

A comprehensive analysis of #Enuresis conversation on Twitter

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Abstract

Introduction: We sought to perform a quantitative and qualitative analysis of online Twitter discussion of enuresis using the hashtag #Enuresis.

Methods: Symplur, a fee-based Twitter analytics service, was employed to aggregate and analyze Twitter activity, users, and content for #Enuresis, the official Twitter hashtag for enuresis, between June 2016 and November 2018. Twitter activity was analyzed using average tweets and new users per month. Users were classified based on geographic location, occupation, and organizational affiliation. Content analysis was performed by retrieving information about Twitter engagement metrics, including retweets, links, media, mentions, replies, and frequently used words and hashtags.

Results: A total of 3133 tweets and 1555 users utilizing #Enuresis were identified between June 28, 2016 and November 28, 2018. The average \pm standard deviation (SD) number of tweets using #Enuresis per month were not significantly different from 2016 through 2018 ($p=0.292$). The number of users increased from six to 1555 during the study period, but there was no statistically significant increase in number of new users per month ($p=0.346$). Physicians comprised 14% of the top 100 influencers, followed by medical device organizations (13%). Popular hashtags in #Enuresis tweets were #Bedwetting, #PisEnLaCama, #schoolnurses, #helpingkids, #ninos, and #salud. Hyperlinks used in #Enuresis tweets included advocacy, academic, commercial, and other social media websites.

Conclusions: Our analysis of #Enuresis demonstrates that the online Twitter discussion regarding enuresis is growing. These results indicate that enuresis has a global appeal and has especially gained traction in European countries, as well as in the U.S.

Introduction

Enuresis is defined by the International Children's Continence Society (ICCS) as discrete episodes of nocturnal urinary incontinence in children greater than the age of five¹ and is a common problem among the pediatric population. It is estimated that 16% of children at the age of five will experience enuresis, which decreases to 13% at the age of six, 10%

at the age of seven, and 1–2% after age 15.^{2–4} Some studies have found that enuresis can have a detrimental impact on childhood development. For instance, children with enuresis were found to have lower perceptions of self-esteem and self-image.^{5,6} These children may, therefore, have difficulties adjusting to social situations due to an inability to participate in common activities, such as sleepovers, residential school trips, and camping trips.⁷ Although there are many management options for enuresis, including bedwetting alarms, motivation therapy, and pharmacological interventions, the impact of these treatments on self-esteem and patient mental health is an area of active investigation.⁸

The Internet has become a widely used resource for patients to obtain medical information, share personal experiences, and garner peer support. Online support groups for conditions such as cancer, mental health disorders, and human immunodeficiency virus (HIV) have been found to be effective in alleviating psychosocial burdens.^{9–11} While no studies have examined the role of online support groups in pediatric urology, several studies have investigated the role of the internet and social media in this field. In 2009, Routh et al studied internet content for 10 different pediatric urology conditions, including enuresis, and found that the available online content was high-quality for both common and uncommon conditions.¹² In 2008, Rowe et al demonstrated that social media can be employed as a novel tool for undertaking pediatric urologic-focused, patient-centered outcomes research.¹³

Twitter, a microblogging platform, is a social media service that has emerged as a popular discussion forum for healthcare topics.¹⁴ Conversations on Twitter use hashtags that effectively serve as keywords for topics. Twitter has gained popular appeal among both medical professionals and patients. O'Kelly et al, in 2017, identified that parents of pediatric urology patients use social media accounts of medical journals, physicians, and hospitals to access health education information.¹⁵ Many open-source efforts, including the Urology Tag Ontology Project, have aimed to structure the conversation for pediatric urological conditions via hashtags. #Enuresis was established as the official hashtag for Twitter discussions by the Urology Tag Ontology Project, and has been recognized by urological organizations such as the Urology Care Foundation, as well by

academic urology journals sponsored by the American Urological Association and the European Association of Urology.¹⁶ The goal of this study was to examine the content contained within conversations using #Enuresis by analyzing users contributing to the conversation and the content of tweets incorporating the hashtag.

Methods

Twitter analysis

We analyzed the use of #Enuresis using Symplur, a Twitter analytics service (www.symplur.com), between June 28, 2016 and November 28, 2018. This time frame included all tweets containing #Enuresis since the Symplur service began monitoring #Enuresis. Tweet activity was analyzed by examining number of total users, new users per month, and tweets per month. Tweet metric analysis was performed by obtaining information about retweets, as well as tweets with links, embedded media, mentions, and replies.

User information was aggregated via Symplur based on publicly available information. A user profile was generated based on geographic location, occupation, and organizational affiliations. The number of users in North America (Canada, Mexico, U.S.) were compared against Europe and the rest of the world.

