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Comparison between Top-Ranked Iranian Medical Universities and Top-Ranked World Universities based on the Website Analysis

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Abstract

Evaluating the quality and quantity of information presented by universities on their website is the main strategy to ensure that the university web-based activities are in the correct order. In this regard, there are several ranking systems that evaluate the quality and quantity of web-based activities of universities and accordingly rank them. Comparing the universities based on web activity measurement is a suitable tool to find out the weaknesses of the university for presenting itself on World Wide Web. In this study, top-ranked Iranian medical universities were compared with top-ranked world universities according to the website traffic data. For this purpose, the website traffic information was acquired from "Similarweb" website. The results showed that the total traffic size, bounce rate and backlinks from referrals and social networks were significantly different between Iranian medical and world top-ranked universities. Furthermore, the results of this analysis revealed that the quality of website, which expectedly increased the visit duration and visited pages, was not significantly correlated with total traffic size for nor top-ranked world and Iranian medical universities. In addition, the results showed that the total traffic size of top-ranked world universities was significantly correlated with backlinks from direct access and search engines, while for Iranian medical universities such correlation could not be found. In conclusion, the main gap between top-ranked Iranian medical universities and top-ranked world universities was due to the search engine optimization issues and the link between social networks and universities, that both need more enhancement.

Keywords: Web-based Activity, Website Traffic, Webometric Rankings, Medical Sciences Universities, Iran.

Introduction

During the last decades, websites have been the most important tool for within-organizational and between-organizational information exchange (Tarafdar & Zhang, 2008). Websites are an indicator for reflecting the performance of the organization and help the organization for providing management services (Arslan & Seker, 2014). From this perspective,

the comparison and evaluation of web-based activities of organizations through their websites can help to improve some management policies and procedures.

Several studies were performed so far for evaluation and comparison between websites of different organizations. Kriemadis, Terzoudis & Kartakoullis (2010) compared the website content of England and Greece football clubs from the marketing perspective point of view. They found that the England websites were more developed and more sophisticated due to the strong links for marketing purposes. This helped these clubs to use the opportunities offered by the internet more optimally. An (2007) compared the local websites of eastern and western countries based on the website content analysis. The comparison revealed different visual strategies in web advertising between eastern and western nations. Such an outcome highlights the importance of considering specific communication styles for the intended market to have more effective advertising strategies. Such result is useful for advertisement designers.

Besides the comparison between websites, the optimal way for information representation on a website is another topic of interest among researchers. Ngindana (2006) investigated the differences between text and graphics-based hyperlinks on website impact and found that although in case of humans the graphical aids made the navigation easier, search engine crawlers could not index such graphical-based hyperlinks. In this regard, a trade-off should be considered between text-based and graphical-based hyperlinks during website design. Bernard and Chaparro (2000) studied the search performance for three types of menu structures. The menu structure types were *Index*, *Full* and *Restricted*, where the alphabetically-organized hyperlinks were used, the hyperlinks were appeared according to the category and only the category topics were presented to the user, respectively. The results showed that the *Full* and *Restricted* types of hyperlink representation obtained the most satisfaction, possibly due to restricting the amount of presented information which obtained a higher level of attention during search procedure.

World Wide Web has been the most important tool for information communication between universities, enhancing the educational services and management of university affairs(Kurt, 2011). Such facilities have convinced the universities to create their own website and continuously improve the quality of the website. In order to encourage the powerful web presence, several ranking systems have been established so far, which sort the universities according to the quantity and quality of their web-based activities (Jati & Dominic, 2017; Thelwall, 2009). Such a website's comparison and evaluation strategies produced a great competition between universities for promoting their web-based activities in order to get better position in ranking systems. There are several studies that considered the website content of universities for evaluating their web-based activities. Thelwall, Binns, Harries, Page-Kennedy, Price & Wilkinson (2002) surveyed the size of websites of higher educational institutes in the European Union. They found that richer countries in the European Union, which usually obtained a higher rank in ranking systems, had larger websites. The size of website is an important factor for many ranking systems and indicates higher quantity of information has been accessible through the website. Kim, Lee, & Ahn (2016) studied the contribution of the websites of universities for promoting giving campaigns in the U.S and South Korea. The obtained results showed that the websites of U.S. universities targeted more frequently the university-affiliated donors compared with South Korea, which possibly showed the more optimized usage for U.S. universities from website capability for promoting campaigns.

