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Public Health Surveillance of Pediatric Dentistry via Twitter

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Public Health Surveillance of Pediatric Dentistry via Twitter

by

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Public Health Surveillance of Pediatric Dentistry via Twitter

Shirin Mullen, DDS

ABSTRACT

Background: Twitter is a social networking site that has become a leading global real-time communications platform. Twitter users post brief 140-character long messages ('tweets') on a variety of topics. To date, it is not known what parents are saying about their children's oral health on Twitter.

Purpose: The purpose of this study was to understand parents' actions and perceptions towards their child's oral health on the Twitter.

Methods: Publically available tweets on Twitter were extracted from 14 randomly selected non-consecutive days in December 2012 and January 2013. A total of 1451 tweets meeting the search criteria were extracted and, after excluding ambiguous or irrelevant tweets, a total of 1073 tweets were included and analyzed. Tweets were coded using pre-established non-mutually exclusive categories.

Results: The 1073 included tweets were coded into 5 main categories: attitude (n=606, 56.6%), event (n=535, 49.9%), action (n=499, 46.5%), concern/question (n=203, 19%), and behavior (n=77, 7%). The proportions of tweets with negative (n=321, 53.0%) and positive (n=285, 47.0%) attitudes expressed by parents were similar. The most frequent reported events included eruption (n=237, 44.3%), exfoliation (n=194, 36.3%) and grinding (n=62, 11.6%). The most frequently reported actions were general dental appointment (n=204, 40.9%), prevention (n=165, 33.1%), and extraction (n=44, 8.8%). A majority of the tweets describing children's behaviors were negative (n=55, 71%) rather than positive (n=22, 29%) ones. The most frequent concerns and questions were about esthetics (n=57, 28%), eruption (n=34, 17%) and dental home/access to care (n=27, 13%).

Conclusions: Twitter can serve as a rich source of data on parental perceptions and actions towards their child's oral health. Parents report their child's dental events, actions and behaviors, as well as express concerns, questions and attitudes on Twitter. Parents frequently report their child's dental visits. Among those who report an attitude about these dental visits, only 1 in 3 are positive. Future research is warranted to understand factors contributing to positive and negative attitudes toward pediatric dental care. As Twitter evolves the way society interacts and communicates, it is critical for oral health professionals to actively monitor and engage in the dialogue to improve societal health and well-being.

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INTRODUCTION

There have been significant advancements in the worldwide web (Internet) that have changed the way people obtain and disseminate information. People have gone from passively obtaining information from the Internet to actively creating content in an open and interactive manner.[1] These advancements have created a wealth of user-generated content on the web of shared experiences, concerns, and questions posed to an online community.[2] The online interactions are made possible by social media, the means by which people communicate in virtual communities and networks.[3] These online communities have increased rapidly in recent years with an estimated 62% of adults worldwide now using social media.[4] These rapid developments have not only changed communication on global events,[5] but also the way people obtain and disseminate information about their health.[6] One social networking site that has become a global real-time communications platform is Twitter (San Francisco, CA).[7] Twitter has undergone rapid growth since its inception in 2006. Currently, Twitter has 200 million users broadcasting 400 million tweets per day.[8] Twitter has been used as a way to stay updated on medical advances in real time[9] and to further health professional communication and continued education.[10] It has been found that 12% of Americans looking online for health information have used Twitter to share updates about themselves or others.[11]

Among US adult Internet users (which comprise 74% of all US adults), 80% have searched online for health information and 34% have read health information generated by other users.[12] More than half (51%) of parents who use the Internet have reported searching online for general pediatric health information at least once in the past three months.[13] A majority of the US population searches for health information on the web. However little is known about

the kinds and credibility of the information available. Peer-reviewed journal articles and professional presentations are the two primary methods that researchers use to disseminate their work.[14] It has been argued that scientists are failing to communicate science to the public at large and in a timely manner.[15] Social media websites, such as Twitter, have promising potential to facilitate communication between health professionals and research communities to the lay public. Increasingly more health organizations and scientific societies are becoming involved in social media for education and promotion of oral health and view their involvement as a critical move in this Internet society. The American Academy of Pediatrics and The American Academy of Pediatric Dentistry have active Twitter accounts with 19,713 and 3, 220 followers, respectively. Also, Almost every major scientific society of dentistry has a Twitter account.

