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Title:

A comparison in pediatric dental website design from a guardian and
pediatric dentists' perspective.

A thesis submitted in partial fulfillment of the requirements for the degree of Master of
Science in Dentistry at Virginia Commonwealth University.

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May, 2020

Acknowledgements

I would like to thank my incredible wife, Stephanie, for all her support and love during my dental education. She has enabled and motivated me to become who I am today and I will always respect her generosity and patience. I would also like to thank my youngest brother Robert. He had a significant role in creating the webpages used in this project. His computer skills were invaluable during the creation of the guardian survey. A very sincere thank you to Dr. Bill Dahlke and Dr. Patrice Wunsch who have guided me through my specialty training with endless knowledge and persistence. Thank you to my thesis advisor, Dr. Tiffany Williams, for her engagement and support during this research. I would also like to thank Dr. Caroline Carrico. Without her knowledge and attention this study would not be the same. Thank you to everyone who has supported me during my dental education, you have all become part of my success and I could not have done it without you.

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Abstract

A comparison in pediatric dental website design from a guardian and pediatric dentists' perspective.

By: David Voth, DDS, MBA

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Dentistry at Virginia Commonwealth University.

Virginia Commonwealth University, 2020

Thesis Advisor: Tiffany Williams, DDS

Pediatric Dentistry

Purpose: This project aims to determine which aspects of pediatric dental practice websites are preferable to the guardians of pediatric dental patients and which of these aspects are currently available to guardians on the websites of pediatric dental practices across the United States. The comparison will reveal if practice websites are meeting the needs of the guardians of pediatric dental patients. Our hope is to provide meaningful guidance to pediatric dentists designing new practice websites and to provide the guardians of pediatric dental patients with an appealing online experience during their use of the aforementioned websites.

Methods: A survey with questions regarding design features of pediatric dental practices

was administered to the guardians of pediatric dental patients in 3 private practices within an hour drive of Richmond, Virginia. Guardians responded to 16 website characteristics using a numeric scale to indicate desirability. In parallel, a website audit was performed on a representative sample of US pediatric dental practice websites to determine the presence of the same 16 features to allow for comparisons. In addition, guardians also rated sample webpages and answered questions regarding website use and demographics.

Results: A total of 51 guardians completed the survey across 3 practices. The majority of respondents were female (36, 71%) and had private insurance (n=43, 84%).

Guardians were predominantly between the ages of 25 and 54 (49, 98%) and the majority of the children they represented were between the ages of 5 and 13 (69%).

The guardians rated the homepage image showing diverse children ($p < 0.0001$), the “About the Doctor” section in structured list format ($p < 0.0001$) and the location of the contact information banner at top and right side ($p < 0.0020$, $p < 0.0148$ respectively) significantly higher than the other options. The guardians also ranked the homepage information banner location at the top of the page higher than at the bottom but this was not significant ($p = 0.0528$). The guardians also rated 6 features of pediatric dental websites at a level of importance above 50 percent while these features were present on less than 30 percent of the websites audited. These features are online payments, a search function, before and after pictures of treatments, a chat box for communication with the office, video testimonials from guardians and patients and ways the dental practice gives back to the community. Half of the guardians (n=26, 51%) agreed or strongly agreed the website was a factor in the decision to become a patient of a

particular dental practice ($p=0.0001$) and this group visited an average of 2.5 websites before deciding to become a patient at a specific dental practice.

Conclusion: Regarding available features, guardians' preferences seem to differ from what is currently available on pediatric dental websites. Pediatric dentists need to consider adding certain convenience features to their websites to allow a more esthetic and useful experience for the guardians of their patients. Guardians prefer photos of children with diverse ethnic backgrounds on the homepage of pediatric dental websites. Guardians who use websites to choose a practice reported visiting an average of 2.5 pediatric dental practices' websites before choosing which pediatric dentist to visit.

Introduction

Every day millions of people access information using webpages. These webpages are available to anyone with an open internet connection and an internet capable device. As the Internet becomes more and more popular the information available to the user grows at a faster and faster rate.¹ The Internet has made the world a smaller place by allowing information to be shared across continents and oceans in a matter of seconds. Additionally, the rapid improvement in communication has enabled everything from access to healthcare in rural, remote villages via tele-medicine to a user receiving a complete meal without ever leaving his or her home. For the past 30 years the internet has been available to the general public.² Over the last two decades the Internet has become an everyday tool used by consumers when researching information about everything from household consumer items to health care needs. The Internet is made up of more than 5,000 separate computer networks in more than 70 countries. These networks are interconnected in a variety of ways and speeds and are bound together by the Internet suite of protocols.³ The 5,000 plus networks are owned by federal agencies, state governments, non-US governments, private industry, international carriers, not-for-profit companies, universities, and various combinations of these. Some are managed as business units within multi-billion dollar communications carriers, others by a group of people who meet on a university campus and, out of a common interest, agree to manage and operate a network.³ In 2014, global online

retail sales reached \$1.3 trillion annually, representing over 5% of total global retail sales.⁴ The increasing trend toward Internet use demonstrates the importance of establishing a presence on the Internet for businesses. As this trend increases, businesses are eager to develop a means for measuring and analyzing consumer responses to different kinds of website designs.

Prior to the Internet the individual who wanted to advertise his or her business was limited to only direct mailing, word of mouth, printed advertisements, the telephone book and telephone calls.⁵ With the exponential increase in the amount of Internet traffic in the last twenty years, having a presence on the Internet has become an essential part of any modern company. To provide some additional background on the growth of Internet traffic: In December of 1995, 16 million Internet users were recorded which correlated to just 0.4% of the world population. By March of 2019, over 4.3 billion Internet users were recorded which correlated to over 56% of the world population.⁶

Many factors can be considered in the contributions to this massive growth. The human population in rural and developing areas gained access to land and air based Internet connections, the number of personal computers in the world increased exponentially over those decades, the inception and rapid growth of social media attracted additional users and the mobilization of technology through smart phones, laptops and tablets allowed for users to access the Internet without being tied to a wired device.⁷ The spike in smartphone and mobile device adoption over the past few years has substantially changed the way in which people interact with their mobile devices. Both Apple's iPhone and Google's Android phone took the market by storm and have

made the Internet far more accessible and convenient for millions of users around the world.⁸

Towards the end of 2013, mobile browser usage overtook desktop browser usage for the first time, and that trend is still evident today.⁸ With regard to social media and the Internet, the advent and popularization of social media has completely changed the way users interact with each other as well as the way users interact with businesses. Social media networks were originally created for personal use, though they are now effectively used by businesses of all sizes to advertise their products or services and to communicate with current and prospective consumers.^{9,10}

Marketing research has shown that the selection process for professional services is often based on a less well-developed set of criteria than that for more generic services.^{11,12} In recent years the dental practitioner, a professional service provider, has been pressured to enter the crowded Internet market space due to an increasing number of patients searching for health care information on the Internet.

