International Journal of Health Sciences
Available online at www.sciencescholar.us
Vol. 8 No. 2, August 2024, pages: 129-144
E-ISSN: 2550-696X
https://doi.org/10.53730/ijhs.v8n2.14949

Malaysian Hospitals on the Web: a Multi-Criteria Assessment of Official Websites

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Manuscript submitted: 27 March 2024, Manuscript revised: 18 May 2024, Accepted for publication: 09 June 2024

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Keywords

assessment;
evaluation;
health;
hospital;
website;

Abstract

This study thoroughly examines and assesses hospital websites in Malaysia according to a predefined list of indicators and sub-indicators, based on four criteria: Technology Features, Content, Services, and Community Interaction, as defined in the Health Sector Website Assessment Index (HSWAI). A total of 107 Malaysia hospitals were assessed. Private and university hospitals outperform public ones, especially in online appointment management and patient care automation areas. Most hospital websites perform well in the technology features criterion and satisfactorily on content, but show shortcomings in accessibility, reliability, research and teaching, participation, and community interaction elements, and most of them fall short in quality metrics data. Malaysian hospitals should adopt best practices to improve their websites concerning accessibility, reliability, services, and community interaction. The website design should endeavour to include multiple stakeholders, considering people with disabilities, in line with the sustainable development goals of leaving no one behind. Additionally, websites should ensure the dissemination of evidence-based information while taking advantage of social media to reach a wider audience.

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Contents

1 Introduction

In healthcare, digital technological transformation occurs not only in diagnostics and equipment but also in healthcare administration, management, and improved service delivery (Lyanna et al., 2022; World Health Organization, 2021). With the emergence of the COVID-19 pandemic, digital health services, such as telehealth services, have surged (Ahmed et al., 2020). The WHO Global Strategy on Digital Health presents a roadmap for digital technology to be supportive of equitable and universal access to quality health services (World Health Organization, 2021). In this regard, technology applications can improve health institutes' operation and optimise service provision enabling them to provide high-quality, affordable and equitable care. Furthermore, emerging technologies can enhance health outcomes if supported by quality governance and institutional systems to deliver healthcare (Junaid et al., 2022).

The hospital website is an essential element of the digital healthcare ecosystem that supports the shift from an organization-centric to a patient-centric delivery healthcare services model (Serbanati et al., 2011; Viswanadham, 2021). Websites are important means for establishing communication and exchanging information between healthcare professionals and patients and thus should enjoy an acceptable level of quality (Jeddi et al., 2017). Hospitals have increasingly maximised this utility by developing websites that provide services and patient-relative information (Saghaeiannejad-Isfahani et al., 2019; Farrahi et al., 2018). Designing intelligent health systems that can work following the patient is expected to be one of the key success factors of intelligent health service provision (Stephanidis et al., 2019), even considering AI-patient interaction (Antona et al., 2019; Macakoğlu & Peker, 2023). Information on websites enables people to schedule and book medical appointments online, avoiding overcrowding in hospitals (Yang et al., 2019; Zhao et al., 2017). This encourages and empowers people to take a more active role in managing their health (Salarvand et al., 2016). This also means that the workload on hospital staff and waiting times are reduced which means better quality of patient care (Raji et al., 2013). Hospital websites have been used for the dissemination of scientific results, educational material, knowledge management and telemedicine services (Yan et al., 2020). Furthermore, hospitals are using web-based and social media tools for advertisement and marketing purposes (Ford et al., 2013).

Research on content, services and quality features of hospital websites has led to the development of different tools to assess healthcare institutes' websites. Previous studies, worldwide, have assessed healthcare websites considering various aspects (Sarantis et al., 2023a; Sarantis et al., 2023b). Bach et al. (2019), analysed five dimensions of hospitals that include technical items, hospital information and facilities, admission and medical services, interactive online services and external services (Bach et al., 2019). The most prevalent and important categories for hospital websites are accessibility, content, design method, security, confidentiality of personal information treatment and user-friendliness (Jeddi et al., 2017). In a study on infectious diseases, hospital websites in Poland websites were evaluated based on search engine optimisation, website availability, and mobile-friendliness (Król & Zdonek, 2021). In Iran, studies have assessed hospital websites based on website contact interactivity, content, design, organisation, user-friendliness, performance, technical points, care and medical services implemented in hospitals (Bakhshi et al., 2017; Rafe & Monfaredzadeh, 2012). Similarly, in Kuwait, hospital websites were evaluated based on accessibility, presence, content, and usability dimensions to improve consumer engagement and access to health information (Alhuwail et al., 2018). In China, an assessment based on content, function, design, management and usage showed good website performance in content, normal performance in website function and design

and bad performance in website management and usage (Liu et al., 2011), Similarly, another study showed hospital websites were weak for product, price, and promotion, and the quality of hospital websites differed across locations and levels of care (De Song et al., 2015).