In order to improve the dissemination of information and health promotion, it is important to understand public perceptions and attitudes of health topics. Infodemiology, an emerging field that involves the analysis of near real time information collected from the Internet, has shown to be important in informing public health and public policy.[16] Twitter has been used increasingly to provide a platform for researchers to analyze public perceptions and attitudes about health topics such as the H1N1 flu epidemic,[17] concussions,[18] antibiotic use,[19] dental pain,[20] epilepsy,[21] and cancer screening.[22]

Pediatric oral health is a significant health issue that demands attention. Dental decay is the most common chronic childhood disease in the United States today, five times more common than asthma.[23] Dental care is the most prevalent unmet health need among children in the United States and throughout the world.[24] Striking oral health disparities exist, with poor and

minority children accounting for the majority of dental decay and disease.[25] Poor oral health can have significant and long-standing effects on a child's overall health, growth, and development.[26] Parents are primarily responsible for the health of their young children. Investigating parents' perceptions about their children's oral health will further the understanding of the oral health disparity and will improve the formulation and dissemination of appropriate oral health information. To date, there has not been research conducted on children's oral health behavior on social media sites. We sought to explore the nature and content of pediatric dental communications on Twitter.

METHODS

Study Design and Setting

This cross-sectional study conducted qualitative content analysis of publically available content on the Twitter social networking site (www.Twitter.com). Twitter is a forum in which people can share information in real-time through 140 character messages called "tweets." The content on twitter is largely public, with a downward trending 6% of accounts being private in 2009.[27] Users may select to be a 'follower' to other individual users and organizations by receiving their tweets. When a user with a public account broadcasts a tweet it is sent to their followers and can also be retrieved publically through public online searches.

Data collection

Twitter data was retrieved through a data collection script created and submitted to the Twitter Search API (https://dev.twitter.com/docs/api/1/get/search). The data collection script included a specified query that consisted of a series of search terms and logical operators.

The Twitter Search API's time based parameters were used to confine the selected date range of tweet extraction. The data collection script was programmed to run to repeatedly poll the Twitter Search API and retrieve all the specified tweets from the selected dates. The resulted collection of tweets generated by the Search API contained contents of the selected tweets, timestamp, the author of a tweet, and other related user information as available. The assembled data were then flattened and exported in a tab-delimited format for import into spreadsheets or statistical software. We analyzed the content of a random non-consecutive 14-day sample of publically available tweets during the months of December 2012 to January 2013, which defined the 'study period.' In order to obtain equal representation from each weekday, a random number generator was used to randomly select each weekday twice during the study period. To reduce biases introduced by advertisements, or active Twitter users repeating or resending tweets conveying similar contents, we included only the first tweet from each unique user with the earliest date and time stamp in the study sample, and excluded subsequent tweets from the same user. Re-tweets (re-shared tweets from another user) and spam (commercial links or advertisements) were also excluded. We did not confine our analysis to any specific user location, age, or gender. Individuals were not contacted and information set as private was not accessed.

Search Terms Selection

The objective of the study was to capture what parents are saying about their children's pediatric dental situations on Twitter. An initial set of inclusionary search terms that were likely to capture descriptions of dental situations such as "teeth" and "dentist" and parent-child relationship such as "my child" and "my son" were identified. To exclude re-tweets and advertisements, the exclusionary terms "RT" and "http" were used. Search terms that

yielded a majority of irrelevant tweets, such as “nail” which yielded irrelevant statements such as “fight tooth and nail,” were excluded from further analysis. Some words, such as “baby” and “our child,” were not included because they did not result in more relevant tweets or resulted in a higher number of irrelevant tweets. The search term identification (API, Twitter, San Francisco) went through 13 iterations. With each iteration a new inclusion or exclusion term was added or removed and 50-100 tweets was pulled and analyzed. Each set of pulled tweets generated additional inclusion and exclusion terms that were further analyzed. The goal was to obtain the highest degree of relevant tweets without narrowing our search such that we would be excluding valuable information. Using this interactive process of adding one new exclusionary term at a time and assessing the search results, the following final set of inclusion and exclusion terms were selected: Inclusion – (“Dental” OR “Teeth” OR “Tooth” OR “Dentist”) AND ("my child" OR “my son” OR “my daughter” OR “my kid”); Exclusion – “http” OR “RT” OR “dog” OR “puppy” OR “fairy” OR “whitney” OR “bieber” OR “comb” OR “nail” OR “skin” OR “dagger.” These search terms consistently yielded 60% relevant tweets with 3 separate random samples of 100 tweets.

Coding Scheme Development

After exploratory searches were done, a sample of 800 tweets was obtained and analyzed. The sample of tweets was categorized until thematic saturation was obtained and a coding scheme was formed. The coding scheme consisted of broad themes that branched into more specific categories The research team of 5 members reached consensus on the final non-mutually-exclusive five major categories and 33 subcategories (Figure 1). After the final coding scheme was developed, an independent set of 50 tweets was used to determine inter-rater reliability between the primary coder [SM] and each of the 4 other team members. The

average Cohen's Kappa and PABAK[28] were .98 and .97, respectively, which indicated high degree of agreement in categorization of tweets between coders.