Some studies in this field were focused on the evaluation criteria for measuring the quality

of websites of universities. Qiu, Chen & Wang (2004) investigated the backlinks and impact factors for the websites of Chinese universities. The study showed that the external backlink counts of website could be a more reliable evaluation measure compared with website impact factor. Sherafat et al. (2018) introduced an evaluation and improvement model consist of four components (i.e. objectives, processes, criteria and feedback) for evaluating the weaknesses and strengths of organizations' websites. In addition, GharibeNiazi & Karbala Aghaei Kamran (2016) evaluated the quality of Iranian state universities based on webQEM criteria and using a checklist prepared by webQEM.

The comparison and evaluation of the web-based activity of Iranian medical universities have been the center of attention during the last decade. Aminpour, Kabiri, Otroj & Keshtkar (2009) analyzed the websites of Iranian medical universities based on the webometric indicators. They showed that Iranian universities of medical sciences were not known internationally. Some shortcoming such as linguistic barriers and issues related to the website design were introduced as the major reasons. The main focus of Aminpour et al. study was on the website visibility indicator (total pages, inlinks and external links), while the quality of website design and its effect on visibility was not considered in detail. Hamdipour (2011) assessed the websites of the library for Iranian universities of medical sciences and showed that considering the content of websites, these libraries were at a low level, while search and user facilities were in good and medium level, respectively. The obtained results were not compared with well-known world universities. Okhovati, Karami & Khajouei (2017) investigated the usability of central library websites of Iranian medical universities using a cross-sectional and descriptive study. The study revealed the problems related to the aesthetic and minimalist design of the websites of Iranian medical universities. Shadpour, Teimourpour &Asadi (2013) studied the website of Iranian hospitals which usually affiliated with Iranian medical universities using a Webometrics based analysis. They obtained a positive relationship between website visibility and size and suggested increasing website size for improving the webometric ranks of hospital's website. Habibi, Seyed-Akbari, Torab-Miandoab & Samad-Soltani (2019) considered the usability of academic library websites of type-1 Iranian medical universities from effectiveness, efficiency, and satisfaction point of view. The study concluded that improving website usability enhanced the interest of user in services and helped the realization of library goals. The major weaknesses could be summarized as lack of user-orientedness, weak content of the main page, shortcomings for navigation and browsing tools and issues related to updating the content.

In spite of several studies regarding the evaluation of the website of Iranian medical universities, little has been done for comparing these universities with top-ranked world universities. In the present study, a comparison between the website of top-ranked Iranian medical universities and top-ranked world universities considering the website traffic data was performed. For this purpose, the indices related to the traffic of website such as total traffic size and the contribution of traffic sources and also the indices related to the quality of website content such as bounce rate, average visit duration and average pages per visit were utilized. The objective of this study was to check if the website traffic information and the quality of the content of website for Iranian medical universities were statistically different from top-ranked world universities. In this regard, it was important to check out the extent of the differences in a detailed manner.

Material and Methods

Population of study

In this study, top-ranked world universities and top-ranked Iranian medical universities according to the Webometrics ranking system (January edition (2019.1.2) were selected. The Webometrics ranking is the best-known ranking system for evaluating the quality and the volume of web content for academic centers, which is usually used as the main database for comparing the web-based activities of universities. For determining the population size in each group, the total traffic size of universities was considered in a way that when the total traffic size of four successive universities in Webometrics ranking fell below the average traffic size value of population, the addition of further university to the top-ranked population was terminated. In this regard, 19 universities were selected for the Iranian medical university group and 21 universities were chosen for world universities. In order to equalize the population size in each group, twenty universities were selected in each group. The name of the universities was given in Table 1.