Hospital websites that are informative, accessible, and easy to use can strengthen health services and patient care, subsequently contributing to Universal Health Coverage (UHC), and Sustainable Development Goals (SDGs). Hence, it is important to also investigate the quality of hospital websites, to understand their strengths, and gaps and provide recommendations for policy changes to promote better hospital websites.

To the best of our knowledge, no previous study in Malaysia has assessed the quality of hospital websites. Hence this study aims at providing a comprehensive assessment of Malaysian hospitals' websites across multiple dimensions for their public engagement and access to health information and services. The next section illustrates the applied assessment methodology and section three presents the results (Singh et al., 2012). Section four discusses and analyses the findings and concluding remarks are presented in the last section.

2 Assessment Methodology

The assessment uses the Health Sector Website Assessment Index (HSWAI), an instrument that assesses the hospital website according to four main criteria: Content, Services, Community Interaction, and Technology Features. This section briefly describes the assessment methodology and the application process in the Malaysian context followed in the study.

The instrument

A detailed description of the assessment methodology used, named HSWAI, can be found in Sarantis et al. (2022). Thereinafter the four criteria (Table 1) are briefly presented.

Table 1
HSWAI Criteria, Indicators and relative weights

C1: CONTENT			**20%**
	C1.i1. Health institution information available on the website	20%	
	C1.i2. Quality Metrics	20%	
	C1.i3. Organizational Structure and Medical Information	10%	
	C1.i4. Patient Information	40%	
	C1.i5. Research and Teaching	10%	
	Total weight of C1 indicators	100%	
C2: SERVICES			**50%**
	C2.i1. Administration Procedures	20%	
	C2.i2. Appointments	40%	
	C2.i3. Patient Care	40%	
	Total weight of C2 indicators	100%	
C3: COMMUNITY INTERACTION			**20%**
	C3.i1. Participation	70%	
	C3.i2. Media	20%	
	C3.i3. Advertising/Marketing	10%	
	Total weight of C3 indicators	100%	
C4: TECHNOLOGY FEATURES			**10%**
	C4.i1. Navigability	20%	
	C4.i2. Accessibility	20%	
	C4.i3. Usability/Readability	20%	
	C4.i4. Credibility	20%	
	C4.i5. Privacy/Security	20%	
	Total weight of C4 indicators	100%	
TOTAL			**100%**

A hospital's website content is one of the fundamental reasons for a user to visit and use it and is therefore of prime importance. Content completeness is crucial for maintaining the credibility of the hospital website and providing valuable resources for patients, caregivers, healthcare professionals, and the community (Adams, 2010). The criterion examines the availability of health institution's information, the provision of quality metrics elements, the presence of the institution's organization knowledge, fundamental medical information, and essential material for the patient and hospital's research and education activities (Verlicchi et al., 2015).

Online services assessment, in the context of a hospital website, refers to the evaluation and analysis of the digital services and functionalities provided to users through the website (Roy et al., 2009). Services criterion considers online health services provision, including for instance, automation of administrative procedures, healthcare scheduling, prescription renewal or drug acquisition, billing and payment services, telehealth services and doc-tor-patient consultation mechanism.

Community interaction activities on a hospital website are designed to foster engagement, communication, and collaboration between the healthcare institution and the local community. These activities aim to provide valuable information, support community health initiatives, and enhance the hospital's relationship with patients and other stakeholders (Wang & Luo, 2005). Community Interaction criterion considers various participation, media, advertising and marketing elements.

Finally, the Technology Features criterion focuses on the technical quality of hospital websites. Its main concern is attributes such as navigability, usability, readability, accessibility, security, privacy, accuracy, and coherence aspects.