Twitter users employing #Enuresis were classified into healthcare categories based on profession, organizational affiliation, or credentials using Symplur category definitions.^{17,18} All Symplur classifications were manually verified and corrected, if necessary, to confirm that stakeholders were accurately identified.

Users were also classified based on influence on the #Enuresis Twitter discussion. Influence was determined via the SymplurRank metric. SymplurRank is a propriety score that is similar to Impact Factor measurements used by academic journals and controls for Twitter activity that is corrupted by spammers, such as number of tweets, retweets, and mentions.¹⁹ The top 100 users with the highest SymplurRank were reported as key influencers of the online discussion.

Tweet content was determined by analyzing words, hashtags, links, and the presence of media attachments. Each of these categories were separately investigated to further understand the content within #Enuresis conversations. The 100 most common words were analyzed, along with the top 25 hashtags and top 10 links used in tweets containing #Enuresis. A survey of tweets containing #Enuresis, as well as any associated hashtags was performed given the fact that tweets may have multiple hashtags.

Statistical analyses

All statistical tests were undertaken using the R Programming Language 3.5.0 (<https://cran.r-project.org/>). Two separate analysis of variance (ANOVA) tests were performed to determine differences in #Enuresis tweet volume and new user adoption in the study time frame. Specifically, the first ANOVA was performed comparing the average number of tweets per month across the three-year interval, and the second ANOVA was performed comparing the average number of new users per month across the same time interval. The change in number of users was modelled using a linear regression, and the regression coefficient was tested for statistical significance. A two-sample, two-sided t-test was used to compare the average number of #Enuresis users in North American countries compared to European countries and to the rest of the world across the 2016–2018 time period.

Results

A total of 3133 tweets and 1555 users using the #Enuresis hashtag were identified since the inception of #Enuresis monitoring on June 28, 2016. Of the 3133 tweets, 2266 were sent with links to other sites (72%), 1103 contained media images (35%), 803 were retweets (26%), 1150 were mentions (37%), and 18 had replies (0.57%). The majority of tweet languages were in English (55%), followed by Spanish (40%), German (1.3%), Indonesian (0.90%), and Romanian (0.32%). There was no statistically significant difference in tweet volume from 2016–2018 ($p=0.292$) (Fig. 1A). The average \pm standard deviation (SD) number of tweets per month containing #Enuresis was 111 ± 56 in 2016, 118 ± 53 in 2017, and 85 ± 45 in 2018.

The overall number of users using #Enuresis increased during the study period (Fig. 1B). There were initially six users in June 2016 that increased in a linear trend to 1555 users by the end of November 2018 ($R^2=0.96$, $p<0.01$). There was no statistically significant difference in the average number (\pm SD) of new users per month ($p=0.346$). There were 57 ± 35 new users in 2016, followed by 60 ± 37 in 2017, and 40 ± 27 in 2018. Users tweeted from 45 different countries. Most known users were located in Spain (31%), followed by the U.K. (16%), Mexico (14%), the U.S. (11%), and Australia (2%). North American countries had, on average, more users compared to the rest of the world (32.7 ± 25.3 vs. 6.5 ± 19.0 , respectively, $p=0.029$). However, when comparing the average number of users in North American countries to European countries (13.5 ± 30.7), there was no significant difference detected ($p=0.328$).

Most influencers by tweet activity were classified as doctors (14%), organization medical devices (13%), individual non-health (12%), organization advocacy/support (11%), and organization provider (11%). These were followed by