Qualitative Coding and Quantitative Data analysis

A total of 1451 Tweets were collected using the final set of inclusion and exclusion search terms set from the randomly selected 14 days during the study period. Two coders reviewed all 1451 tweets independently to determine if the tweets should be included and to designate codes to each included tweets. Discrepancies occurred with 110 (8%) of tweets and were resolved by regular meetings and discussion. When conflicting codes (*e.g.* child negative attitude and parent positive attitude) were designated to a tweet the dominant code was selected. A total of 1073 (74%) tweets were included for analysis. To be included in the analysis, a tweet was required to be written by a parent in regards to their child's dental situation. Tweets written about someone else's child, not about a dental situation, or incomprehensible were excluded (n=378). The quantitative data was analyzed by IBM SPSS Statistics, Version 21. Descriptive statistics, which include frequencies for each coding major and subcategories, mean number of codes per tweet and its standard deviation (SD) were computed.

RESULTS

Figure 2 shows a word cloud, a graphical representation of word frequency, created on http:www.wordlenet/ using the text contents from 1073 tweets. The larger the font size of the word in the word cloud, the more frequently the word was used in the tweet. The most frequent words were teeth, son, daughter, tooth, going and dentist. All of these words except for "going" were used as search terms and thus were expected to be found most frequently in

the word cloud. Other words that were not search terms that appear to have high frequency are brush, first, lost, take, like, just, now, appointment, grind, and front.

Each tweet was classified in at least one major category, which may be further classified into one or more subcategories. The categories were not mutually exclusive. The mean number of major categories coded per tweet was 1.79 (SD = 0.68; median =2.0), ranged from 1 to 4. The mean number of subcategories coded per tweet was 1.83 (SD= 0.74; median = 2.0), ranges from 1 to 5. For example, the tweet *"At the dentist with my son, poor baby has to be put in a blanket. He hates it. :(#specialneedskidproblems"* contains 4 major categories plus one subcategory within each major category coded: i) Event (subcategory: special needs); ii) Action (subcategory: dental visit); iii) Attitude (subcategory: negative); iv) Behavior (subcategory: negative). Table 1 provides detailed information on the number and percentage of tweets classified within each of the major categories and subcategories. Of the 1073 included tweets, 57% described an Attitude (e.g., "positive" or "negative" towards dentistry), 50% reported a dental Event (e.g., eruption, exfoliation, etc.), 47% reported a dental Action (e.g., a general dental appointment, dental procedure, etc.). Fewer tweets (19%) contained a dental Concern or Question, and 7% reported a positive or negative Behavior of the child towards a dental situation.

Overall, half (51%) of the tweets received classifications for 2 major categories, 35% were classified into a single major category, and 14% were classified into > 2 (range 3 to 5) major categories. A majority (70%) of the tweets received 2 or more coded subcategories (range 2

to 5), 30% were coded into a single subcategory. Representative examples of tweets for each of the major categories are shown in Table 2.

Attitude

Each attitude-coded tweet was classified into either positive or negative attitudes. In case of the presence of both positive and negative attitudes (n = 17), a dominant attitude (either positive or negative) was selected. Slightly over half of the attitude-coded tweets reporting negative attitudes (n=321, 53%). To further describe the attributes of negative and positive attitudes, the Attitudes code was subdivided into dental setting and non-dental setting and further into parent or child subcategories.

Of the 606 total tweets reporting an attitude, a majority (73%) described an attitude associated with a non-dental setting, and 27% described an attitude related to a dental setting. None reported attitudes related to both settings on the same tweet. For example, *"So happy today...my son grew his first tooth!!! Wooooopieee!!!,"* was coded as reporting an attitude in the non-dental setting. In contrast*, "The highlight of my day was taking my daughter to the dentist!"* was coded with a dental setting attitude.

Among tweets reporting attitudes related to a dental event or situation that does not involve a dental setting (n=445), the distribution of positive (49.7%) and negative attitudes (50.3%) were half-and-half. In contrast, about 1 in 3 attitudes related to dental settings (such as dentist, hygienist, or dental appointment) was positive (37.9%), while 2 in 3 were negative (62.1%). A Pearson chi-square test was conducted to examine the association between the

types of attitudes (positive versus negative) and the settings involved (dental versus non-dental). Results indicated there were a significantly high portions of negative attitudes expressed involving dental settings when compared to non-dental settings, $\chi^2(1) = 7.35$, $\underline{p} = 0.007$.

Regarding the source of the attitudes, of 606 attitude-coded tweets, 82.7% were from parents only (e.g., *"My Son Bit His Cheek Real Bad B/c His Mouth Was Numb. I Hate The Dentist!"*), 8.6% referred to that of a child (e.g., "*My Kid Loves Brushing His Teeth, Especially Since I Got Him An Electric/Spinning Big Boy Tooth Brush*"), and 8.7% referred to attitudes expressed by both parent and child (e.g.,*"ever since we bought the yummy-flavored toothpaste for the kids, my son wants to brush his teeth a million times a day. it's hilarious."*). The proportions of positive attitudes expressed by parents only, child only, and both parent and child were: 46.1%, 59.6%, and 43.4%, respectively. The distributions of positive and negative attitudes by the source were statistically similar (χ^2 (2) = 3.76, $\underline{p}$ = 0.15).