Each HSWAI criterion includes a set of indicators, each of which has a specific weight (Table 1) that illustrates its relative relevance to the overall assessment of the website (Sarantis et al., 2020). Each indicator is further subdivided into sub-indicators. Sub-indicators of an indicator weigh equally, being their weight obtained by expression (1).

Sub-indicator weight = (1/(number of applicable sub-indicators))*100% (1)

Taking into account these weights, an index that shows the level of maturity of the health institution's website can be calculated. Each indicator is obtained by expression (2).

$$Indicator\ Value = \frac{\sum values\ of\ all\ the\ sub_{indicators}}{Total\ number\ of\ sub_{indicators} \neq \text{not applicable}} \quad (2)$$

The values of the four criteria are calculated by expressions (3), (4), (5) and (6)

Criterion1 = 20%*Criterion1i1 + 20%*Criterion1i2 + 10%*Criterion1i3 + 40%*Criterion1i4 + 10%*Criterion1i5 (3)

Criterion2 = 20%*Criterion2i1 + 40%*Criterion2i2 + 40%*Criterion2i3 (4)

Criterion3 = 70%*Criterion3i1 + 20%*Criterion3i2 + 10%*Criterion3i3 (5)

Criterion4 = 20%*Criterion4i1 + 20%*Criterion4i2 + 20%*Criterion4i3 + 20%*Criterion4i4 + 20%*Criterion4i5 (6)

The final value of iHSWAI is a value between 0 and 1 and it is obtained by expression (7)

iHSWAI = 20%*Criterion1 + 50%*Criterion2 + 20%*Criterion3 + 10%*Criterion4 (7)

The application process

The assessment will take place in 2022 through direct observation of the health institutes' websites. For this reason, the first step in the application process is to identify the URL of the health institute's main website. In addition, remarkably relevant is to cover geographically the whole country and identify all different health institute types.

Initially, the list of hospital websites in Malaysia was compiled from the websites of the Ministry of Health (MOH) and the Association of Private Hospitals in Malaysia (APHM). An additional manual search was conducted in "Google Search" to locate additional websites of hospitals not listed by the two sources above. For a hospital website to be included in the assessment process it should be active, reachable and available in either the Malay or English language and associated with a hospital recognized by the Ministry of Health in Malaysia which offers multi-day in-patient admissions and services.

Hospitals have been geographically classified in the state or federal territory they belong. The listed hospitals have been further classified, based on their type, as private, public (under MOH) and teaching (university) hospitals (under the Ministry of Higher Education). Furthermore, public hospitals were categorised as either state or district-level hospitals. Additional information such as the number of beds capacity for each hospital was recorded during the mapping exercise. As a result, a total of 145 public hospitals, 146 private hospitals and 5 university hospitals were included in the initial mapping process.

The second stage involved the selection of hospitals to be included in the assessment process. The major referral hospitals in Malaysia, all state/federal territory level hospitals (13 federal territory or state-level hospitals), were included in the assessment. Additionally, all the teaching (university) hospitals (5) were selected. In each state, we selected four government district-level hospitals. In states with more than 4 district hospitals, bed capacity was used to select the four largest district hospitals. In states with less than four district hospitals, all the hospitals were automatically included in the assessment (Suryasa et al., 2022).

The five largest private hospitals in each state were selected using bed capacity as an indicator of size. Particular attention was paid not to selecting more than one hospital from the same district or company in each state. If the two largest private hospitals were from the same company, the next largest hospital from another company was selected. As a result, 16 state/federal level government hospitals, 45 district level government hospitals, 56 private hospitals and 5 university hospitals were selected for the assessment.

The assessment was conducted through direct observation of the set of criteria, indicators, and sub-indicators. Value 1 was assigned to the existence of the sub-indicator, 0 to non-existence, and NA if it was not relevant. The study was performed by a group of two assessors, under the supervision of a third one (supervisor), who is an expert on the assessment process. This means that for each hospital website, there are two values (one from each assessor) which were approved by the supervisor. In cases where the two assessors assigned different values to a specific sub-indicator, this was signalled to them to be reassessed more thoroughly. In case the assessment discrepancy remained, the supervisor resolved which value was assigned to the sub-indicators.