This entrance is presumably an effort to promote their practices to potential patients with the hope of converting some website users into active consumers of the practice's dental care. The trend of professional services marketing to patients via the Internet has encouraged the healthcare industry to investigate user behavior with regard to Internet based healthcare research. As the industry researches how using the Internet can improve health communication, there is a need to better comprehend the use of the Internet by laypeople.¹³ While it is recognized that Internet users have the possibility of accessing a variety of sources of health-related websites, including medical and dental

websites dedicated to health professionals, little is known about individuals' initial motivations for searching for health information, about the process by which they turn to the Internet for finding and selecting such information as well as on the integration of information into their everyday lives.¹³

Dental specialists (*Orthodontists, Endodontists, Periodontists, Oral Maxillofacial Surgeons, Prosthodontists, Oral Pathologists, Oral Maxillofacial Radiologists and Pediatric Dentists*) are using the Internet on a regular basis to promote their practices directly to patients and the guardians of patients but also to general dentists who may become a referral source to the specialist. Since the inception of the Internet, and more importantly, over the last decade, there has been almost no formal research performed on the preferences of website design from the perspective of the guardians of pediatric dental patients and the designing pediatric dentist. Therefore, when a pediatric dentist is designing a website for his or her practice the data on the preferences of design are extremely limited in scope and typically the practitioner is forced to rely on a professional website design company to dictate on which elements the website should focus. When considering marketing and advertising the most important factor considered was the website of the dental practice.¹⁴

Many of the sources used for the foundation of this study are based in other genres such as business, finance, web design, information technology and marketing. Interestingly, some studies similar to this one have been completed in the dental specialty of orthodontics. One particular orthodontic study compared the preferences of adult patients and guardians of young patients with the preferences of orthodontists on

website design. The study found significant differences in the preferences of the two groups.¹⁵ Given that orthodontists also treat a large number of children and adolescents, our hope is to use the results from the orthodontic studies in comparison with our own results. Many pediatric dentists refer their patients to orthodontists and therefore the choice may be more related to referrals than websites. Because pediatric dentists rely less on referrals as a source for new patients it is possible that websites play an even more important role in pediatric dentistry.

One of the desired outcomes of this study is to have the ability to parallel the survey responses from guardians of pediatric dental patients with the findings of a nationwide website audit of pediatric dental practices. The goal of this nationwide pediatric dental website audit was to gather information on the currently available features of the websites of an evenly distributed collection of pediatric dental practices from across the United States.

The aim of this evaluation was to reveal any similarities or disparities in the guardians' preference of website design to what is currently available on the websites of pediatric dental practices from across the United States. These results can provide meaningful guidance to pediatric dentists designing new practice websites to better meet the needs and desires of the guardians of pediatric dental patients. It has been shown that making the access to pediatric dental care more convenient will prompt more guardians to seek and utilize the care available in their locality.¹⁶

The most common chronic disease of children in the United States is dental caries and lowering barriers to pediatric dental care may help reduce the number of children

affected by this chronic disease.¹⁷ The expectation for the findings of this study will be to provide a helpful guide to the designers of pediatric dental websites in an effort to create more beneficial and more useful practice websites. By creating more useful websites, as a specialty we may increase the level of convenience and comfort for guardians to utilize pediatric dental care, and ultimately better serve our patient population.

Materials and Methods

After exempt approval from the Virginia Commonwealth University Institutional Review Board (HM20015255), a survey with questions regarding 16 features of pediatric dental practices was administered to the guardians of pediatric dental patients in 3 private practices from within an hour drive of the Richmond, Virginia area. A parallel website audit was conducted pertaining to the presence of the same 16 features on pediatric dental websites throughout the United States. This website audit was completed on a representative sample of 50 practice websites using demographic data provided by the ADA outlining the number of pediatric dental practices per state in the United States.¹⁸ The practice data was used to extrapolate and obtain a representative percentage of each state's pediatric dental practices in relation to the total number of pediatric dental practices in the United States. Upon obtaining this information, a number of websites of the pediatric dental practices from each state was chosen to audit based on the percentage of pediatric dental practices within that particular state. A single rater evaluated the webpages. Features assessed by the website audit are listed in Table 1. Guardians also rated a set of screenshots of sample webpages. The sample webpage images were created using open source photos and artwork. The final portion of the guardian survey included additional questions regarding the use of practice websites when selecting their child's provider along with their demographics and those of the child(ren). The goal of this portion of the survey was to gather an understanding of what type of information the guardian prefers to see on the homepage and in what

location on the page they prefer to see it. The guardian survey was modeled after a previous study conducted in the field of Orthodontics.¹⁵ Complete survey is given in the appendix.

The guardians were recruited from the selected private practice populations that contained patients with several different payment methods, self-pay, private insurance and Medicaid/CHIP. When they presented to one of the three pediatric dental practices around the Richmond, Virginia area a pediatric dental resident or fourth year dental student made an introduction to the guardian and provided some details about the purpose of the study. The guardian had the ability to opt in or opt out of participation in the survey. If the guardian preferred not to participate, the guardian was thanked for their time and the dental appointment proceeded normally with the provider.

If the guardian chose to participate in the survey they were offered two methods for responding to the survey. The ability to respond to the survey was offered by direct response on a provided electronic device such as a tablet or laptop computer as well via a mobile response in which a survey response web link was initiated to the guardians' personal electronic device. When the guardian chose to respond via a provided electronic device the device was preset to immediately show the guardian the consents and instructions page so the guardian would be able to choose to participate once the initial page has been read. If, after reading the instructions and consent page of the survey or at any point during the survey, the guardian chose not to respond to the survey the child's dental appointment continued as normal. If the guardian chose to continue with the survey response the provided electronic device was used in the

waiting area or carried through the dental clinic to allow the guardian an uninterrupted response experience. In the event of technical error such as, wireless internet service interruption, electronic device connection interruption, REDCap survey link failure or website loading error, the guardian was consulted about the details of the error and the survey was restarted at the point where the error occurred. In the event that the previously completed portion of the survey was not saved, the survey was restarted and a new response will be generated. The direct verbal instructions to the guardian pertaining to their survey response were intentionally kept to a minimum in an effort to reduce biases.

The data for the pediatric dental practice distribution was obtained from the American Dental Association's publication on the Distribution of Dentists in the United States by Region and State, 2008.¹⁸ A collection of commonly available features and designs from within these websites was gathered and compared to the preferences of the guardians responding to the survey

The average importance scores from guardian responses were summarized using means and standard deviations. The association between the presence of features on the websites audited and the average importance score was assessed using Pearson's correlation. Guardian's responses regarding the importance of practice websites and the number of sites they visited before choosing their practice were summarized using descriptive statistics. Number of sites visited were compared based on the perceived importance of websites using ANOVA. Repeated measures ANOVA models were used to determine the most preferred sample websites, which controlled for the associations among ratings from the same respondent (i.e. each respondent

rated 15 web pages). Post hoc pairwise comparisons for all ANOVA models were adjusted using Tukey's adjustment. Significance level was set at 0.05 and SAS EG v.6.1 was used for all analyses.

Results

A total of 51 guardians completed the survey across 3 practices. The majority of respondents were female (36, 71%) and had a college degree or higher (n=42, 82%). The majority of respondents had private insurance (n=43, 84%). Guardians were predominantly between the ages of 25 and 54 (49, 98%) and the majority of the children they represented were between the ages of 5 and 13 (69%). Demographics are given in Table 1.