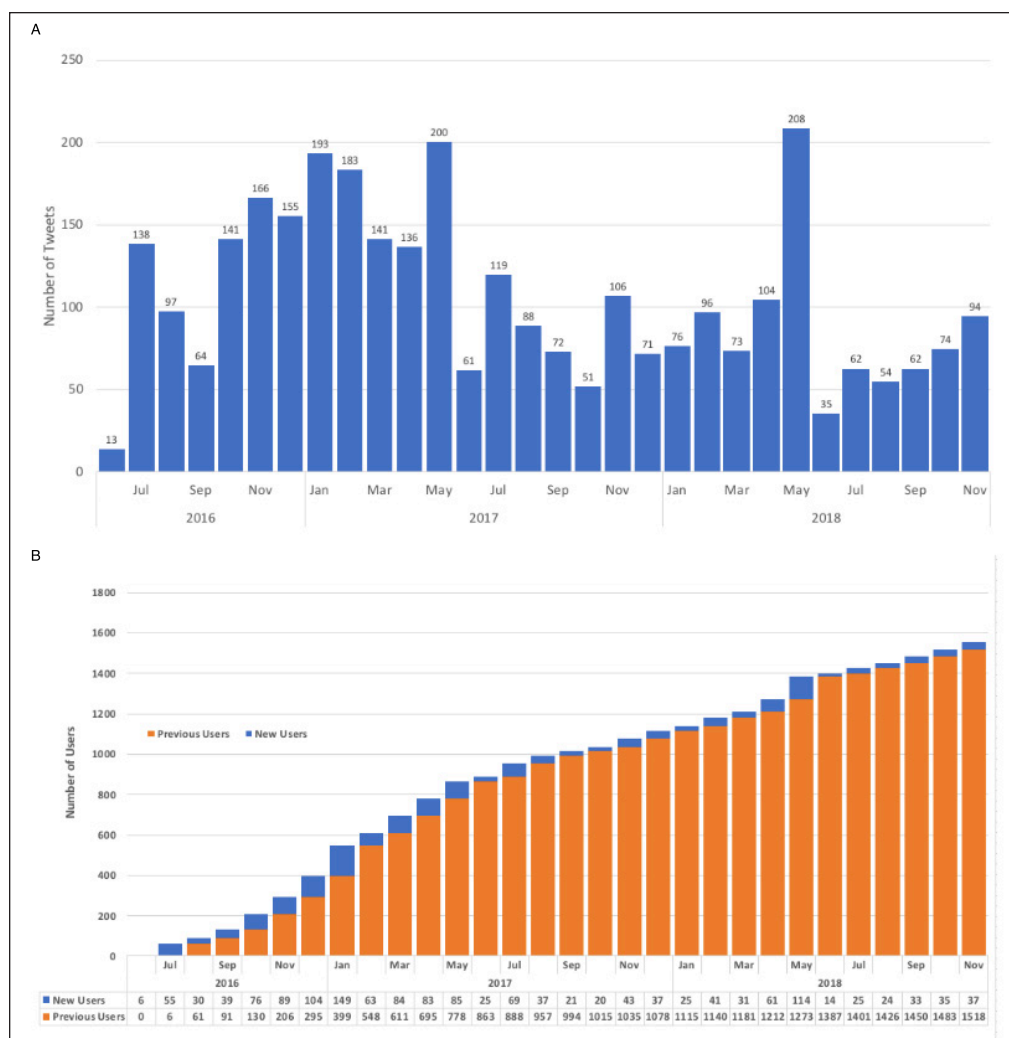


Fig. 1. Analysis of tweet activity (A) and user influx (B) from June 28, 2016 to November 28, 2018.

organization media (9%), healthcare providers (5%), organization other healthcare (5%), caregiver/advocate (4%), journalist/media (3%), organization non-health (2%), individual other health (1%), organization research/academic (1%), and researcher/academic (1%) (Fig. 2).

A word map of the 100 most common words in #Enuresis tweets is shown in Fig. 3. The most common words were “adult” (643 tweets), “enuresis” (377 tweets), “bedwetting” (299 tweets), “children” (290 tweets), “cama” (272 tweets), and “niños” (216 tweets). A detailed overview of associated hashtags used in tweets containing #Enuresis is shown in Fig. 4. The most common hashtags used in conjunction with #Enuresis were #Bedwetting (779 tweets), #PisEnLaCama (158 tweets), #schoolnurses (93 tweets), #helpingkids (91 tweet), #ninos (73 tweets), and #salud (58 tweets).

The top 10 website uniform resource locators (URLs) that were included in tweets with #Enuresis included *thebedwettingdoctor.com* (136 shares), *pisenlacama.com.ar* (114

shares), *www.tenscare.co.uk* (89 shares), *www.dri-sleeper.com* (74 shares), *www.facebook.com* (38 shares), *www.eric.org.uk* (36 shares), *elpais.com* (34 shares), *www.guiainfantil.com* (32 shares), *malem-medical.com* (30 shares), and *onlinelibrary.wiley.com* (30 shares).

Discussion

Social media provides a platform for providers, patients, and healthcare organizations to communicate and share information. Smailhodzic et al found that social media encouraged equal communication between the patient and physician and increased the rapport of patient-physician relationships.²⁰ Laranjo et al found that interventions for patients using social network sites were able to effectively promote health-related behavior change.²¹ Farpour et al described how patients with chronic medical conditions were able to improve their mental health by participating in healthcare interventions that incorporated social media tools.²² Our study

was focused on analyzing Twitter conversations employing #Enuresis in order to understand existing discussion patterns and highlight avenues to more effectively leverage this platform for improving management of the condition.