3 Results and Discussions

In total 123 hospitals were selected for assessment in this study. Of these, 88% (107) were included in the final assessment. Sixteen hospital websites were excluded because they were inactive at the time of the data collection. Excluded hospital websites were from the district level that either did not have a website or the websites were under maintenance and could not be reached through the entire data collection period. The majority of the highest-ranked hospitals in Malaysia, as indicated in Table 2, are situated in Peninsular Malaysia and are privately owned. Notably, the top 10 hospitals predominantly consist of private healthcare facilities, with only one university hospital included, and no public hospitals featured.

Table 2
Top 10 hospitals in Malaysia in HSWAI assessment

Hospital Name	State/Federal Territory	Type	HSWAI
Mahkota Medical Centre Melaka	Melaka	Private	0,54
KPJ Perdana Specialist Hospital Kelantan	Kelantan	Private	0,53
Gleneagles Hospital Johor	Johor	Private	0,53
Subang Jaya Medical Centre	Selangor	Private	0,52
Prince Court-KL	Kuala Lumpur	Private	0,51
KPJ Damansara	Selangor	Private	0,51
University Kebangsaan Hospital Malaysia	Kuala Lumpur	University	0,51
KPJ Sabah Specialist Hospital	Sabah	Private	0,50
KPJ Perlis Specialist Hospital	Perlis	Private	0,50
Regency Specialist Hospital	Johor	Private	0,50

Technology features sub-indicators were implemented by the majority of hospitals in Malaysia. Navigability (TF), Privacy/Security (TF) and Usability/Readability (TF) indicators score the highest at 0.89, 0.73 and 0.72 respectively, in all hospitals (Table 3). Almost all public and teaching hospitals (0.96) provide navigability features on their websites. Three-quarters (0.75) of privacy features have been implemented by private and teaching hospitals compared to 0.71 in public healthcare facilities. Content emerges as the second best-implemented criterion among hospitals in Malaysia. More than half of, Health Institution Information Available on the Website(C), Patient Information (C) and Organisational Structure and Medical Information (C) sub-indicators, are present in Malaysian hospitals (0.51-0.57). On average, Health Institution Information Available on the Website(C) is covered to a greater extent at public hospitals (0.60) compared to private (0.54) and teaching (0.57) ones. On the other hand, Patient Information (C) is implemented more satisfactorily in teaching (0.60) and private hospitals (0.58) compared to public (0.42) ones.

Advertising/Marketing (CI) indicator scores 0.45. Analysing further this indicator, while teaching hospitals focus on advertising/marketing activities (0.65), private hospitals score 0.51 and public hospitals underperform by scoring 0.38 in this area. Nearly a third (0.30) of participation sub-indicators are provided on Malaysian hospital websites. Private hospitals (0.33) perform slightly better at this indicator compared to university and public (0.27) ones. Similarly, the Media indicator scores are 0.27 at all hospitals, with 0.36 at teaching hospitals, 0.27 at private hospitals and 0.24 at public ones. Administration Procedures (S) scores 0.37, Patient Care (S) 0.13 and Appointments (S) 0.12. While teaching hospitals score relatively high (0.56) in Administration Procedures, public hospitals score relatively low 0.31. Similarly, Patient Care features scores of 0.23 at private hospitals but only 0.01 at public ones. Expectedly, Research and Teaching (C) score better at teaching hospitals (0.28) than public (0.17) and private (0) ones. The lowest performance appears at Quality metrics (C), with 0.07 in all hospitals.

Table 3
Indicator value (average of sub-indicators) (criterion in parenthesis)

Indicator	All Hospitals	Public Hospitals	Private Hospitals	University Hospitals
Navigability (TF)	0,89	0,97	0,81	0,96
Privacy/Security (TF)	0,73	0,71	0,75	0,75
Usability/Readability (TF)	0,72	0,72	0,73	0,75
Health institution information available on the website (C)	0,57	0,61	0,55	0,57
Patient Information (C)	0,51	0,42	0,58	0,60
Organisational Structure and Medical Information (C)	0,51	0,49	0,52	0,63
Credibility (TF)	0,46	0,47	0,44	0,57
Advertising/Marketing (CI)	0,46	0,38	0,51	0,65
Accessibility (TF)	0,45	0,47	0,42	0,50
Administration Procedures (S)	0,37	0,31	0,40	0,56
Participation (CI)	0,30	0,27	0,33	0,27
Media (CI)	0,27	0,25	0,29	0,36
Research and Teaching (C)	0,18	0,17	0,00	0,28
Patient care (S)	0,13	0,01	0,23	0,14
Appointments (S)	0,12	0,01	0,21	0,17
Quality Metrics (C)	0,07	0,07	0,06	0,16

Content

On average Malaysian hospital websites adequately covered features that compose the content criterion (Table 3). Three indicators of this criterion are health institution information available on the website, Organisational Structure and Medical Information and Patient information scored more than 0,5. University teaching hospitals performed best on all the indicators except the Health institution information, where public hospitals performed better.