Table 1: Demographics of Guardians Surveyed in Pediatric Practice Offices

	n	%
Gender		
Male	10	20%
Female	36	71%
Prefer not to say	5	10%
Guardian's Age		
25-34	13	25%
35-44	21	41%
45-54	15	29%
55-64	1	2%
65+	1	2%
Community Size		
Small Town (Less than 2,500)	2	4%
Town/Small city (2,500-50,000)	19	37%
Large City (50,001-500,000)	26	51%
Metropolitan (more than 500,000)	3	6%
Guardian's Education		
High School/GED	9	18%
Bachelors	30	59%
Masters	12	24%
Dental Insurance		
Private insurance	43	84%
Medicaid/FAMIS/CHIP	6	12%
No insurance/Self-pay	2	4%
Child's Age (select all that apply)		
1-3	5	10%
3-5	9	18%
5-7	11	22%
8-10	19	37%
11-13	19	37%
14-16	8	16%
17+	0	0%

A total of 50 practice websites were audited which represented practices spread across the various AAPD districts (Table 2, Figure 1). A summary of the presence of various website features is given in Table 3 and Figure 2. All websites were mobile

optimized (100%), most came up in the top three when searching in their area (98%), and most showed directions to the practice (96%). None of the sites had a search feature (0%), and very few had pictures of actual patients before and after treatment (4%) or chat features (6%). There was a moderate positive correlation between the presence on websites and the average importance as rated by guardians ($r=0.49$, $p\text{-value}<0.0001$). The parents rated mobile optimization and an about the doctor section highest on average (89.4, 86.9, respectively). The main discrepancies between the parent ratings and the actual presences on websites (based on the website audit) were for ability to make online payments (average importance: 82.1, presence on websites: 18%). There was also a large discrepancy between guardian rated importance for before and after pictures (average score 64.3) and the rate of websites that actually had them (4%). Parents tended to rate the features higher than the prevalence (both on 100-point scale) with the main exceptions for being in Top 3 when searching (98% vs 65.8) and having links to social media (84% vs. 47.5).

Table 2: Distribution of Practice Websites Audited by AAPD District

AAPD District	Number of Sites	Percent
East North Central	6	12%
East South Central	3	6%
Middle Atlantic	7	14%
Mountain	4	8%
New England	3	6%
Pacific	9	18%
South Atlantic	10	20%
West North Central	3	6%
West South Central	5	10%

