norm rather than the exception within the Bulgarian healthcare system. From the perspective of the social model of disability, the findings suggest that barriers to healthcare are created not only by the physical environment but increasingly by inaccessible digital platforms. Healthcare websites therefore function as institutional gatekeepers that shape opportunities for participation long before patients interact with healthcare professionals. Similar conclusions have been reported in studies of eHealth and telehealth services, which demonstrate that inaccessible

digital environments reduce independent access to healthcare and reinforce existing health inequalities for persons with disabilities (Pettersson et al., 2023; Valdez et al., 2021).

The distribution of accessibility errors further demonstrates that the problem extends beyond isolated technical shortcomings. More than 40% of the websites analysed contained over 30 accessibility errors, placing them within a category of substantial digital inaccessibility. Although approximately 56% of the websites recorded fewer than 30 errors, they nevertheless failed to meet basic WCAG success criteria that are critical for users who rely on assistive technologies. A relatively low number of identified errors should therefore not be interpreted as evidence of meaningful accessibility, since even a single violation may completely prevent independent navigation for a particular group of users.

A particularly important finding concerns the cumulative nature of accessibility barriers. Approximately 41% of the websites analysed contained four or more distinct categories of accessibility violations, indicating that exclusion is rarely produced by a single technical problem. Instead, multiple barriers frequently coexist within the same interface, simultaneously affecting the perception of information, navigation, interaction with forms, and compatibility with assistive technologies. Such cumulative barriers significantly increase the complexity of website use and create fragmented user experiences that disproportionately affect persons with disabilities. As Goodley (2014) argues, exclusion emerges through interacting systems of disadvantage rather than through isolated obstacles. The present findings show that digital environments reproduce precisely such cumulative mechanisms. Rather than occurring in isolation, accessibility barriers frequently accumulate within the same digital interface, producing compounded exclusion for users who depend on assistive technologies. Comparable patterns have been identified in large-scale evaluations of public-sector websites across different countries (Martins, Duarte, 2024).

The analysis also reveals that accessibility problems are not randomly distributed across WCAG criteria. Insufficient colour contrast accounts for 71% of all identified errors and occurs on 87.5% of the websites, making it the most widespread accessibility problem in the Bulgarian healthcare sector. Although colour contrast is often regarded as a relatively minor design issue, it directly affects users with low vision, age-related visual impairments, dyslexia and certain cognitive impairments (Lazar, Goldstein, & Taylor, 2015). In the context of healthcare, poor visual legibility may prevent patients from locating departments, understanding administrative procedures, identifying emergency contact information or accessing healthcare services. Colour contrast therefore becomes not merely an issue of interface aesthetics, but a matter of equal access to health information. Similar findings have been reported in evaluations of healthcare websites internationally, where insufficient colour contrast consistently ranks among the most prevalent accessibility failures affecting users with visual impairments (Giummarra et al., 2025).

Similarly, almost half of the websites (46.9%) contained linked images without alternative text, while 25.5% included images with no alternative descriptions at all. These findings suggest that key navigational elements and informational content remain invisible to screen-reader users. For these patients, access to online appointment booking, information about clinics and healthcare professionals, website navigation and available medical services is seriously or completely obstructed. The practical consequence is increased dependence on family members, carers or healthcare staff to obtain information that should be independently accessible.

Navigation-related problems further reinforce this pattern of exclusion. More than half of the websites analysed (53.9%) contained empty links, while 23.2% included empty buttons, creating substantial barriers for keyboard users and individuals who rely on assistive technologies. Such interface errors violate basic usability principles and transform healthcare websites into unpredictable environments in which orientation and interaction become unnecessarily difficult. From the perspective of digital ableism (Ellis & Kent, 2011), these design practices reflect implicit assumptions that users interact with websites through conventional visual interfaces using a mouse, thereby excluding individuals whose interaction depends on alternative technologies.

Institutional commitment to accessibility appears equally limited. Only 16 of the 271 websites analysed (8.3%) had published accessibility statements, despite this being a legal requirement under European and Bulgarian legislation. Even among these 16 websites, some statements were outdated, dating from 2020 or 2021, and had not been reviewed annually. More concerning still, among the 51 healthcare institutions that underwent official inspection in 2024–2025, only nine had published an accessibility statement. This suggests that regulatory pressure is largely ineffective within the healthcare sector and that accessibility remains peripheral to digital governance practices. This finding closely mirrors evidence from Sweden, where public healthcare providers have also demonstrated inconsistent compliance with the legal requirement to publish accessibility statements despite the implementation of the European Web Accessibility Directive (Jonsson et al., 2025).