Event

Among the 535 tweets reporting some sort of dental events, the most common reported event was eruption (44%), followed by exfoliation (36%) and grinding (12%). Other less common events reported were trauma (n=21, 4%), pain (n=22, 4%), caries (n=16, 3%), and special needs (n=4, 0.7%). All tweets reported up to 2 events, with a majority (n=514; 96%) reported a single event. More than half (n=12; 55%) of the tweets reporting two events reported eruption and pain. For example, *"my son teeth coming in!!! :(and he wont stop crying!!"*

Action

Of the 499 tweets reporting a dental action, a description related to a general dental appointment was the most common action (n = 304, 41%). Other less common actions reported in dental settings were orthodontics (n=14, 3%), sedation (n=8, 3%), medication prescribed (n=3, 1%), or emergency treatment (n=2, 0.4%). Most tweets (67%, 204 out of 304) reported going to a dental visit, but did not state what occurred at the dental visit (e.g.,*"The irony or torture that I sit at the dental office for my son, and eat chocolate in front of him, while he sits in the chair…")* versus a small proportion (33%, 100 out of 304) that described a more specific action at the dentist (e.g.,"*…to get his cavities fixed*").

The second most common action was related to prevention (33%). Prevention actions were defined as the implementation of hygiene practices at home, such as nutrition, brushing, or flossing. For example, *"My son has a Captain Rex spin toothbrush. I so enjoy brushing his teeth! :D."* Within the tweets reporting a prevention action, 34% reported a difficulty with prevention (e.g., *"My son is horrible at brushing his teeth right. I always have to watch him because otherwise he just plays around"*). Nearly all (95%) of the tweets reporting a difficulty with prevention specified the cause of difficulty was due to the child's uncooperative behavior (n=28, 50%), nutrition barriers (n=21, 38%), or time management (n=4, 7%). A roughly equal number of tweets reported a tooth extraction by the dentist (n=44, 9%) versus tooth extraction by the parent or child at home (n=32, 6%).

Concern/Question

Of the 203 total tweets reporting a concern or question, the largest subcategories were aesthetics (28%), eruption (17%), dental home/access to care (13%), prevention (10%), grinding (10%), exfoliation (5%), and dental visit/treatment (5%). Examples of common concerns were: *"My child can't have crooked teeth, I won't let then suffer like I do,"* and *"my daughter is 14 months and only has 6 teeth…when should I take her to the dentist??"* Other less common parental concerns and questions subcategories were behavior (n=3, 1%), pain (n=2, 1%), and trauma (n=2, 1%).

Behavior

Among the 77 tweets reporting a child's behavior towards a dental situation, a majority reported negative (71%) verses positive (29%) child behavior. In the dental setting category, there were 17 (63%) negative verses 10 (73%) positive child behavior tweets (e.g., *"My daughter refuses to let the dentist take X-rays of her teeth. Hate going to the dentist. #Traumatizing"*). In the non-dental settings, there were 38 (76%) negative verses 12 (24%) positive child behavior tweets (e.g. *"The fact that I still have to hold my child down to brush his teeth blows me away. You'd think at 3 years old he would cooperate a little."*).

DISCUSSION

This is one of the first studies to examine the topic of pediatric dentistry on Twitter. This study demonstrates that parents are conversing about the oral health of their children on Twitter and that these conversations can be easily found using simple search terms. With the 140-character constraint of Twitter, parents are able to provide rich information in describing

their child's dental experiences. These findings reveal new avenues for investigations of parents' perceptions and actions in regards to their child's dental situations in order to better understand factors that influence the oral health of children.

One of the major findings of this study was that tweets about children's dental eruption, exfoliation, and grinding were the most frequently reported events and were also among the most frequently reported questions and concerns, with one in three (32%) concerns on one of these topics. These findings are consistent with frequently asked questions by parents to dental professionals in the clinical setting[29, 30, 31] Also, the largest category of questions and concerns were those about dental esthetics (28%). Previous studies have also shown esthetics to be a major concern of parents. For example, a study evaluating factors motivating patients and their parents to seek orthodontic treatment found that 87% of parents were concerned about the appearance of their child's teeth.[32] This study also found that a frequent concern and question of parents is about finding a dental home or access to care. Access to dental care concerns among parents are expected to rise as the fastest growing populations of children are those with the highest oral disease rates and least access to dental care.[33] The similarities between this study and previous findings suggest that the experiences shared by parents on Twitter are similar to those in the general public, thus supporting the Twitter as a data source.

The most frequent action related to children's oral health that parents tweet about was dental visits. Further investigation is needed to understand further the contents of what parents are saying about their child's dental appointments and the attitudes and concerns are associated with them. The second most frequently reported dental action was caries prevention.