Health institution information indicators include sub-indicators related to the hospital contact details, hospital history, hospital financial data, applied legislation, ways of reaching the hospital location and quality management certifications. Almost all hospital websites in Malaysia contain details about the logo, mission

statement and contact information while nearly two-thirds (63.6%) have a welcome message. Most health institutions in Malaysia provide contact information on their websites such as the institution's postal address, institution telephone and/or fax number and institution e-mail address. Additionally, 81.3% of the hospitals provide the map location whilst almost two-thirds (64.5%) have information on parking facilities around the institutions. Ways of reaching the hospital via private and public transportation were covered by only 23.4% of the hospitals. Information about quality management certification is provided by 68.2% of hospitals in Malaysia. Furthermore, health institutions in Malaysia also include information on service, health and excellence awards from different organisations on their websites. Most health institutes do not mention management reports, home hospitalization information, applied legislation to the health institutions' context and VAT number. Almost a third (29.9%) of the health institutions provide a connection to the national e-*procurement portal.*

The survey identified that almost all of the quality metrics features have a very low performance (0%-9%). Teaching hospitals perform relatively better in this indicator (15.6%) compared to the public (6.5%) and private (7.3%) ones. While 78.5% of the hospitals disclose the number of institution beds, no health institution provides a waiting list. Only 4-9% of the health institutions cover waiting time consultation, waiting time to be seen in the emergency room, and number of admissions in the previous year. None of the health institutions includes surgery waiting time, date of last monitoring of the waiting list, number of internships accepted by the hospital and clinical open data. Organisational Structure and Medical Information features are implemented by more than half of the healthcare facilities. Teaching hospitals (62.5%) perform well in this indicator while public hospitals lower with an average of 49.2%. Almost all hospitals (98.1) list services available at the institution while 89.8% provide lists for departments or units providing user services and outpatient institution services available. Issues to do with the personnel map, medical glossary and conditions and treatments are poorly covered (10.3%-16.8%). The list of employed doctors, doctors' curricula and photos of the medical teams are satisfactorily presented on institutions' websites.

Patient care service information is satisfactorily covered with more than half (51.3%) of the hospitals implementing this feature. Teaching (60.0%) and private hospitals (58.5%) show better results in this indicator compared to public (42.4%) ones. A list of consultations/services with fees available and admission-related information provided by three-quarters of the hospitals. Low coverage (<15%) appears on patient care services such as location, business hours and telephone data. Information regarding research and training activities, such as courses, publications, scheduled activities and library-related information appears in less than 30% of Malaysian hospitals. Coverage of research and training activities is also low (27.8%) among teaching hospitals. Half of the hospital websites have information about a library while 37.5% provided details on publications by the institution.

Services

Services criterion is made up of administrative procedures, appointments and patient care indicators. Coverage in this criterion is low, with the lowest performance in Appointments (12.1%) and the highest in Administration Procedures (36.9%). Teaching hospitals perform better in administration procedures (56.3%) while private ones are better in appointments and patient care (21.4%, 22.8%). Public hospitals consistently show low coverage on all three indicators with just 1% coverage of appointments and patient care. The best performance (66.3%) appears in the feature provision of online forms. However, relatively poor performance (22.4% - 33.0%) appears in features of forms downloading, filled forms uploading and electronic payments.

Admission arrangements via the web and managing visits to outpatient consulting rooms via the web sub-indicators present a very low performance (less than 5%). Manage medical examination via web feature is also poorly covered (28.0%). Asynchronous communication with the doctor via email (3.7%) and through chat (17.8%) is a low-performing sub-indicator. Features like the provision of telemedicine (video-conference system) services, private area access: with username and password and the possibility to require and/or obtain medical prescription appear at low levels (20.6% - 26.2%). Patient telemonitoring and Private area access: with Citizen Card or Mobile Digital Key sub-indicators present the lowest scores (0%-0.9%).

