What do parents say about their children's oral health on twitter?

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ABSTRACT

Using twitter, a social networking platform, this study examined parents' perceptions and behaviors related to their child's oral health. Publically available tweets on twitter were extracted from 14 randomly selected nonconsecutive days in December 2012 and January 2013. A total of 1073 tweets meeting the search criteria were included and analyzed. Parents frequently described events related to their children's dental eruption, exfoliation, and grinding on twitter, which accounted for close to half of the tweets. One in three (32%) concerns that parents raised was related to one of these events. Concerns about dental esthetics represented the largest category of concerns (28%) that parents had. The most frequent actions described were related to dental visits (61%) and caries prevention (33%). More than half of the tweets contained an associated attitude of the parents themselves or their children (57%) with 2 in 3 attitudes related to dental settings, such as dental visits, being negative. Twitter can serve as a rich source of data on parental perceptions and behaviors related to their child's oral health. Future research is warranted to better understand how social media can facilitate parental positive attitudes and oral health promotion behaviors.

Key words: Attitude, dental care for children, parents, social media, twitter messaging

INTRODUCTION

Among United States (US) adult Internet users, which comprise 74% of all US adults, 80% have searched online specifically for health information and 34% have read health information online generated by other users.[1] Many parents (51%) who use the Internet have reported searching online for general pediatric health information at least once in the past 3 months.[2] Social media websites, such as twitter, have promising potential to facilitate communication between health professionals and research communities to the lay public. Twitter, a social network site that has become a global real-time communications platform[3] has 200 million users broadcasting 400 million tweets per day.[4] In order to enhance the dissemination of scientific information and health promotion messages, it is important to understand public perceptions and attitudes of health topics. Twitter has been used increasingly to provide a platform for researchers to analyze public perceptions about health topics such as the H1N1 flu epidemic,[5] concussions,[6] anti-biotic use,[7] dental and other pain experiences,[8,9] epilepsy,[10] and cancer screening.[11]

Pediatric oral health is a significant health issue that demands attention. Dental decay is the most common chronic childhood disease in the US today, 5 times more common than asthma.[12] Dental care is the most prevalent unmet health need among children in the US and throughout the world.[13] Striking oral health disparities exist, with poor and minority children accounting for the majority of dental decay and disease.[14] Poor oral health can have significant and long-standing effects on a child's overall health, growth, and development.[15] Parents are

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primarily responsible for the health of their young children. Investigating parents' perceptions and behaviors about their children's oral health will further the understanding of oral health disparities and will improve the formulation and dissemination of evidence-based oral health information. This study aimed to understand parents' perceptions and behaviors related to their child's oral health by analyzing twitter posts on pediatric dental communications.

MATERIALS AND 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.[16]

Search terms selection

The objective of this study was to capture the topics and contents that parents talked about relating to 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 a majority of irrelevant tweets, like "nail," which yielded irrelevant statements such as "fight tooth and nail," were excluded from further analysis. The search term identification went through multiple iterations in which a new inclusion or exclusion term was added or removed and 50-100 new tweets were pulled and analyzed. The goal was to obtain the highest degree of relevant tweets without narrowing our search such that we would be excluding relevant information. Using this iterative process of adding one new exclusionary term at a time and assessing the search results, the final set of inclusion and exclusion terms were selected [Table 1]. These established search terms consistently yielded 60% relevant tweets with 3 separate random samples of 100 tweets.

Coding scheme development

A sample of 800 tweets using the established search terms over 1 week was obtained and analyzed for coding scheme development. 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 nonmutually-exclusive five main categories and 33 subcategories [Figure 1 and Table 2]. 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[17] were .98 and .97, respectively, which indicated a high degree of agreement in categorization of tweets between coders.

Data collection

Using the established set of inclusion and exclusion search terms, we retrieved publically available tweets from 14 nonconsecutive days that we randomly selected in December 2012 and January 2013. In order to obtain equal representation from each weekday, a random number generator was used to randomly select each weekday twice during this 14-day study period. Twitter data were retrieved through a data collection script created and submitted to the twitter search application program interface (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 resulting collection of tweets generated by the Search API contained contents of the selected tweets, timestamp, and username. The assembled data were then flattened and exported in a tab-delimited format for import into spreadsheets or statistical software. A total

Table 1: Inclusion and exclusion terms used in final query to generate the data set

Inclusion terms	Exclusion terms	Relevancy rate, percentage*
"Dental" or "Teeth" or "Tooth" or "Dentist" and "my child" or "my son" or "my daughter" or "my kid"	"http" or "RT" or "dog" or "puppy" or "fairy" or "whitney" or "bieber" or "comb" or "nail" or "skin" or "dagger."	60