Extensive decay in preschool children, or early childhood caries (ECC), is a major health problem that requires aggressive rehabilitation and prevention. Up to 50% of children with ECC who receive comprehensive dental treatment under general anesthesia will require retreatment after 6 months.[34] Prevention at home is critical and cannot be taken lightly. Health professionals must investigate what barriers parents are facing in preventing dental decay in their children and implement effective methods to educate, empower, and support parents in their efforts. In this study, it was found that among all tweets that reported a preventative measure, 34% reported difficulty, and half were due to the child's uncooperative behavior. A questionnaire survey found that 59% of mothers stated that they lacked the skill to clean their children's teeth.[35] Another study found that parents, whose children had recently had comprehensive treatment under general anesthesia, highly valued oral health professionals sharing practical tips or giving actual demonstrations of oral care techniques such as lying a 2-year-old boy down in the parents lap and holding him tight while brushing.[36] This need for instruction and assistance with behavior management is consistent with the difficulty expressed by parents in this study with uncooperative children during preventative measures. In addition to demonstrating techniques with parents in the clinical setting, health professionals can meet this need by posting tips and web links of demonstration or discussion of techniques for dental decay prevention on Twitter.

More than half of the tweets in the study contained an associated attitude (57%). In the non-dental setting, the positive and negative attitudes were about 50%. In contrast, only 1 in 3 attitudes relating to the dental setting were positive. The larger number of negative attitudes towards the dental visits could be correlated with the high number of negative behaviors

(71%) of the children at the dentist. It is important to explore further the attitudes of parents as research shows that parents' beliefs and attitudes toward dental health influence the way in which they practice oral hygiene with their child.[37] It has been found that mother's positive oral health-related attitudes are associated with brushing twice daily and sound dentition in children.[38] Similarly, parents with positive attitudes to hygiene and diet had almost five times lower caries experience then those parents with less positive attitudes.[39] Therefore, it is important to explore ways to positively influence parental attitudes towards their children's dental experiences. Early evidence indicates that social media has potential to shift consumer behavior through influencing perceptions and attitudes. For example, in a randomized trial in which vaccination information, social feedback, and online booking were provided to consumers, influenza vaccination rates were significantly higher than control group (12% vs. 5%).[40] Further, research suggests that social networks can directly mediate health conditions such as obesity and depression by influencing the social norms and behaviors that lead to them.[41,42] Social networks have also been shown to influence patterns of health screening, sleep, and drug use.[43] Thus, social media is a promising tool for improving parental attitudes towards dental care providers and their children's oral health. Further studies need to examine factors associated with parental negative and positive attitudes and how these attitudes can be influenced through social media.

The question of what responsibility and moral obligation health professionals have to ensure that health information on the Internet is accurate and accessible must be carefully considered and explored. The Internet and social media is no passing fad; healthcare providers must not ignore this cultural phenomenon.[44] Engagement in social media can help

raise awareness of disease prevention and evidence based health practices, publish health-related news, and close the gap of accessible evidence based health care information. The MayoClinic has been at the forefront of social media, launching a Facebook page in 2007 and joining Twitter in 2008. The MayoClinic has also made information from its expert researchers, scientists, and physicians available to the public. The MayoClinic claims that its involvement in social media has opened up communication and enabled them to have more in-depth information sharing with patients.[10] The dental profession is in a unique position to influence the health of children at large through its involvement in social media. Twitter not only can serve as an effective avenue for health information sharing, but also as a data source for investigating perceptions of parents, particularly those of minority and low-income populations, whose children are most at risk for dental disease. Twitter use for 25-35 year olds more than doubled between November 2010 to May 2011, increasing from 9% to 19% of total Internet users in this age bracket.[45] On average, women have their first child at 25.4 years old.[46] Thus, one of the fastest growing age groups on Twitter are those with young children. Furthermore, a majority of Twitter users are African-American and Hispanic with one in ten African-American Internet users visiting Twitter on a typical day.[45] Minority and low-income children disproportionately experience dental decay, with higher levels of caries found in African-American and Hispanic groups.[47] Twitter may provide an effective way to reach these minority groups, which are often hard to reach, with health information.[48] Additional studies should be conducted to further explore the perceptions, attitudes, questions, and concerns of parents regarding their children's oral health on social media. With increased knowledge of these populations, new health behavior interventions can be designed that deliver important information to these social networks directly.