Community interaction

Community Interaction criterion indicators range between 0.27 and 0.65 (Table 3). University teaching hospitals perform well in advertising/marketing (0.65) and media (0.36) while private hospitals are best in participation (0.33). Regarding sub-indicators, information on differentiated advertising and content and advertising not contradictory to the website contents are exceptionally covered by at least 95% of the hospitals. Most health institutions (84.1%) have Facebook links while YouTube and Twitter exist at 31.8% and 27.1% respectively. More than half (57%) of the institutions provide information on vacancies. No hospital discloses information on sponsors and investors and only 5.6% of the hospitals provide information on how to donate to the hospital.

Websites present a mixed performance regarding media sub-indicators. The following features: The website provides an up-to-date news/events schedule/newsletter and Links to other websites of interest are covered by 73.8% of the hospitals. The institution in the media: features news that appeared in the press, radio, TV, social networks and Institution news: new techniques used by the centre specialists, and infrastructure improvement are moderately covered, (38.3% vs 47.7%). Low coverage (<6%) is observed in public relations and virtual visits to the institution.

Technology features

Technology Features indicators illustrate the highest average scores in the assessment. Their scores range from 0.45 to 0.89. Generally, all hospital types score similarly throughout those indicators. However, university teaching hospitals are best in credibility (57.1%), accessibility (50.0%) and usability (57.1%). Private hospitals perform best in privacy/security (75.3%) while public hospitals scored the overall best percentage, for navigability (97.0%). Regarding accessibility indicators, website visibility, browser compatibility and mobile device accessibility are features provided by almost all hospital websites (>99%).

Compliance with all the levels (A, AA, AAA) of Web Content Accessibility Guidelines (WCAG) 2.0 W3C is very low (0.9% - 16.8%). Similarly, the presence of accessibility symbols on the main webpage (16.8%) and website validation through W3C CSS 3.0 Validation Service (8.4%) are very low. However, the website listed on the first page of results after performing a Google search is available at almost all hospitals. The navigability indicator is the most adequately covered in our assessment (88.7%). The majority of the hospitals contain the website name on the browser title bar, have an active part of the site appearing on the browser title bar, have inter-website links distinguished from intra-website links, provide inter-website links showing a full description of the linked website, use functioning intra-website links and functioning inter-website links. However, less than half of the health institutions (40.1%) indicate the best browser version for the website.

The majority of hospitals' websites provide a rich and wide range of usability/readability features. The highest coverage (89.7%-100%) is observed on website pages that can be printed, individual sub-pages have specific and meaningful titles and graphics open conveniently among other features. Only 13.1% of the websites offer a means to modify the contrast of textual information for visitors with visual impairments while 25.2% of the websites offer a means to modify the text size without compromising the functionality of the website. Almost all (more than 96%) websites are grammatically correct and they do not have spelling errors while only 39.3% had their pages updated. Hospital websites achieve poor performance (less than 11%) in the following features: interest conflict declaration or declaration of non-conflict is shown and the website has HON (Health on the Net) foundation code certification (0.9%). More than two-thirds (71.1%) of the hospital websites contain information on the webmaster characteristics. Remarkably, more than 97% of the institutes handle copyright notices while just over half (56.1%) provide general disclaimers. Website encryptions are very high among health institutions (94.4%) while content on ownership of the site (83.2%) and responsibility of website content (72.9%) is well covered. Relatively poor performance (less than 27.1%) appears in on features like cookie policy

Discussion and Suggestions

Malaysian hospitals' websites provide adequate, technological features that enhance users' navigability, usability, and privacy issues while online. However, conformance with accessibility guidelines and means to

enhance the accessibility of the websites is relatively low. Malaysian website developers usually do not give much attention to providing alternative text descriptions for the interface items such as buttons, links, and images to support visually impaired people. Hospital websites should aim to provide disability context-specific information since public health resources are often of greater importance to people living with disabilities (Alajarmeh, 2022). Furthermore, our findings show the low performance of Malaysian hospital websites concerning WCAG 2.0 guidelines. This finding confirms earlier studies which showed poor compliance with WCAG 2.0 (Alajarmeh, 2022; Alhuwail et al., 2018). Non-conformance to these kinds of standards has been considered a form of discrimination against persons with disabilities (Australian Human Rights Commission, 2014; Congressional Research Service, 2022). This means that hospital websites should be available in a format which is accessible to all, regardless of ability or disability and understandable by as many people as possible without discrimination.