*Relevancy rate is the percentage of the extracted tweet sample that was evaluated as relevant and had a description of or a clear reference to one of the four pain types
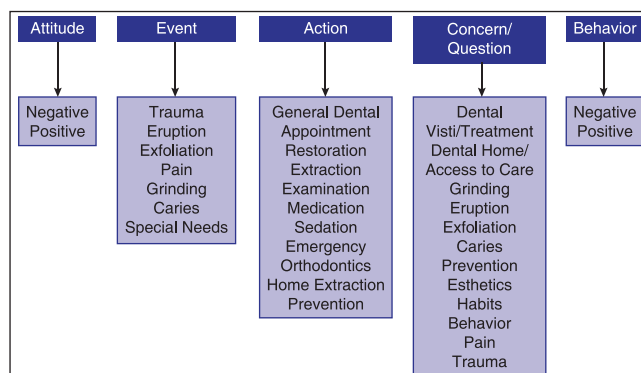
Attitude	Event	Action	Concern/Question	Behavior
Negative Positive	Trauma Eruption Exfoliation Pain Grinding Caries Special Needs	General Dental Appointment Restoration Extraction Examination Medication Sedation Emergency Orthodontics Home Extraction Prevention	Dental Visti/Treatment Dental Home/Access to Care Grinding Eruption Exfoliation Caries Prevention Esthetics Habits Behavior Pain Trauma	Negative Positive

Figure 1: Coding scheme

Table 2: Coding Description and Sample tweets

Main 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 J"
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	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..."

of 1451 tweets meeting the search criteria during were collected from the defined 14-day study period.

Qualitative coding and quantitative data analysis

Two coders reviewed each tweet independently to determine if the tweets should be included and to designate codes to each included tweet. To be included in the analysis, a tweet was to be written by a parent in regard to their child's dental situation. Tweets written about someone else's child, not about a dental situation, or incomprehensible were excluded (*n* = 378). A total of 1073 (74%) tweets were included for analysis. The quantitative data were analyzed using IBM SPSS statistics, version 21. Descriptive statistics, which include frequencies for each coding main 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 the 1073 tweets that were included in the study. The larger the font size of the word in the word cloud, the more frequently the word was used in the tweets. The most frequent words were teeth, son, daughter, tooth, and dentist. All of these words 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 appeared to have high frequency were: going, brush, first, lost, take, appointment, grind, and front.

Each tweet was classified in at least one main category, which may be further classified into one or more subcategories. The categories were not mutually exclusive. The mean number of main categories coded per tweet was 1.79 (SD = 0.68; median = 2.0; range from 1 to 4).
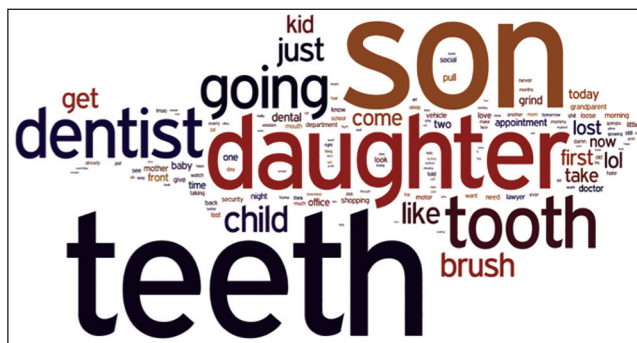

Figure 2: Word cloud

The mean number of subcategories coded per tweet was 1.83 (SD = 0.74; median = 2.0; range 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 main categories plus one subcategory within each main category coded:

a. Event (subcategory: Special needs);
b. Action (subcategory: Dental visit);
c. Attitude (subcategory: Negative);
d. Behavior (subcategory: Negative).

Table 3 shows the number and percentage of tweets classified within each main category and their subcategories.

About half of the tweets (*n* = 535; 49.9%) reported some sort of dental events. Of these 535 tweets, the most common reported event was eruption (*n* = 237; 44%), followed by exfoliation (*n* = 194; 36%) and grinding (*n* = 62; 12%). All tweets reported up to 2 events, with a majority (*n* = 514; 96%) reporting a single event. Among those that reported 2 events, the most commonly reported events were eruption and pain on the same tweet (*n* = 12 of 21; 55%).

Table 3: Distribution of non-mutually exclusive main categories and subcategories

Main categories	N (%)*	Subcategories	N (%)+
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	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)
Child's Behavior	77 (7)	Negative	55 (71)
		Positive	22 (29)
Attitude	606 (56.5)	Negative	321 (53.0)
		Positive	285 (47.0)

*Percentage of tweets out of total included tweets (*n* = 1073), +Percentage of tweets out of total Tweets in respective main category

Close to half (*n* = 499; 46.5%) of the tweets reported action taken related to a child's dental matter. The most frequently described action take as a general dental visit (*n* = 204 of 499, 41%). The second most common action was related to prevention (*n* = 165; 33%). Prevention actions were defined as the implementation of hygiene practices at home, such as nutrition, brushing, or flossing. Within the tweets reporting a prevention action, 34% reported a difficulty with prevention. Nearly all (95%) of the tweets reporting difficulty with prevention specified the causes of difficulty were the child's uncooperative behavior (*n* = 28, 50%), nutrition barriers (*n* = 21, 38%), or time management (*n* = 4, 7%). Of the 203 total tweets reporting a concern, the largest subcategories were esthetics (28%), eruption (17%) and dental home/access to care (13%).