Figure 1: Map of Practices Audited

Practice Websites Audited

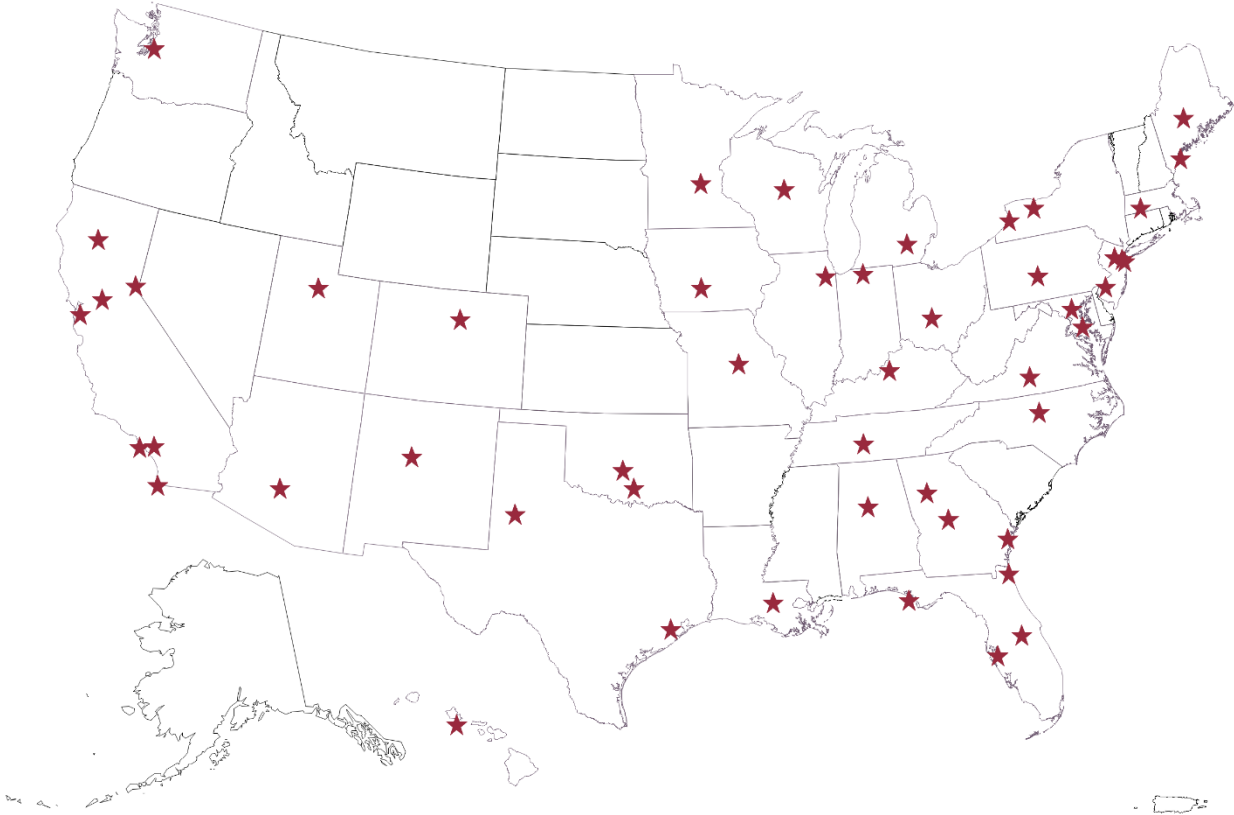


Figure 2: Presence of Website Features from Pediatric Dental Website Audit

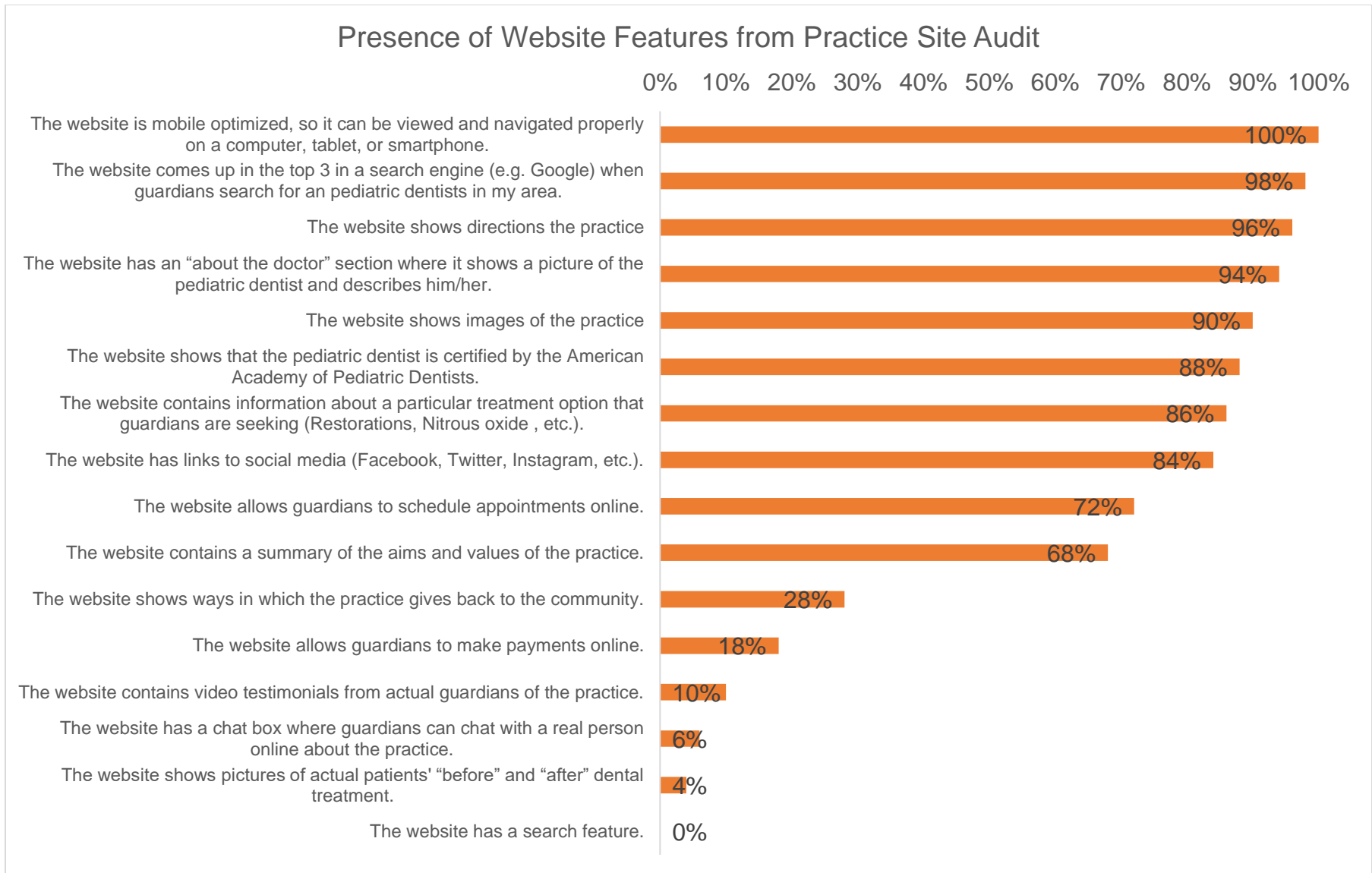
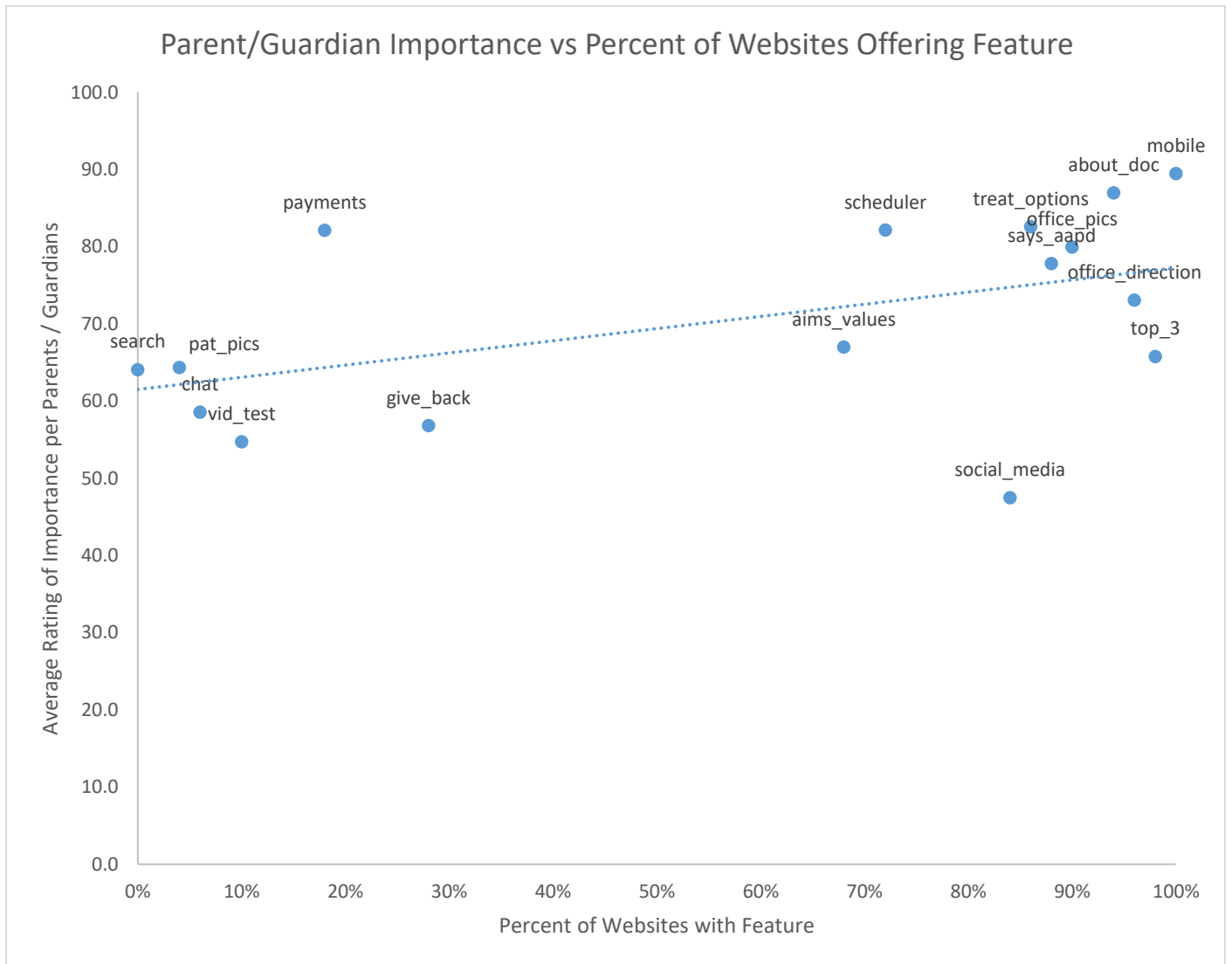


Table 3: Summary of Presence of Features Present on Website and Guardian Perceived Importance

Feature	Present on Website	Guardian Mean Importance
The website allows guardians to make payments online.	18%	82.1
The website allows guardians to schedule appointments online.	72%	82.1
The website comes up in the top 3 in a search engine (e.g. Google) when guardians search for pediatric dentists in my area.	98%	65.8
The website contains a summary of the aims and values of the practice.	68%	67.0
The website contains information about a particular treatment option that guardians are seeking (Restorations, Nitrous oxide, etc.).	86%	82.6
The website contains video testimonials from actual guardians of the practice.	10%	54.7
The website has a chat box where guardians can chat with a real person online about the practice.	6%	58.5
The website has a search feature.	0%	64.0
The website has an “about the doctor” section where it shows a picture of the pediatric dentist and describes him/her.	94%	86.9
The website has links to social media (Facebook, Twitter, Instagram, etc.).	84%	47.5
The website is mobile optimized, so it can be viewed and navigated properly on a computer, tablet, or smartphone.	100%	89.4
The website shows directions the practice	96%	73.0
The website shows images of the practice	90%	79.9
The website shows pictures of actual patients' “before” and “after” dental treatment.	4%	64.3
The website shows that the pediatric dentist is certified by the American Academy of Pediatric Dentists.	88%	77.8
The website shows ways in which the practice gives back to the community.	28%	56.8

Figure 3: - Linear Association between Parent / Guardian Importance Scores and Pediatric Dental Websites Offering the Feature



Half of the guardians reported that they agree or strongly agree (51%) that the practice’s website was a factor in their decision to seek treatment at the practice where they completed the survey, with one quarter (27%) indicating they were “Neutral” and the remaining either disagreed or strongly disagreed (22%). The average number of

websites guardians reporting visiting was 1.6 overall (standard deviation: 1.5), but among those who agreed or strongly agreed (n=26), the average number of sites visited was 2.5. As expected, there was a significant difference in the number of sites visited based on the response to the question regarding the importance of websites, with the highest number among those who agreed or strongly agreed and the lowest among those who disagreed or strongly disagreed (p-value<0.0001). Results are given in Table 4.