The credibility of Malaysian hospital websites is moderately low, which means the websites are less reliable and credible in the eyes of users. However, university hospitals are perceived as more credible than other hospitals. Health website quality influences the intention to use the health website when users have trust in and perceive the usefulness of the system (Boonitt, 2019). Malaysia hospital websites should ensure the existence of a declaration of conflict of interest to enhance their credibility. Credible and reliable hospital websites have recently been of great concern (Anderson & Rainie, 2017) due to the rapid rise in online misinformation and disinformation (Del Vicario et al., 2016). As demonstrated by the website usability scores, there is an ease of use of hospital websites in Malaysia. However, there is a need to improve the usability of hospital websites in Malaysia regarding website load time, accessibility in foreign languages and providing means to modify text size without compromising quality. Improved hospital website usability could reduce demand for services and help hospitals better manage waiting times for services (Alhuwail et al., 2018). With well-designed hospital websites, healthcare providers can engage patients and guide them to quality, evidence-based health information (Lee et al., 2014).

Focusing on content criterion, Malaysian hospitals provide health institution information, organisational structure, Medical Information and patient care service information adequately. The results indicate that the hospitals are mostly using their websites as information sources since they provide static information such as hospital location, reachability and organizational structure. Our results are consistent with similar studies (Sarantis et al., 2022) suggesting the need to improve gaps appearing in specific areas (e.g. quality metrics and specific hospital procedures). Furthermore, our findings show that university hospitals have more complete content information on their websites, especially on quality metrics. In Malaysia, there are great opportunities for public hospitals to use their websites to help educate patients as well as provide useful information to patients such as admission guides, the number of beds in an institution or waiting times information. There is a significant number of public hospitals involved in research and training activities. Therefore, they should aim to provide information on scientific studies, medical glossary terms or library information. The provision of properly developed content on hospital websites is an easy and accessible manner to support civic health education and promote equity (Koehle et al., 2022).

As evident from the findings, hospitals in Malaysia offer poor online services across their websites. Administrative services are moderately covered and more effort is required to ensure that services related to appointments and patient care are available on hospital websites. Malaysian hospital websites should improve user access and provide patients with more options in decision-making about their preferences for appointments and patient care services (Zhao et al., 2017). Translating visitors' interest in a hospital, into action is one of the most important purposes of a hospital website (Soares, 2017). Therefore, allowing the patient to communicate and feel informed is one important aspect hospitals should consider while developing their websites. This means all hospital websites in Malaysia; particularly public hospitals should strive to provide services that help the public make informed decisions. As expected, private hospitals outperformed other hospitals in appointments and patient care services. This may be linked to the business approach and the profit focus of private hospitals. Related to this, private hospitals focus on medical tourism and the need to attract foreign clients. Additionally, most private hospitals in the country are owned and operated by large corporations which tend to standardize their websites. While other hospitals performed poorly on administration services, university hospitals appear to be focused on simplifying and optimizing the administrative interaction with their customers.

On community interaction, Malaysian hospitals seem to be focused more on advertisement and marketing than media and participation aspects. Private and teaching hospitals feature more advertisement and marketing elements on their websites. This may be explained by the fact that these types of hospitals operate on a profit basis and therefore aim at maximizing the advertisement and marketing potential of their websites. Similar to other findings (Alhuwail et al., 2018), the results demonstrate the modest presence of public hospitals, on social media platforms. Given that most healthcare services are provisioned by the public sector, Malaysian public hospitals must leverage social media to gain better outreach and engagement with patients. Doing so will also help hospitals increase their reach in local communities and beyond and improve patient experience and engagement.

Analysing the three various organisational hospital types, teaching hospitals perform best in most of the indicators while public and private, which make up the majority of the hospitals perform closely, but not identically. Looking closer at the results private hospitals pay more attention than public ones in providing relative information to the patient, developing advertising and marketing activities through their websites, granting participation possibility to the patient and maybe expectedly focusing on patient online services provision. These features are probably justified by their financial and market competition incentives. On the other side, public institutions cover better, accessibility and navigability aspects, something that can be interpreted by their social and community satisfaction motivation. They also cover more extensively health institution information which may show their concentration on providing complete and accurate data to taxpayers. Additionally, in public hospitals, there is an increased coverage of research and teaching aspects, compared to the private ones. This shows a better and more systematic connection between public hospitals with Malaysian education. Related to that, is the provision of participation features of hospital websites in Malaysia which is low. Hospital websites strive to communicate with the community and with existing or prospective patients and provide mechanisms of interaction. None of the hospital's websites in Malaysia provides a discussion forum, opinion polls or information on associations linked to the hospital. Additionally, while hospitals are encouraged to take advantage of the internet to report current news and release announcements and press statements, our findings show that hospital websites in Malaysia rarely use these channels for information dissemination.