Of the 77 tweets reporting a child's behavior, a majority reported negative (71%) child behavior. In the tweets

related to a dental setting, there were 17 (63%) negative verses 10 (37%) positive child behavior tweets. In the nondental settings, there were 38 (76%) negative versus 12 (24%) positive child behavior tweets.

Each of 606 attitude-coded tweets 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 reported negative attitudes (*n* = 321, 53%). To further describe the attributes of negative and positive attitudes, the attitudes code was subdivided into dental visit and nondental setting, and further into parent or child subcategories. A majority (73%) described an attitude associated with a nondental setting with no mentioning of dental professionals, dental procedures or clinics, and 27% described an attitude related to a dental visit. None reported attitudes related to both settings on the same tweet. Among tweets reporting attitudes related to a dental event or situation that does not involve a dental visit (*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 visits (such as dentist, hygienist, or dental appointment) was positive (38%), while 2 in 3 were negative (62%). 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 nondental). Results indicated there were significantly higher proportions of negative attitudes involving dental visits when compared with nondental settings, $\chi^2(1) = 7.35$, $P = 0.007$. Regarding the source of the attitudes, of 606 attitude-coded tweets, 83% were from parents only, 9% referred to that of a child, and 9% referred to attitudes expressed by both parent and child. The proportions of positive attitudes expressed by parents only, child only, and both parent and child were: 46%, 60%, and 43%, respectively. The distributions of positive and negative attitudes by the source were statistically similar (χ^2 (2) = 3.76, $P = 0.15$).

DISCUSSION

To our knowledge, this is one of the first studies that examine the topic of pediatric dentistry using twitter. This study demonstrates that parents are conversing about the oral health of their children and providing rich descriptions of their child's dental experiences on twitter. These findings reveal new avenues for oral health professionals to better understand parents' perceptions and behaviors in regards to their child's dental care in order to more effectively promote oral health among children.

One of the major findings of this study was that tweets about children's dental eruption, exfoliation, and grinding

were the most frequently discussed topics and were also among the most frequently reported concerns, with one in three (32%) concerns related to one of these topics. These findings are consistent with frequently asked questions by parents to dental professionals in the clinical setting.[18-20] The largest category of 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.[21] This study also found that a frequent concern 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.[22-24]

The most frequent action taken related to children's oral health that parents tweet about was dental visits. The fact that parents are talking about their children's dental visits on twitter opens up possibilities for the dental profession to address them with evidence-based messages that will optimize the oral health care of their children. Parents were also found to talk frequently about 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.[25] Prevention at home is critical. Dental professionals should 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.[26] 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 parent's lap and holding him tight while brushing.[27] 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 social media sites, such as twitter.

More than half of the tweets in the study contained an attitude expressed toward a pediatric dental related situation. In the nondental setting, the proportions of positive and negative attitudes were similar. In contrast, when the context involved dental settings, only 1 in 3 attitudes reported were positive. The larger number of negative attitudes toward the dental visits could be correlated with the high number of negative behaviors (71%) of the children in the dental office setting that were reported. Understanding parental attitudes is important as research shows that parents' attitudes toward dental health influence the way in which they practice oral hygiene with their child.[28] It has been found that mother's positive oral health-related attitudes are associated with brushing twice daily and sound dentition in children.[29] 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.[30,31] Thus, social media is a promising tool for improving parental attitudes towards dental care providers and their children's oral health.

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, including those of minority and low-income populations, whose children are most at risk for dental disease. Internet users between the ages of 18 and 29 make up the largest age group of twitter users.[32] On average, women have their first child at 25-year-old.[33] Thus, one of the fastest growing age groups on twitter are those with young children. Furthermore, African-American and Hispanic internet users have high adoption rates (25% and 19%, respectively) for using twitter.[34] Twitter may provide an effective way to reach these minority groups with oral-health information,[35] given that these groups disproportionately experience dental decay, with higher levels of caries found.[25-27]

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. The 14-days, however, were chosen from 2 months that include both holiday and nonholiday time periods in order to capture a variety of circumstances that may affect the content of the tweets. Second, the manual coding process might have been biased due to individual's subjective judgment. The research team worked to minimize bias by calibrating the team members on coding and having two researchers independently code all tweets and reconcile differences that occurred. Third, background information about 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 demonstrates that twitter is a unique data source in which parents are communicating information regarding their child's oral health. The similarities between this study and previous findings in the literature 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.

These findings revealed what parents are reporting about their children's oral health on twitter. Social media is a force that has and will continue to transform health 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, dental professionals have the potential to make lasting contributions by increasing the ability of parents to improve the oral health of their children.

CONCLUSION

Based on this study's results, the following conclusions can be made:
1. Parents are conversing about their children's oral health on twitter. These conversations can be used as a data source to better understand parental attitudes and perceptions towards their child's oral wellbeing.
2. Parents frequently described events and concerns related to their children's dental eruption, exfoliation, and grinding on twitter.
3. Caries prevention is a common topic reported by parents with 1 in 3 parents reporting a difficulty with prevention; thus demonstrating a need for prevention education among parents and children.

A majority of parental attitudes toward their child's dental visit were negative. Future research should explore factors related to both positive and negative attitudes and how attitudes about dental visits might be improved.

ACKNOWLEDGEMENT

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