The absence of accessibility statements has implications beyond simple non-compliance with administrative requirements. Accessibility statements constitute institutional recognition of accessibility as a governance responsibility and communicate both existing limitations and planned improvements. Their widespread absence therefore reflects a broader lack of institutional accountability for digital inclusion. This observation is consistent

with previous accessibility research showing that legislative obligations alone rarely produce substantive improvements without effective monitoring, enforcement and organisational commitment (Wentz, Jaeger, & Lazar, 2011). Longitudinal evidence likewise suggests that legislation alone is insufficient to improve accessibility unless accompanied by systematic monitoring, enforcement and organisational capacity building (Inal & Torkildsby, 2025).

Taken together, the empirical findings support the central theoretical argument advanced at the outset: digital barriers in Bulgarian public healthcare should be understood as manifestations of institutional ableism rather than as isolated technical problems. The widespread occurrence of accessibility violations across institutions of different sizes indicates that exclusion is systematically reproduced through organisational practices rather than arising from exceptional circumstances or insufficient financial resources. Healthcare websites are therefore not neutral channels for the provision of information, but infrastructures that actively regulate access to healthcare services.

From a human rights perspective, these findings have important implications for the realisation of the right to health as articulated in the United Nations Convention on the Rights of Persons with Disabilities (United Nations, 2006). Web accessibility is a prerequisite for independent access to health information, administrative procedures and healthcare services. When institutional websites remain inaccessible, barriers arise at the very first stage of healthcare use, before patients have the opportunity to consult healthcare professionals. Digital exclusion therefore becomes a mechanism through which inequalities in healthcare are reproduced.

Overall, the findings indicate that the Bulgarian healthcare system continues to operate within a digital environment characterised by widespread institutional barriers. Improving web accessibility therefore requires considerably more than the correction of isolated programming errors. It requires accessibility to be embedded in institutional governance, public procurement procedures, digital transformation strategies, quality assurance processes and healthcare policy. Only under such conditions can digitalisation contribute to reducing, rather than reinforcing, existing inequalities in access to healthcare. These conclusions are consistent with the growing international literature, which argues that sustainable improvements in digital accessibility require governance reforms, continuous monitoring and the integration of accessibility into digital transformation strategies, rather than relying solely on technical compliance with WCAG (Inal & Torkildsby, 2025; Jonsson et al., 2025; Martins, Duarte, 2024).

5. CONCLUSION

The digital transformation of healthcare has fundamentally changed the ways in which citizens access health information, communicate with healthcare institutions and navigate healthcare systems. Consequently, web accessibility can no longer be regarded merely as a technical characteristic of institutional websites; it has become a prerequisite for equitable access to healthcare. The findings of this study demonstrate that the websites of public healthcare institutions in Bulgaria continue to exhibit widespread accessibility barriers that systematically restrict independent access for persons with disabilities.

The high prevalence of WCAG violations across almost all of the websites analysed indicates that digital exclusion is neither isolated nor incidental, but embedded within the current organisation of the public healthcare system. These findings support the argument that inaccessible digital environments represent a form of institutional ableism, reproducing inequalities through technological infrastructures rather than through explicit discriminatory practices. Healthcare websites therefore function as digital gatekeepers, shaping opportunities for access and participation before any direct interaction with healthcare professionals takes place.

The study also demonstrates that accessibility should be understood as an issue of governance and institutional responsibility rather than simply website quality. The limited adoption of accessibility statements, despite clear legal obligations, together with the persistence of fundamental accessibility errors, suggests that compliance with accessibility standards has not yet become an integral component of digital governance in Bulgarian healthcare. Legislative requirements alone appear insufficient without effective monitoring, organisational commitment and mechanisms of accountability.

By integrating Critical Disability Studies with web accessibility evaluation, this study extends existing research beyond technical compliance and conceptualises WCAG violations as indicators of broader institutional practices that shape access to healthcare. In doing so, it contributes to the growing body of research positioning digital accessibility at the intersection of disability rights, public administration and health policy.

The study is subject to several limitations. It relies on automated accessibility evaluation, which cannot identify all accessibility issues, particularly those requiring expert judgement or user testing, and it assesses only the home pages of institutional websites. Future research should combine automated assessment with expert evaluation and usability testing involving people with different types of disabilities.

Despite these limitations, this study provides the first comprehensive assessment of the web accessibility of public healthcare institutions in Bulgaria from the perspectives of Critical Disability Studies and the right to health. Its

findings demonstrate that digital accessibility should be recognised as a fundamental dimension of health equity and that creating accessible digital environments is an essential condition for social inclusion, equal citizenship and the effective realisation of the right to health.

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