Table 4: Importance of Websites in Selecting Practice and Number of Sites Visited (p-value<0.0001)

Perceived Importance	n, %	Average Number of Websites Visited	SE	
Agree/Strongly Agree	26, 51%	2.5	0.237	a
Neutral	14, 27%	1.1	0.323	b
Disagree/Strongly Disagree	11, 21%	0.4	0.364	b

*Levels connected by the same letter are not significantly different from Tukey's adjusted post hoc pairwise comparisons

When presented with the sample homepages with varying main images, there were significant differences in the preference based on the image (p-value<0.0001). The highest rating was for the picture with a diverse group of children (average: 8.1) which was significantly higher than all the other pictures except for the image of an individual child in the dental chair (average: 7.2). The sample image of a cartoon office was rated significantly lower than all the other images (average: 4.9).

Guardians also demonstrated preference for the location of the menu banner (p-value=0.0171). The sample page with no menu banner was rated significantly lower than the sample with a banner at the top (6.1 vs 7.1, adjusted p-value=0.0125). The

banner at the top was rated the highest, but it was not significantly different from the banner at the bottom (7.1 vs 6.7, adjusted p-value=0.4170).

Similar results were demonstrated with the contact information (p-value=0.0020). Respondents rated the page with no contact information the lowest and the information at the top of the page the highest (5.6 vs 6.9, adjusted p-value=0.0015). Contact information at the bottom was marginally significantly lower rated than at the top (6.1 vs 6.9, adjusted p-value=0.0528). The contact information was also presented at the top left and top right of the page and preference was for the top right (7.5 vs 6.7, p-value=0.0148).

The “About the Doctor” section of the website was presented as either a paragraph or a structured list of information. Respondents rated the structured format significantly higher than the paragraph (8.3 vs 6.4, p-value<0.0001). Complete results regarding the preference of various sample webpages is given in Table 5.

Table 5: Guardian Preference for Various Sample Webpages

Variable	Mean	SE	P-value*
Homepage Image			<0.0001
Diverse Kids	8.1	0.27	a
Single Child in Dental			
Chair	7.2	0.27	a,b
Mom and Child			
Brushing	6.7	0.27	b
Actual Office Image	6.5	0.27	b
Cartoon Office Image	4.9	0.27	c
Banner Location			0.0171
Top	7.1	0.25	a
Bottom	6.7	0.25	a,b
Not Present	6.1	0.25	b
Contact Information			
Position			0.0020
Top	6.9	0.27	a
Bottom	6.1	0.26	b
Not Present	5.6	0.26	b
Contact Position:			
Left/Right			0.0148
Top Right	7.5	0.24	a
Top Left	6.7	0.24	b
About the Doctor			<0.0001
Structured List	8.3	0.20	a
Paragraph	6.4	0.20	b

*P-value from Repeated Measures ANOVA; Levels connected by the same letter are not significantly different from Tukey's adjusted post hoc pairwise comparisons

Figure 4: Website Importance to Seeking Treatment

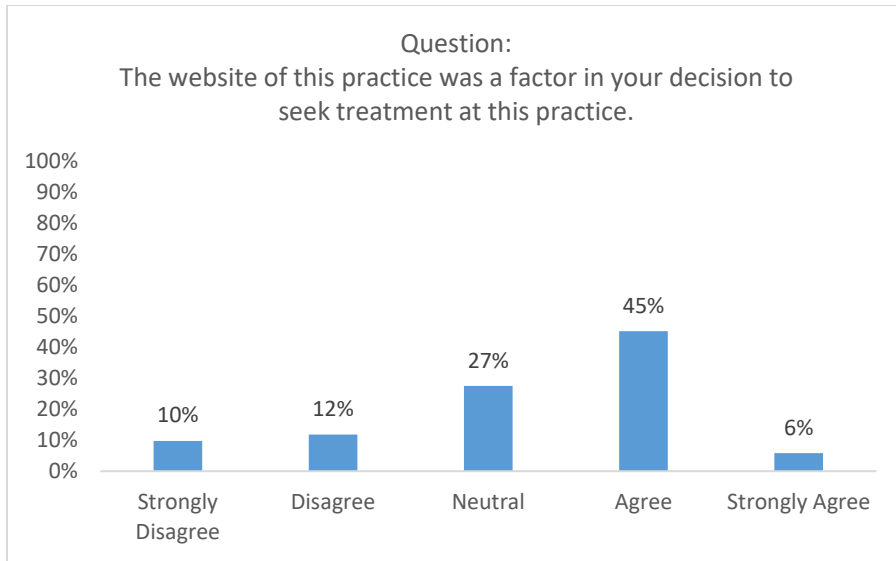
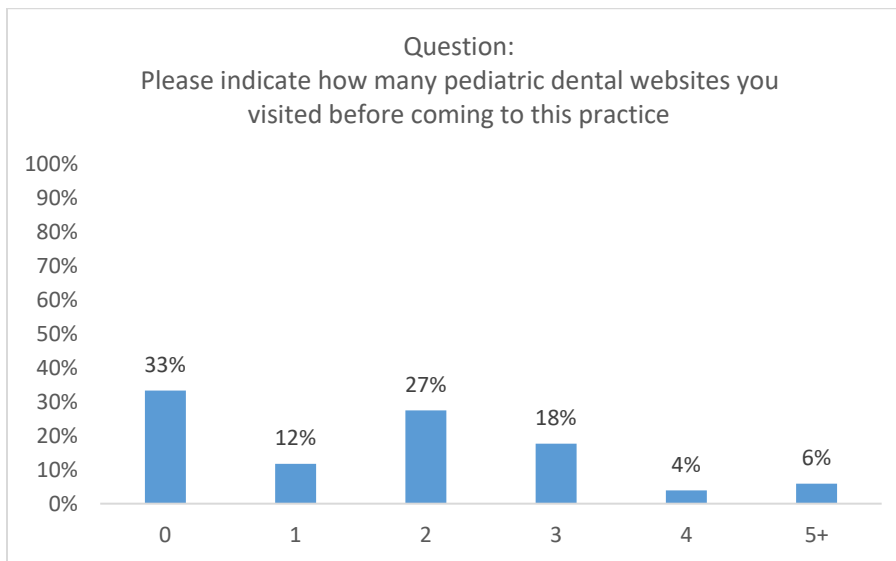


Figure 5: Number of Practice Websites Visited Prior to Seeking Treatment



Discussion

In the realm of pediatric dental website design there is very little information on the importance and value of the content within the site. Some research states that 97 percent of patients (guardians) prefer to visit a dental practice's website versus calling the office for information.¹⁹ This statement deviates from our findings in the guardian survey. One third of the guardians indicated they did not visit any pediatric dental websites prior to scheduling an appointment. For this portion of the respondents, it is thought that word of mouth coupled with other forms of advertising may play a role in their decision on which practice to visit. The guardian survey contained questions designed to allow the researchers to develop a sense of the overall level of use and importance that guardians place on pediatric dental websites. These graphs are displayed above as Figure 6 and Figure 7. These findings are interesting because they indicate that guardians surveyed are not visiting more than two or three websites when choosing a pediatric dental office and less than half of them agree that the practice's website is a factor in seeking treatment at a particular practice.