There are several limitations to this study. First, we extracted tweets out of a randomly selected 14-day period in a specific timeframe. It is possible that the tweets during this timeframe are not representative of tweets at other periods of time. However, the 14 days were chosen from two months that include both holiday and non-holiday time periods in order to capture a variety of circumstances that may affect the content of the Tweets. The coding process required some degree of individual's subjective judgment and could be subject to bias. The research team worked to minimize bias by calibrating the team members on coding and having two researchers code all tweets. In addition, the exact demographics from the Twitter users are unknown and the population posting about pediatric dentistry may differ from the general population using Twitter. Finally, to minimize over inflation of the topics from repeat users conveying similar contents, we only included the first tweet from each unique user during the sampling period. This methodology could have resulted in the loss of depth of the information on each conversation and the sequence of events for each particular user. Future studies can explore the progression of events and influencing factors for each user's reported experiences.

Despite these limitations, this study contributes several important findings. This study demonstrates that Twitter is a unique data source in which parents are extensively sharing information regarding their child's dental situations in real time. Through Twitter, parents discussed their child's dental events (*e.g.* trauma, eruption), actions (*e.g.* dental visit, home prevention), behavior, and questions/concerns (*e.g.,* grinding, eruption). More than half the tweets involved expressions of an attitude, with roughly equal negative and positive attitudes

in the non-dental setting, and predominating negative attitudes associated with a dental setting. These findings revealed what parents are discussing their children's oral health on Twitter. Social media is a force that has and will continue to transform communications worldwide. It is vital that the dental profession does not get left out of the conversation, but works to engage parents by reaching them in these arenas that they are already actively participating. Through social media, health professionals have the potential to make important and lasting contributions.

TABLES

Table 1 Distribution of non-mutually exclusive major categories and subcategories

Major categories N (%)*	**Subcategories**	**N (%)+**
Attitude 606 (56.5%)	Negative	321 (53.0%)
	Positive	285 (47.0%)
Event 535 (49.9%)	Eruption	237 (44.3%)
	Exfoliation	194 (36.3%)
	Grinding	62 (11.6%)
	Pain	22 (4.1%)
	Trauma	21 (3.9%)
	Other (Caries, Special Needs)	20 (3.7%)
Action 499 (46.5%)	General Dental appointment	204 (40.9%)
	Prevention	165 (33.1%)
	Extraction	44 (8.8%)
	Home Extraction	32 (6.4%)
	Examination	27 (5.4%)
	Orthodontic	14 (2.8%)
	Dental visit– Other (Medication, Sedation, Emergency)	13 (1.2%)
Concern/Question 203 (19%)	Esthetics	57 (28%)
	Eruption	34 (17%)
	Dental Home/Access to Care	27 (13%)
	Grinding	20 (10%)
	Prevention	20 (10%)
	Habits	16 (8%)
	Exfoliation	11 (5%)
	Dental visit/Treatment	11 (5%)
	Caries	8 (4%)
	Other (Behavior, Pain, Trauma)	7 (3.4%)
Behavior 77 (7%)	Negative	55 (71%)
	Positive	22 (29%)

*. Percentage of tweets out of total included tweets (n=1073)

+ Percentage of tweets out of total Tweets in respective major category

Table 2 Coding Description and Sample tweets

Major Category	Definition	Sample tweet
Attitude	Parent or child's attitude towards a dental experience	• "It's picture day at my son's school today! YAY! I hope he smiles big…I love his little perfect teeth" • "My son has perfect teeth already ☺"
Event	Child's dental experience/incident	• "Ugh my son has an abscess tooth" • "My son is growing in 2 top teeth!"
Action	Child's dental action	• "At the dentist with my daughter. Time for her to get the choppers cleaned" • "My son is brushing his teeth for the 3rd time today
Concern/Question	Parent concern or question regarding their child's dental experience	• "I'm going to need to work 2 part time jobs just to pay for my kid's dental work." • "How soon can babies start cutting teeth? My son is 7 weeks old and has a white spot in his gums, could this be a tooth?"
Behavior	Child's behavior towards a dental experience	• "My daughter is a rock star at the dentist. Climbs up in that chair like she owns the place. Love that girl." • "My son lost his first two baby teeth. They had to be pulled out. He refused the shot…"