It should be noted that the world top-ranked universities in our selected population were not pure medical universities because most of the well-known international universities are integrated organizations consist of various schools (such as engineering, medical, law schools and so on). The ranking systems usually report the scores for the whole university, not separated faculties and schools. Considering this fact, in this study Iranian medical universities were compared with top-ranked world universities and not with their medical counterparts.

Table 1
Name of universities included in the current study.

Top-ranked Iranian medical universities	**Top-ranked world universities**
Tehran University of Medical Sciences	Harvard University
Shahid Beheshti University of Medical Sciences	Stanford University
Tabriz University of Medical Sciences	Massachusetts Institute of Technology
Mashhad University of Medical Sciences	Oxford University
Shiraz University of Medical Sciences	California Berkeley University
Isfahan University of Medical Sciences	Michigan University
Iran University of Medical Sciences	University of Washington
Ahvaz Jundishapur University of Medical Sciences	Cornell University
Kermanshah University of Medical Sciences	Columbia University New York
Mazandaran University of Medical Sciences	University of Pennsylvania
Kerman University of Medical Sciences	University of Cambridge
Hamadan University of Medical Sciences	Johns Hopkins University
Baghiyatalah University of Medical Sciences	University of California Los Angles
Shahid Sadoughi University of Medical Sciences	Yale University
Shahrekord University of Medical Sciences	Wisconsin Madison University
Zanjan University of Medical Sciences	University of California San Diego
Kurdistan University of Medical Sciences	University of Minnesota System
University of Social Welfare and Rehabilitation Sciences Tehran	Pennsylvania State University
Urmia University of Medical Sciences	University of Toronto
Guilan University of Medical Sciences Rasht	Duke University

Data collection strategy

The selected criteria for the evaluation of web-based activity were different from Webometrics criteria, where website traffic data and some quality criteria according to the way that user audiences visited the website were utilized. The information related to the website of considered universities (i.e. total traffic size, traffic sources, average visit duration, average pages per visit and bounce rate) were extracted from "similarweb" website (https://www.similarweb.com). Total website traffic size was the number of user audiences or visitors who visited the website during one month. Average visit duration (in terms of second) was the average time that the user audiences spent on a website. Average pages per visit was the average number of pages that were clicked during one session and the bounce rate (%) was the percentage of website visitors who left the website after observing the first page. Furthermore, since there are different ways for accessing the website content, including direct access, access using search engines, referrals, social networks and emails, the contribution of each of these options was compared between world top-ranked and Iranian top-ranked medical universities. It should be noted that since the "Similarweb" data is updated continuously, in order to consider the generality of obtained results, the average value of each measurement for three months (including February, March and April 2019) was used in this analysis. In this case, the contribution of different sources on traffic size was rescaled to cover 100% traffic size.

Statistical analysis

For comparing top-ranked world and Iranian medical universities, the normality test according to the Anderson-Darling test was carried out to be sure that the samples were from a population with a normal distribution. For normally distributed samples, two-sample t-test was used for statistical analysis, while for the cases that the normality test was rejected, after checking that the outliers did not cause the non-normality using quantile-quantile (Q-Q)plot (Meloun & Militky, 2011), the non-parametric Wilcoxon rank-sum test was used. The statistically significant difference was evaluated using p-value.

Furthermore, the correlation between criteria was calculated according to the Pearson's correlation coefficient that obtained the linear dependence between two random variables (Benesty, Chen, Huang & Cohen, 2009). All statistical analyses were performed using MATLAB software and statistical analysis toolbox (Mathworks Inc., MA, USA).

Results

The statistical analysis for comparison between the traffic information of top-ranked Iranian medical and top-ranked world universities was given in Table 2.

Table 2.
Website traffic information for top-ranked world and Iranian medical universities. R and A letters show rejection and acceptance of normality test, respectively.