Within the websites of pediatric dental offices, the layout of the website and decisions on where to place content is not based on any information other than the layout of past websites and the opinions of the pediatric dentist or website designer. In this study, a focus was placed on what features are currently available on pediatric dental websites from around the United States and what the guardians of pediatric dental patients want to see and utilize on the websites of their pediatric dentists.

Currently, the pediatric dentist and website designer alike are only providing the information that has been provided on past websites, much of which is not specific to pediatric dentistry. This type of content typically includes a home page with multiple choices on where to navigate within the website as well as some photos of the office, the staff, pediatric dental providers, parents and the pediatric dental patients. In a 2012 article in *Dental Economics*, the following statement was made: to make a lasting impression on patients and convey your expertise, website content must offer them value that appeals to their wants, needs, and challenges.²⁰

Among all the features examined a total of six features were ranked by the guardians at higher than 50 percent and were also present on less than 30 percent of the audited websites; these features include a website search feature, the ability to pay online, a live chat function, actual video testimonials from parents and patients, patient pictures before and after dental treatment and a dedicated page illustrating the philanthropic mission of the dental practice. Out of all the guardians surveyed, an average ranking of 64/100 was recorded regarding a website search feature and none of the pediatric dental websites audited had a search feature. If all of the surveyed websites added a search feature it could create value for guardians by improving the utility of the website. With regard to making payments online, the guardians ranked this function 82/100 and only 18 percent of the websites offered this feature. There has been exponential growth in online transactions in recent years and when coupled with the equal growth in online security many consumers now feel comfortable using secure information online.²¹ Guardians ranked the live chat feature at 58.5/100 and the patient pictures before and after dental treatment as 64.3/100 while the dental office websites

having this feature were 6 percent and 4 percent respectively. Video testimonials from the parents and patients were ranked as 54.7/100 by the guardians and about 10 percent of the websites audited had the feature.

The guardians ranked the importance of seeing ways the practice serves the community on the website as 56.8/100 and 28 percent of the practices had information like this on their website. Studies have shown that consumers tend to feel gratitude towards firms that divert at least a portion of their resources to corporate philanthropy.²² The six features above represent the features which ranked highly with guardians but were not present on most websites audited.

Some features were widely available on pediatric dental websites but ranked relatively low with guardians. Eighty-four percent of practices had a social media presence on websites like Facebook, Instagram and Twitter while the guardians only ranked the importance of the feature as 47.5/100. This was an interesting finding considering the popularity of social media with the majority of Americans. In 2014, Social networking was the most popular online activity and 91% of adults online are regular users of social media. Facebook, YouTube, and Twitter are the second, third, and eighth most trafficked sites on the Internet.²³ Ninety-eight percent of the websites audited were in the top 3 websites when a specific geographic location was searched for pediatric dental websites but guardians only ranked this feature as 65.8/100 in importance.

A poor quality website has resulted in some companies suffering bad press, customer dissatisfaction, and even customer loss, so the design of the website and understanding of its effects on users is very important.²⁴ There are more formal

methods of measuring website quality as outlined in a paper by Loiacono et al. This study discusses why the ability to measure the quality of a website is the critical concern of both Information System and Marketing researchers. The paper presents the development and validation process of a website quality measure with twelve core dimensions: informational fit-to-task, tailored communications, trust, response time, ease of understanding, intuitive operations, visual appeal, innovativeness, emotional appeal, consistent image, on-line completeness and relative advantage.²⁵

Search engine optimization is also something dental practices can take advantage of by hiring a company to develop text and query words which allow the pediatric dental practice's website to be listed at the top of a particular search engine when a guardian is trying to find a potential pediatric dentist in their area. Evidence suggests that search engine users hold preexisting, implicit beliefs about ranking, such as the expectation that the top results are the most relevant to search terms.²⁶ This service is an expensive, but highly competitive way to make a practice more visible to guardians who search the internet for pediatric dental care.

One possible benefit to improving the online experience relates to a conversion of potential pediatric dental patients to actual active pediatric dental patients based on the aforementioned article by McDowell et al. With regard to user activity on the Internet and the success rate of businesses generating Internet based sales, the term *conversion rate* is used. Conversion rate is defined as the interaction between a website and its consumers' buying choices as well as the percentage of users purchasing a product out of the total of unique visitors entering a website.⁴ To simplify, a website's conversion rate is the percentage of users who perform a desired action

specified by the website designers. These actions may include the purchase of a product, signing up for a weekly email or other actions like willingly divulging personal information useful to the company. Any learned information the web page designers can use to potentially increase the conversion rate to future users may also be considered a success to the website designer.

To the knowledge of the researchers this is the only study of its kind within the specialty of pediatric dentistry, however many studies have been done in the medical profession and orthodontics regarding website conversion rates. An article from 2010 in the *Journal of Plastic Surgery* stated, “Your design should also be conversion-oriented.” Many design features can have an impact, both positive and negative, on a visitor’s experience while on your Web site, and this, in turn, can affect your overall conversion rate.²⁷

A sample conversion rate calculation for the purposes of this study could be performed by using the data in Table 4, Figure 6. The 14 guardians who perceived a website’s importance as “Neutral” only viewed an average of 1.1 websites prior to choosing a dental practice for their child. If the 1.1 websites viewed were primarily the website of the dental practice where the guardian responded to the guardian survey, then that website had a nearly 100% conversion rate with the “Neutral” guardians. It is logical that the guardians who are neutral about the perceived importance of a website only viewed 1.1 websites prior to making a decision on a dental practice.

The homepage of a website is the page that displays when the web link for the dental practice is initially clicked. This is sometimes referred to as the landing page and

acts as a central point within the site and all other features of the website should be accessible from the homepage. In the specialty of orthodontics, Longoria et al showed that informative websites are important factors in the guardians' selection of an orthodontist. The display of before-and-after photos and a referral from a pediatric dentist were also important.²⁸ The observation and task behind influencing the way in which users view a website is a term called, visual hierarchy, or the way certain elements are arranged on the page.²⁹ Research has shown that facial images attract website users' attention, and can serve as an entry point for information that is located in their close proximity.^{5,30,31} A consumer or patient's impression of a company or practice can be influenced by the website design and content; initial impression can have a beneficial or detrimental impact on the relationship of the company with the user. Similar results were seen when the study was done in orthodontic setting, with guardians rating similar features as more important than the providers. The study reported those features are: the presence of before and after pictures, online payments, online scheduling and instant message customer support.¹⁵