FIGURES

Figure 1 Coding Scheme

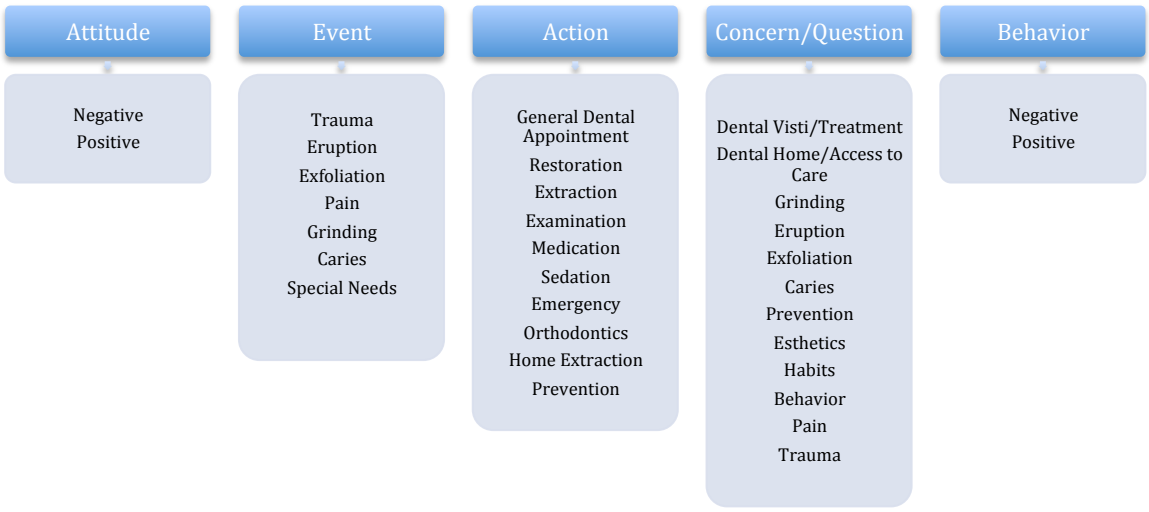
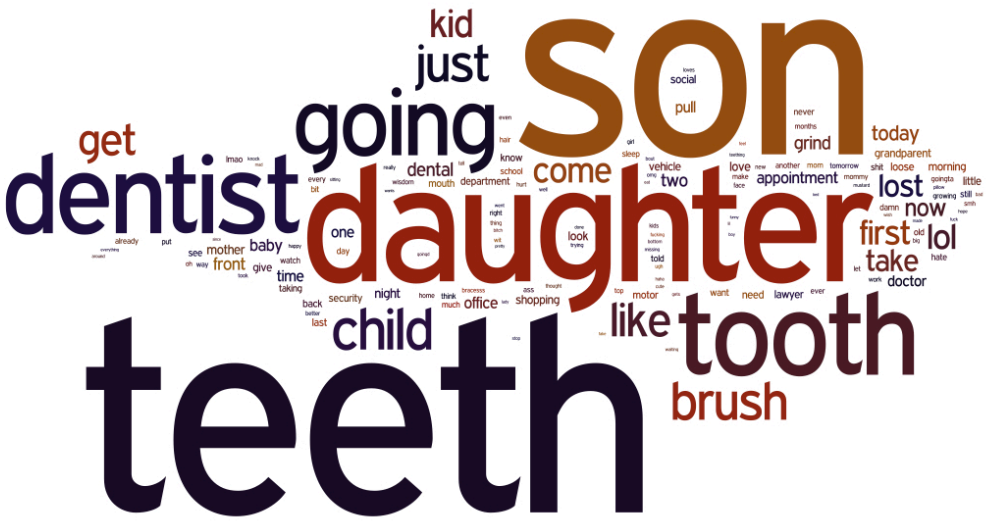


Figure 2 Word Cloud



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APPENDICES

A. CODE DEFINITIONS AND SAMPLE TWEETS

Code	Definition	Sample Tweet
Event	Experience/incident	
Trauma	Broke/chiped/displaced/avulsed Tooth	My son already bust his head and chipped his tooth all within a month
Eruption	Erupting teeth	My daughter has a tooth coming in
Exfoliate	Exfoliating teeth	My son just lost a tooth
Pain	Dental Pain	My kid is crying for two reasons. 1. his tooth hurts. 2. he wants his teeth to fall out. now what?
Grinding	Bruxism/tooth grinding	My son grinds his teeth when he sleep
Caries	Dental Caries	At the dentist with my son to get his cavities filled. I'm more nervous than he is. #fb
Special needs	Special needs child	#Autism ads a lot of extra to events cuz my son lost his first tooth and almost certainly swallowed it.
Action	Child's dental action	
General Dentist Appointment	Dental visit - reason for visit not specified	At the dentist with my daughter.
Restoration	A filling or crown by the dentist	At the dentist with my son. He is a trooper - getting 3 fillings.
Extraction	A extraction by the dentist	Sitting at the dentist's waiting for my son to get a tooth extracted.
Examination	Periodic dental recall/checkup appointment	Fixing to go to my son first dentist check up. Awe. He is so grown.
Medication	Medication perscribed or recommended by dentist	As my son Walker gets some P.M. From his dentist, I'm reminded of how we should maintain our walk with Christ on a continuing basis!
Sedation	Sedation used in the dental appointment(ex. nitrous/oral sedation/general anesthesia)	our dentist gave my daughter laughing gas
Emergency	Emergency dental treatment (ex. Trauma or infection)	Happy Holidays @iamladycc My daughter broke her tooth & had to get it repaired as well. Never realized how important a little tooth could be
Home Extraction	Self extraction or extraction by a parent	My son has just managed to pull his wobbly tooth out.
Prevention	Implementation of hygine practices at home (diet/brushing/flossing)	Teaching my son how to brush his teeth.