Criterion		Iran Medical Universities					World Universities					t-test p value	Wilcoxon rank sum test p value
		Min	Max	Mean(±std)	Median	Normality	Min	Max	Mean(±std)	Median	Normality		
Total traffic size(Number of million visitors)		0.053	0.65	0.1944 (±0.1670)	0.12	R	0.44	44.29	15.54 (±10.10)	12.85	R	**<0.0001***	**<0.0001***
Average visit duration(s)		61	370	185.15 (±71.76)	178	A	94	357	218. (±67.64)	226	A	0.1387	0.14
Average pages per visit		2.18	11.42	4.83 (±2.36)	4.51	A	1.55	6.29	4.06 (±1.09)	4.13	R	0.1962	0.365
Bounce rate (%)		26.80	66.36	47.43 (±11.64)	48.51	A	35.77	71.95	55.97 (±8.44)	56.20	A	**0.0115***	**0.018***
Traffic Source contribution (%)	Direct access (%)	21,69	60.65	39.68 (±11.13)	35.65	A	25.68	64.29	39.28 (±9.09)	37.26	A	0.8362	0.925
	Search engine (%)	36.94	72.04	56.29 (±11.03)	61.36	A	28.98	68.4	50.31 (±8.23)	50.54	A	0.0596	0.086
	Referral (%)	0	3.64	1.57 (±1.02)	1.34	R	3.07	13.84	5.61 (±2.50)	5.23	R	**<0.00001***	**<0.0001***
	Social (%)	0	1.19	0.37 (±0.39)	0.21	R	1.19	4.96	2.41 (±0.91)	2.17	R	**<0.00001***	**<0.0001***
	Email (%)	0	7.85	1.80 (±2.15)	0.90	R	0.13	6.94	2.30 (±1.71)	1.72	R	0.4142	0.101

Since Table 2 showed significant differences for traffic generated by social network backlinks, it was worth investigating the main sources of social networks that contributed to traffic generation for Iranian medical universities and the top-ranked world universities.
In Table 3, at most five social networks which had the most abundance between available resources (common between more than 10% of selected universities) were listed. Also, the reported numbers showed that how much percentage of websites between 20 selected universities had backlinks from the selected social networks.

Table 3
Common social networks contributing to total website traffic for 20 top-ranked Iranian medical universities and 20 top-ranked world universities

Top-ranked Iranian medical universities		Top-ranked World universities	
Social Network	Percentage of 20 top-ranked universities with backlinks from selected social network	Social Network	Percentage of 20 top-ranked universities with backlinks from selected social network
Youtube	50%	Facebook	100%
Facebook	50%	Youtube	100%
ResearchGate	25%	Twitter	100%
WhattsApp webApp	15%	Reddit	90%
		ResearchGate	35%

The average visit duration, average pages per visit and bounce rate were three factors that affected by the quality of website design. By increasing the quality of the website's content, it seems that the average visit duration and average pages per visit should increase, while the bounce rate reduction is expected to occur. In the present study, the causal relationship among these criteria and the size of website traffic was evaluated. The results of correlation analysis were reported for Iranian medical universities and top-ranked world universities in Tables 4 and 5, respectively.

Table 4
Correlation analysis between website quality measures for top-ranked Iranian medical universities.

	Total traffic	Average visit duration	Average pages per visit	Bounce rate
Total traffic	1	0.32(0.17)	0.06(0.80)	0.37(0.11)
Average visit duration		1	0.52(0.017)*	-0.18(0.43)
Average pages per visit			1	-0.08(0.73)
Bounce rate				1

Table 5
Correlation analysis between website quality measures for top-ranked world universities.

	Total traffic	Average visit duration	Average pages per visit	Bounce rate
Total traffic	1	-0.53 (0.018)	-0.11(0.65)	-0.22 (0.36)
Average visit duration		1	0.81(<0.0001)	-0.86 (<0.00001)
Average pages per visit			1	-0.94 (<0.00001)
Bounce rate				1

Another important issue was related to the contribution of different traffic sources in total traffic size. In Figure 1, the correlation coefficient between total traffic size and the contribution of each traffic source on total traffic size of the website was shown for the top-ranked world and Iranian medical universities.