Within the guardian survey, 5 total homepages were created with various scenes ranging from photos of children to cartoons. The homepage with the highest ranking (8.1/10) was the first picture shown to the guardian and it showed a diverse group of children smiling. This picture will be referred to as "diverse children." The second highest ranked homepage (7.2/10) showed a female child looking back from a dental chair while receiving oral hygiene instructions. This photo will be referred to as "single child in dental chair." The homepage with the third highest ranking (6.7/10) was a photo with a mother and single female child brushing their teeth together. In this study, the

guardians who responded favorably to the homepage comprised of a group of diverse children may have been positively responding to the visual hierarchy within the page. Two other homepages were also included in the survey. One photo showed a cartoon image of a child in a dental chair with a dentist at his side, while the other homepage was an actual office photo showing a female staff member with a provider and parent. The photo of the dental office and female staff member ranked 4th out of the five photos (6.5/10) and the cartoon ranked the lowest of all the homepage photos (4.9/10). The low ranking of the cartoon image supports the findings that users like to see facial images displayed on webpages.³⁰

The guardians of pediatric dental patients may use websites as a way to form an initial opinion about the pediatric dental practice they are considering as a dental home for their child. The details of website design are now more important than ever for specialty based medical and dental practices. Nearly every business has some type of Internet presence and often the details available on the website, the aesthetics of the site and the ease of user navigability are the features that set one website apart from another. In a paper by Jiang et al, the following was stated, though aesthetics is generally acknowledged as an important aspect of website design, extant information systems research on web user experience has rarely studied what affects website aesthetics and how aesthetics influences users' perceptions of the organization behind the website.³²

In Jiang et al, the authors combine prior literature from different academic domains in an effort to suggest users' perceived quality of five design elements (i.e., unity,

complexity, intensity, novelty, and interactivity) as the determinants of website aesthetics. Examples of these elements include, adjusting the contrast or color scheme of a website's back- and foreground color (intensity) or adopting a new presentation format or style, such as dynamic or animated features (novelty).³² The author states the previous two elements are more useful in enhancing the website's overall aesthetics than simply adjusting the layout (unity), manipulating the amount of content (complexity), or embedding interaction in the website (interactivity). The effects of aesthetics on users' attitudes toward the website and their perception of the corporate image should be considered when designing a website. These factors are also important considerations in the design of a medical or dental website. In the results of the above study the authors found considerable support for their hypotheses that these five elements indeed form a holistic framework for people to evaluate website aesthetics. The results suggested that these five website design elements were not only relevant but also sufficient and distinct to the task of website design. Additionally, the authors discovered the five design elements were indeed influential on users' perceived aesthetics. The study indicated that perceived aesthetics of a website has a significant impact on users' perception of its utility. When compared to perceived utility, perceived aesthetics had a stronger impact in forming the users' attitudes, which further shaped the corporate image exhibited via the website.³² The elements of the guardian survey which were ranked high by respondents were likely also due to positive perceived aesthetics. All five design elements were evaluated simultaneously in the guardian survey. The unity and complexity elements were tested within the "Features" portion of the survey; guardians assigned a value out of 100 to features they prefer to

see on a pediatric dental website. The novelty and intensity were evaluated within the wide range of colors, features and design architecture of the guardian survey.

To gain some information on the current market surrounding pediatric dentistry two publications were obtained. The 2008 ADA publication, Distribution of Dentists in the United States by Region and State and the 2010 ADA publication, A Survey of Dentists – Pediatric Dentists in Private Practice. According to the 2008 publication, there are approximately 182,000 active practicing dentists in the U.S., of which, approximately 5,900 are pediatric dentists. Within the new active dentists (dentists who graduated up to 10 years prior), 1,800 are pediatric dentists, which represents approximately 27% of the new active specialists.¹⁸ The 2010 ADA publication, A Survey of Dentists – Pediatric Dentists in Private Practice, reports on the highlight and changing demographics within the specialty of pediatric dentistry. The publication reports that approximately 75% of the active pediatric dentists in the U.S. work full time, i.e. 32 hours per week and in 2009, approximately 30% of practicing pediatric dentists were female. According to the publication the number of female pediatric dentists in the U.S. has doubled since 1998. In 2010, 43% of the pediatric dentists in the U.S. were over the age of 55 years, while 17.5% were under 40 years old and the remaining 39.5% were between 40 and 54 years old.

One important factor to consider from this information is the age of the majority of practicing pediatric dentists in the U.S. The age group of 55 years and older was not exposed to the internet until many years into their practice life cycle. This is based on the assumption the majority of the practitioners within this group had a traditional educational timeline into the specialty. The following calculation was performed to

examine the time point when pediatric dentists began graduating from their residency with experience using the internet. The age group of 45 to 54 years comprises approximately 61% of all actively practicing pediatric dentists in the U.S.³³ If we consider the youngest portion of this group at age 45 years and retroactively trace the traditional timeline from birth in 1974 or 1975 to the completion of their residency training in pediatric dentistry, we arrive at approximately 29 years.

If the majority of these specialists completed their training within 29 years the calendar year would have been 2003 or 2004 at the time of their graduation from dental residency. It is likely that most of these new pediatric dentists during those years were not using the internet regularly until the latter half of their time in dental school and therefore had not begun to view the internet and webpages as an integral part of the practice model. Based on a 2003 study, "Internet Use in a Dental School," the average dental student at that time was using the Internet "about once a month" for dental school.³⁴ No data could be found on the number of new pediatric dental graduates that chose to integrate a website into their practice during these years of growing internet popularity. During the time of the "dot-com" boom a lot of external societal pressures were manifesting with regard to creating a web presence. This age group of pediatric dentists was being exposed and informed about the potential of developing a website for their practices.³⁵ It is very possible this group of graduates was the first to understand the importance of creating a web based presence for dental specialists.

The results of this study have reinforced the importance of a web presence for pediatric dental practices and provided direction on the importance of certain aspects of the website. There are a myriad of options regarding the details and design within a

website so selecting popular content will increase the value of the website to the specialist and the guardian. The pediatric dentist should remember that website designers may not fully appreciate the needs of the guardians and proven data should be considered before beginning the process of designing a website.

While this study is one of the first to investigate the importance of pediatric practice websites, it is not without limitations. A relatively small number of guardians completed the survey. Recall bias is a consideration in this study. As guardians completed the guardian survey they may not have recalled the details of their website use correctly. It was noted during the data collection that some guardians had trouble perceiving differences in the sample webpages which may have affected results. The guardian surveys were also gathered in the greater Richmond area and the results were compared with practices across the United States. Although the sample was aimed to be nationally representative, there were states excluded and the small sample size was relatively small compared to the total number of pediatric dental practices in the country. The guardians with younger children seemed more distracted while responding to the survey because these children needed more parental attention. Some of the dental practices had very short waiting times so a small portion of the survey responses were interrupted by the dental staff calling the child and guardian back to the treatment area. This may have affected the results as the guardian resumed the survey once seated in the treatment area. At times the child receiving care experienced an elevated level of anxiety which required the guardian to become distracted from the survey response. It is possible the data gathered in these responses was affected. Efforts were made to

ensure all guardians had an adequate command of the English language but it is possible some guardians had difficulty understanding the questions in the survey.

Conclusion

Regarding available features, guardians' preferences seem to differ from what is currently available on pediatric dental websites. Pediatric dentists should highly consider choosing images of children with diverse ethnic backgrounds when selecting images to place on a website's homepage. The guardians of pediatric dental patients want video testimonials of actual parents and patients along with before and after pictures of treatment modalities performed by the pediatric dentists. Pediatric dentists can improve their websites by displaying evidence of guideline-based treatment and implementing certain features for added convenience. Pediatric dental offices that place an abundance of resources on social media presence should reconsider those resources and add or improve features that guardians value. Guardians prefer the website layouts of pediatric dentists that have the greatest amount of information on the single homepage. Additionally, Guardians seem to prefer general information banner, practice address, and contact information at the top and right of the homepage. More research should be done in the realm of pediatric dental website design. The products of additional research would not only bring value to the pediatric dental experience for guardians but also providers.