There was no significant difference in the average number of monthly tweets containing #Enuresis across our time period of June 2016 to November 2018 ($p=0.292$). This is in contrast to other reported urology Twitter discussions such as #TesticularCancer¹⁴ and #KidneyStones,¹⁷ which both reported increases over their study periods. One likely explanation is that both testicular cancer and kidney stones impact an older population than enuresis. Testicular cancer, in particular, is the most common malignancy among young men.²³ As a result, those patients are more likely to have access and be active on the internet and social media compared to pediatric patients afflicted with enuresis.

When analyzing the locations of users tweeting with #Enuresis, most known users were found to be in Spain

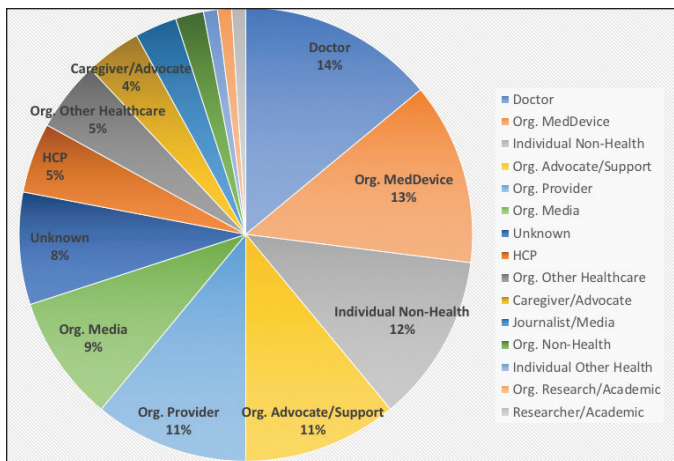


Fig. 2. Distribution of top 100 influencers in #Enuresis conversation.

and other European countries. There was no difference in the average number of users in North American countries compared to European countries ($p=0.328$). This marks a contrast between other hashtag analyses, where the majority of users were located in the U.S.^{14,17} The adoption of #Enuresis across different countries is evidence for the global appeal of Twitter-based healthcare conversations. Our results may suggest that users from European and other foreign countries are more willing to engage in enuresis discussion and research compared to users from the U.S.

There are several reasons why #Enuresis might have higher engagement levels outside of the US. World Bedwetting Day, for example, was launched in 2015 by a coalition of international agencies, including the ICCS and the European Society for Pediatric Urology.²⁴ Additionally, the ICCS, one of the main research/advocacy groups for the condition, has strong international presence, as nine of the 11 board members reside outside of the U.S.²⁵ The fact that these advocacy efforts are driven by European members might be an underlying reason for this distribution of users. In addition, the U.S. healthcare system operates largely as a fee-for-service (FFS) model, where payment is distributed based on the quantity of care that is delivered.²⁶ Since the management of enuresis is non-surgical,²⁷ the economic incentives for enuresis awareness and management may differ from other countries that

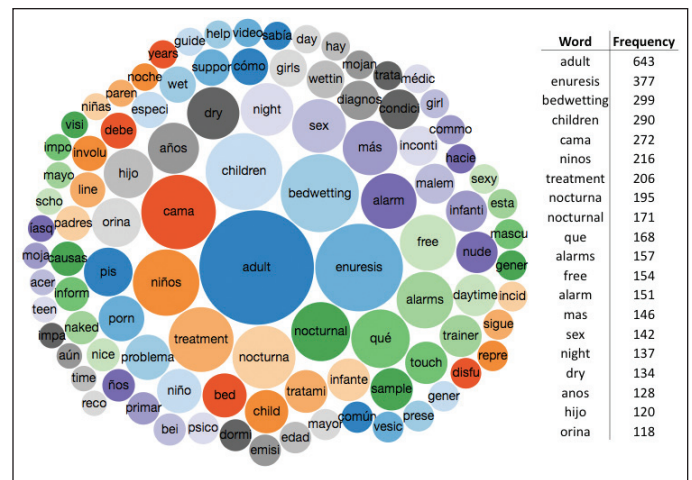


Fig. 3. Cloud map of the top 100 most tweeted words.

promote pay-for-performance and integrated care models. Countries with healthcare systems in place that subsidize health maintenance and long-term followup may draw more awareness to chronic conditions such as enuresis.