Prevention - difficulties	Difficulty in implementing or compliance with oral hygiene practices at home (ex. due to behavior or lack of time)	My son is horrible at brushing his teeth right. I always have to watch him because otherwise he just plays around.
Prevention - uncooperative	Difficulty in implementing prevention interventions due to uncooperative behavior of child.	The fact that I still have to hold my child down to brush his teeth blows me away. You'd think at 3 years old he would cooperate a little.
Prevention - Time management	Difficulty in implementing prevention interventions due to time management issues (ex. lack of time/busy schedules)	The hardest thing in my life right now is remembering to brush my child's 2 teeth.
Prevention - Nutrition barriers	Difficulty in implementing prevention interventions due to nutritional barriers	Just had to clarify this for my son. You have to brush your teeth *AFTER* you eat the cookie. Order of operations matters kiddos!
Attitude	Parent or child's attitude towards a dental experience	
Attitue - Dental Setting	Attitude towards the dentist or dental visit/treatment. Defined by expression of a emotion or a reaction/response.	
Attitude - Child	Child's attitude towards the dentist, dental treatment, or dental visit	
Att-Child +	Positive	My son's dentist has iPads on the walls and a free arcade...tf? No wonder he loves the damn dentist!
Att-Child -	Negative	My son asked me to sing #SoftKitty to him tonight cause he's nervous about the dentist tomorrow. #momlife #proud #bigbangtheory #thatsmyboy
Attitude - Parent	Parent's attitude towards the child's experience with the dentist, dental visit, or treatment	
Att-Par +	Positive	They've done that at my kid's elementary school! Free dental checkups & they also get free flu shots too :)
Att-Par -	Negative	My daughter refuses to let the dentist take X-rays of her teeth. Hate going to the dentist. #Traumatizing
Attitude - Non-dental Setting	Attitude towards the dental experience in a non-dental setting (outside dental office or dental care).	
Attitude - Child	Child's attitude towards the non-dental setting experience	
Att-Child +	Positive	My child loves to brush her teeth and now loves to floss!!!

Att-Child -	Negative	My kid is freaking out cause of this loose tooth in the front.
Attitude - Parent	Parent's attitude towards the child's non-dental setting experience	
Att-Par +	Positive	My daughter is obsessed with brushing her teeth I LOVE IT :)
Att-Par -	Negative	Ugh I hate when my son grind his teeth!!!
Behavior	Child's behavior towards a dental experience in a dental or non-dental setting	
Behavior - Dental	Child's behavior towards the dentist, dental treatment, or dental visit	
Beh-Child +	Positive	My daughter is a rock star at the dentist. Climbs up in that chair like she owns the place. Love that girl.
Beh-Child -	Negative	i'm here with my daughter she broke the first dentist so they had to call in a specialist hope this one's prepared 4 her
Behavior - Dental situation	Child's behavior towards a dental experience in a non-dental setting	
Beh-Child +	Positive	My kid is so self sufficient! He gets himself dressed & matches..! Brushes his teeth & washes his face by himself. I love it. #laying in bed
Beh-Child -	Negative	My child running the the house naked smh we goin miss this dentist appt
Concern/Question	Concern or question regarding their child's dental experience	
Dental visit/ Treatment	Dental treatment/visit	What else can I feed my daughter who had 4 teeth pulled besides: mashed potatoes, jello, pudding, ice cream, smoothie, macncheese, rice, oat
Dental Home/Access to Care	Finding a dental home or making an appointment	my daughter is 14 months and only has 6 teeth.. when should I take her to the dentist??
Grinding	Bruxisim/grinding	Why must my son grind his teeth! #nailsdownblackboard #cassfault
Eruption	Tooth eruption	mmm why does my child have a tooth coming in????
Exfoliation	Tooth exfoliation	My daughter has A loose tooth is it normal for a 4 yrs old teeth to start coming out?
Caries	Dental decay	Me and my daughter have got the dentist at 4.30! Pooin myself mainly coz boo has a cavity and he's gonna

		tell me off! I did everything I cud
Prevention	Oral health prevention (home care/oral hygiene/diet)	Why must I fight with my child everyday about brushing her teeth! !!
Esthetics	Esthetics of teeth (ex. Size, shape, color, alignment)	My son has perfect teeth. Hope they grow back like that. #BabyTeeth
Habits	Oral habits. (ex.. Thumb sucking, finger biting)	My son has the worst habit of biting his nails...lmao but he can't no more..HE HAS NO TOOTH
Behavior	Behavior at the dentist	At the dentist with my son!! I hope he don't be actin up!! Lol
Pain	Dental pain	Took my daughter to the dentist again. She's a fighter! So hard to see her go through this pain, but it's gotta be done.
Trauma	Parental concern regarding their child's dental trauma.	My child his seriously Houdini .. He got the whole front of his cage collapsed .. Teeth were chipped gums bleed. Idk what to do?

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