References

1. Sui, Daniel Z DWR. Environmental Impacts of the Emerging Digital Economy : The E-for-Environment E-Commerce ? *Environ Manage*. 2003;29(2):155-163. doi:10.1007/s00267-001-0027-X
2. Kim S. The diffusion of the Internet : Trend and causes q. *Soc Sci Res*. 2011;40(2):602-613. doi:10.1016/j.ssresearch.2010.07.005
3. Weis AH. Commercialization of the Internet. 2010;2(3):420-435. doi:10.1108/10662241011059453
4. Mcdowell WC, Wilson RC, Owen C, Jr K. An examination of retail website design and conversion rate. *J Bus Res*. 2016;69(11):4837-4842. doi:10.1016/j.jbusres.2016.04.040
5. Jorgensen G. Attracting orthodontic patients via the Internet: A 20-year evolution. *Am J Orthod Dentofac Orthop*. 2015;148(6):939-942. doi:10.1016/j.ajodo.2015.10.001
6. Internet Growth Statistics 1995 to 2019 - the Global Village Online. <https://www.internetworldstats.com/emarketing.htm>. Accessed June 19, 2019.
7. Hooghe M, Vissers S, Stolle D, Mahéo V. The Potential of Internet Mobilization : An Experimental Study on the Effect of Internet and Face-to-Face Mobilization Efforts. 2010:406-431. doi:10.1080/10584609.2010.516799
8. Matters B. Making your brand mobile-friendly by creating a website with a responsive design. 2015;4(7):356-358. doi:10.12968/joan.2014.3.7.358
9. Nelson KL, Shroff B, Best AM, Lindauer SJ. Orthodontic marketing through social media networks : The patient and practitioner ' s perspective. 2015;85(6). doi:10.2319/110714-797.1
10. Stephen AT, Galak J. The Effects of Traditional and Social Earned Media on Sales: A Study of a Microlending Marketplace. *Ssrn*. 2009;49(5):624-639. doi:10.2139/ssrn.1480088
11. Haeger RS. MANAGEMENT & MARKETING. 2011;XLV(6):333-337.
12. Freiden JB, Goldsmith RE. Differences in the Consumer Decision Process for

- Professional Vs. Generic Services. *J Serv Mark.* 1989;3(1):208.
doi:10.1108/EUM0000000002481
13. Oaks T, Delhi N. Informed Patients and the Internet A Mediated Context for Consultations with Health. 2006. doi:10.1177/1359105306061186
 14. Chung C, Tadlock LP, Barone N, et al. American Board of Orthodontics : Time. *Am J Orthod Dentofac Orthop.* 2018;153(3):321-323.
doi:10.1016/j.ajodo.2017.12.005
 15. Brown TR. VCU Scholars Compass Orthodontists ' and patients ' preferences in website design in the selection of an orthodontic practice : a comparative study. *VCU Theses Diss.* 2018. doi:10.25772/EWPZ-2R42
 16. Kelly SE, Binkley CJ, William P, Gale BS. Barriers to Care-Seeking for Children ' s Oral Health Among Low-Income Caregivers. 2005;95(8):1345-1351.
doi:10.2105/AJPH.2004.045286
 17. Roger Chou, Amy Cantor, Bernadette Zakher JPM and MP. Preventing Dental Caries in Children , 5 Years : Systematic Review Updating USPSTF Recommendation abstract. *Am Acad Pediatr.* 2020;132(2):332-350.
doi:10.1542/peds.2013-1469
 18. Association AD. *Distribution of Dentists in the United States by Region and State , 2008 Distribution of Dentists in the United States by Region and State , 2008.*; 2008.
 19. Cooper N. 5 Website Design Tricks All Dentists Should Use—and 5 They Should Avoid. 2016:<https://www.dentaleconomics.com/articles/print/vol.https://www.dentaleconomics.com/articles/print/volume-106/issue-8/practice/5-website-design-tricks-all-dentists-should-use-and-5-they-should-avoid.html>.
 20. G L. Maximizing Your Website's Effectiveness with Great Content. *Dent Econ.* 2012;(800).
 21. Casado-aranda L, Dimoka A, Sánchez-fernández J. ScienceDirect Consumer Processing of Online Trust Signals : A Neuroimaging Study. *J Interact Mark.* 2019;47(August):159-180. doi:10.1016/j.intmar.2019.02.006
 22. Park J, Choi J, Yeu M. RELATIONSHIP BETWEEN CORPORATE PHILANTHROPY AND CONSUMER LOYALTY – THE MEDIATING ROLE OF GRATITUDE , TRUST AND COMMITMENT : SOUTH KOREAN CONSUMER PERSPECTIVES. *Acad Mark Stud.* 2016;20(1):1-17.
 23. Fan BYW, Gordon MD, Than WM. The Power of Social Media Analytics. *Commun ACM.* 2014;57(6):74-81. doi:<https://doi-org.proxy.library.vcu.edu/10.1145/2602574>
 24. Gruman G. E-commerce blurs lines of integrity , but they still exist. 1999:1999.
 25. Loiacono ET, Hall W. WebQual TM : A Measure of Web Site Quality WebQual TM : A Measure of Web Site Quality. (706).

26. Arketing SEENM, Lim KH, Zhou N, Cui N. Brand Positioning Strategy Using Search Engine Marketing. *MIS Q.* 2010;34(2):261-279. doi:doi:10.2307/20721427
27. Baxter R. Exponential growth using the internet and your web site. *Facial Plast Surg.* 2010;26(1):39-44. doi:10.1055/s-0029-1245063
28. Longoria JM, English J, O'Neill PN, Tan Q, Velasquez G, Walji M. Factors involved in choosing an orthodontist in a competitive market. *J Clin Orthod.* 2011;45(6):333-337. <http://www.ncbi.nlm.nih.gov/pubmed/21778587>. Accessed December 19, 2018.
29. American Academy of Pediatric Dentistry. Definitions and scope of pediatric dentistry. *Ref Man.* 2011. doi:10.17226/13058
30. Tavakol S, Lawrence D. Website Usability. *Balanc Website Des Optimising Aesthet Usability Purp.* 2002. doi:10.1007/978-1-84628-795-4_3
31. Djamasbi S, Siegel M, Tullis T. Generation Y, web design, and eye tracking. *Int J Hum Comput Stud.* 2010. doi:10.1016/j.ijhcs.2009.12.006
32. Jiang Z (Jack), Wang W, Tan BCY, Yu J. The Determinants and Impacts of Aesthetics in Users' First Interaction with Websites. *J Manag Inf Syst.* 2016. doi:10.1080/07421222.2016.1172443
33. Association AD. 2010 Survey of Dental Practice 2010 Survey of Dental Practice. 2010:49-51.
34. Walmsley AD, White DA, Eynon R, Somerfield L. The use of the Internet within dental education. *Eur J Dent Educ.* 2003;7:27-33. <http://dx.doi.org/10.1034/j.1600-0579.2003.00268.x>.
35. Miller SA, Forrest JL. Dental practice websites : creating a Web presence. *Dent Clin North Am.* 2002;46(3):463-475.