We observed an increase in the number of users from six to 1555 across our study period. Physicians comprised the majority of the top 100 influencers (14%), which was followed by medical device organizations (13%), and advocacy/support organizations (11%); 79% of these physicians and 64% of these advocacy/support organizations tweeted in Spanish, and words such as “niños” and “cama” were in the list of top 10 most commonly used words. These findings are consistent with the international adoption of this hashtag. The relatively high percentage of medical device organizations is

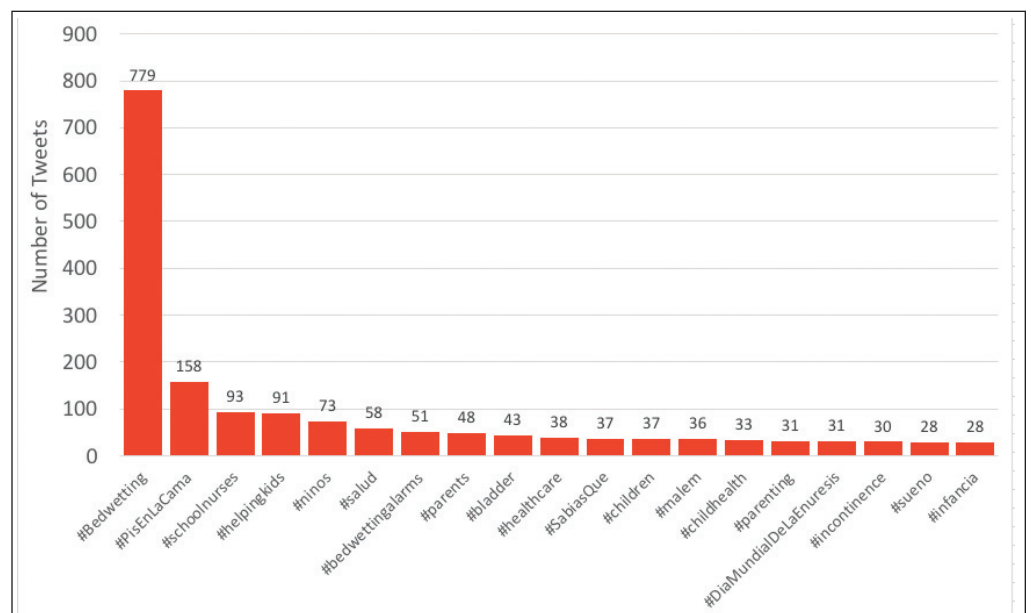


Fig. 4. Most tweeted hashtags in association with #Enuresis.

likely attributed to the popularity of enuresis prevention technologies. A majority of medical device organizations were related to the manufacture and sale of enuresis alarms, which can be used as a primary treatment for enuresis.²⁸

Most tweets (72%) were sent with links. The most commonly tweeted links were affiliated with medical device websites that sold enuresis prevention tools (*thebedwetting-doctor.com*, *www.tenscare.co.uk*, *https://www.dri-sleeper.com/*, *malemmedical.com*). The next most tweeted websites were advocacy/support sites (*pisenlacama.com.ar*, *www.eric.org.uk*, *www.guiainfantil.com*). Currently, there are no studies that have evaluated the effect that online support websites or groups have on alleviating the psychosocial burdens of enuresis. The popularity of these websites in our analysis supports future work to investigate the impact of these internet tools on enuresis management.

We acknowledge that our study has certain limitations. First, we recognize that conversation regarding the condition might exist outside #Enuresis hashtag. Less than 33% of #Enuresis included more colloquial hashtags, such as #Bedwetting or #PisEnLaCama. This demonstrates that the conversation surrounding #Enuresis is substantially distinct from the conversation involving these alternative hashtags. Furthermore, we wanted to investigate the Twitter conversation surrounding discrete episodes of nocturnal urinary incontinence via hashtags incorporating formal medical terminology in lieu of hashtags using colloquial language, such as bedwetting. Second, we recognize that our analysis might be limited by the fact that some Twitter users might not be following traditional Twitter norms, thereby, failing to append #Enuresis to tweets pertaining to this condition. Consequently, we acknowledge that our study might under-predict the volume of Tweets and number of users discussing this condition on Twitter. Last, due to limitations of the Symplur software, we are unable to correlate patient engagement with tweet quality. Emerging evidence has suggested that publications receiving the most media attention may not be the most scientifically rigorous or that the public may place greater value on different subjects than the scientific community.²⁹ As a result, future research is necessary to determine the quality of information that patients are interacting with.

Conclusions

Our analysis demonstrates that Twitter is a popular forum for discussions about enuresis and that many users are employing #Enuresis to converse about the condition. Our results also show that there has been a steady increase in the total number of users who are employing this hashtag. We further show that most conversations about #Enuresis are driven by various influencers, including physicians, advocacy groups, and medical device companies. Finally, we demonstrate that #Enuresis has received strong international adoption and that

Twitter is a widely used platform for discussing the condition around the globe.

Competing interests: The authors report no competing personal or financial interests related to this work.

This paper has been peer-reviewed

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