4 Conclusion

In this study, we provide a comprehensive assessment of Malaysian hospitals' websites using the Health Sector Website Assessment Index (HSWAI). Overall, most hospital websites focus primarily on promoting content and satisfying technology features rather than providing electronic services or engaging and communicating with patients. This means that Malaysian hospitals' websites provide smooth and adequate design and functionality, covering most of the emerging technological requirements regarding primary navigability, usability, readability, privacy and security aspects and secondarily accessibility and credibility. Patients can find, in the majority of the websites the data they need regarding hospitals' operation, staff, treatments and admission procedures.

On the contrary, major deficiencies appear in quality metrics and research and teaching information. The picture becomes worse in administration procedures where the provision of online forms and payments is rarely provided to the user. This is something that maybe could lead to administrative burden and cost increase, time spending and patient dissatisfaction. An almost universal lack appears in patient and hospital interaction. Patients cannot manage their medical examination, hospital admission or doctor communication via the web. Provision of telemedicine (video-conference system) services or electronic medical prescriptions is also not provided. This is an issue that may be strongly connected with Malaysian national health policy and regulation and should be faced at the central level.

Moving to community interaction aspects the picture remains also problematic. Hardly any hospitals provide any form of interaction and communication with the patient. It seems that online suggestions, complaints, discussion forums and public relations are not considered in Malaysian hospitals' website policy. The status improves little in advertising and marketing aspects, especially in private and teaching institutions. Some of the social networks are used to support their promotion and communication campaigns and advertisement sections exist to support their financial sustainability.

Additionally, the websites focus primarily on administrative procedures and marketing services for the hospitals rather than engaging and communicating with patients, providing evidence-based information, ensuring the usability and accessibility of the websites and enhancing quality control measures (Jonsson et al., 2023). Private and university hospital websites outperform public ones. Perhaps this is due to the fierce nature of competing with other hospitals over funds and attracting more patients with private insurance or those that can pay out-of-pocket. Although teaching hospitals in Malaysia fall under the purview of the Ministry of Higher Education, they retain a level of autonomy and most operate private wards that seek to attract high-paying clients. Whereas government hospitals generally do not compete with any other hospitals, neither private nor university. Additionally, the hospital websites for the public hospitals in Malaysia are centrally linked through the Ministry of Health websites thereby leaving no room for variability across the websites. However, if this feature is best used it can help to improve the quality of the websites and provide easy links and integration among different public hospitals.

The evidence from our study points out that Malaysian hospital websites need careful evaluation and rework to improve the access and quality of information presented on the website as well as advance its visitors' commitment and the level of service integration. Hospital managers, public health decision-makers, and health sector website designers can use the recommendations resulting from this study to improve their hospitals' websites and their relative policies.

The study has several strengths and limitations. While most studies had focused on developed countries (Sarantis et al., 2022), social media (Glover et al., 2015) or specific hospitals (Król & Zdonek, 2021) our study was conducted in a specific country, Malaysia, covering all hospitals types. However, this is the first time the HSWAI tool has been implemented within the context of a low and middle-income country. The assessment was conducted by a group of individuals to represent how a user in Malaysia can interact with a hospital website when seeking information. Therefore, the results indicate the perceptions of a hospital website user in Malaysia. Additionally, our findings are based on the information which was available during a specific period on the websites. This information might have improved or deteriorated during the writing of this study. Further research is planned in Malaysia and other Asian countries to critically compare the findings.

Acknowledgements

The research underlying this document was partially supported by "INOV.EGOV-Digital Governance Innovation for Inclusive, Resilient and Sustainable Societies / NORTE-01-0145-FEDER-000087", supported by the Norte Portugal Regional Operational Programme (NORTE 2020), under the PORTUGAL 2020 Partnership Agreement, through the European Regional Development Fund (EFDR).

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