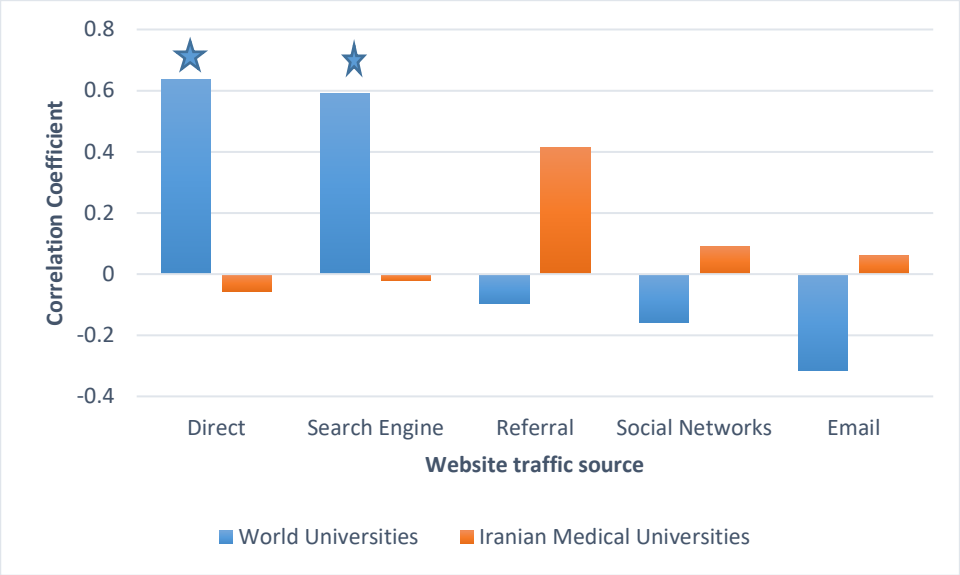

Figure 1. Correlation coefficient between website traffic size and contribution of traffic sources on total traffic size. The 5-point star above the bars shows that the correlation was statistically significant ($p<0.05$).

Discussion

The statistical analysis for comparing the website traffic information of top-ranked Iranian medical universities and top-ranked world universities (Table 2) showed that the main significant difference existed for total traffic size ($p<0.0001$), bounce rate($p<0.05$) and the contribution of referral and social networks on total traffic size ($p<0.0001$). This result showed no statistically significant differences between average visit duration and average pages per visit among top-ranked Iranian medical universities and top-ranked world universities. Furthermore, the contribution of direct access, search engines or email for website traffic generation were not significantly different between two groups (universities).

As Table 2 indicated, the contribution of referrals and social networks on website total traffic size was relatively higher for top-ranked world universities, which was approximately 4 times and 1.8 times higher for world universities compared with Iranian medical universities, respectively. This was perhaps due to more backlinks from other websites and social networks in case of top-ranked world universities.

In Table 3 the most used social networks which created backlinks to the university website for top-ranked Iranian medical and top-ranked world universities were given. Results of this table revealed that all twenty world top-ranked universities had backlinks from Facebook, Youtube and Twitter, while only half of top-ranked Iranian medical universities websites had backlinks from Youtube and Facebook networks. Since social media are suitable tools for quickly improving website traffic (Zhang & Cabage, 2017), it is necessary for Iranian medical universities to fill such gap. There are several suggestions for increasing backlinks from common social networks. One of the main ways for creating backlinks to the website of universities through social networks is to add the university website link to the personal profile of the academic staffs or students affiliated with the university or add the URL in *info* page. Also, it is possible to add the university URL to the posted images on Facebook or twitter wall or adding the university link to the posted videos on Youtube.

In addition, the obtained information according to “similarweb” showed that considering

top-ranked world universities, the main referral websites which were responsible for website traffic generation were "en.wikipedia.org", "login.microsoftonline.com" and "news.ycombinator.com", while for Iranian medical universities "ncbi.nlm.nih.gov" was the most important source of backlink generation. In this regard, the more purposeful activity on Wikipedia as a free online encyclopedia is proposed for Iranian medical universities. Generating pages for introducing the university history, facilities or achievements are some suggestions.

These results for correlation analysis for finding the causal relationship between total traffic size and website quality assessment factors (Tables 4 and 5) showed no significant correlation. The only statistically significant correlation ($p<0.05$) for Iranian medical universities was related to the positive correlation between average pages per visit and average visit duration, in which by increasing the visit duration (possibly due to the higher quality of webpage content), more pages were visited by user audiences. Similar to the Iranian medical universities, there was no significant correlation between the above-mentioned website quality assessment factors and total website traffic size for top-ranked world universities. However, as expected, the higher visit duration and the higher number of visited pages per session caused the lower bounce rate, i.e. higher quality of website content reduced the probability of leaving the website after viewing the first page. Furthermore, the statistically significant correlation was observed between average pages per visit and average visit duration. These results indicated the more significant relationship between website quality assessment criteria for top-ranked world universities compared with Iranian medical counterparts. The reason should be searched according to the website design strategies. In addition, the correlation analysis shows that three above-mentioned criteria for website quality measurement (i.e. average visit duration, average pages per visit and bounce rate) could not predict the total traffic size of the website. In other words, it could be concluded that the total traffic of a website was not affected significantly by the quality of content.

According to Figure 1, it was obvious that for Iranian medical universities there was no significant and meaningful correlation between total traffic size and none of the traffic resources, while for top-ranked world universities the direct access to the university website and access to the website through the search engines were correlated significantly ($p<0.01$) with traffic size. This implied that the top-ranked world universities used the potential of world wide web in a more optimized way for increasing the traffic size or number of visitors. This result indicated that Iranian medical universities should follow a firm strategy for search engine optimization (SEO). Furthermore, direct access to the websites is usually performed using the URL of the website, which can be used by academic staffs, researchers and students affiliated with the university. In this regard, motivating the affiliated person to refer to the website for downloading the rich files, or acquiring supplementary information regarding the staffs, events and equipments and so on, can be regular strategies for increasing the direct access to the websites.

To the best of our knowledge, there is no comprehensive study for comparing the websites of top-ranked Iranian medical universities and top-ranked world universities. However, there are limited numbers of studies in this field, which their obtained results might be the same with our findings. (Sedghi, tafaroji & Roudbari, 2013) found that the high-ranked Iranian medical universities did not receive a considerable number of links from other websites, hence had a low effect on the web. The low international visibility rate of Iranian journals was also reported

in the literature (Davarpana & Behrouzfar, 2009). Our results (Table 2) showed that the total traffic size (total number of visitors) of Iranian medical universities was relatively smaller than top-ranked world universities ($p<0.0001$), possibly due to the minor contribution of referrals and social networks for traffic generation for these universities, compared with top-ranked world universities (Tables 2 and 3). Esfahani et al. (2016) analyzed the traffic information of Iranian student's news agency (ISNA). They found no significant relationship between referral-based traffic and the number of website audiences (Esfahani & Kargar 2016). The same result was observed by our obtained results (Figure 1).

Conclusion

Due to the importance of web-based activities for scientific and academic centers, special attention is gained to this issue by universities all over the world. All universities spend substantial budgets to improve their websites from the quality and quantity point of view, while the available web-based ranking systems track them continuously. One of the best ways for improving the rank for web-based activities of a university is to compare it with top-ranked universities to find the weaknesses and shortcomings. In the current study, the web-based activities of Iranian medical universities were compared with top-ranked world universities. The obtained results showed that Iranian medical universities needed further efforts for search engine optimization (SEO) and follow useful strategies for increasing the backlinks from social networks like Facebook, Youtube, Twitter and so on and also famous websites such as Wikipedia. Furthermore, Iranian medical universities should pay special attention to strategies to encourage their academic members, staffs and students to refer to the website of the university in a more regular manner. Uploading the course's metadata by academic members on their homepage, regular updating of notifications for special events on the website and updating news and announcements could be some useful suggestions.

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Conflict of interest

The authors have nothing to declare.

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