#Teeth&Tweets: the reach and reaction of an online social media oral health promotion campaign

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Key points

Suggests Twitter has the potential to be a useful tool to help tackle oral health inequalities through targeted oral health promotion in areas of high need.	Examines why the majority of dental practices in England are not proactively partaking in 'National Smile Month' via Twitter.	Argues the method outlined can be applied to many other public health policy settings.

Abstract

Aim The aim of the study was to investigate: i) the geographical reach and reaction of the online participants engaging in an oral health campaign 'National Smile Month' UK 2016 (NSM); and ii) whether dental practices during NSM were using Twitter to help address regional oral health inequalities.

Methods Twitter posts, that is 'tweets', were collected using the application programming interface (API) software Mozdeh, for one month. Tweets were classified into high, medium or low engagement. Participants' postcode data of the organisation/practice were obtained via an internet search using Google. The geolocation of tweets was then linked by organisations' postcode to the 2015 Index of Multiple Deprivation and the oral health survey of five-year-olds 2014/15, and subsequently mapped using Google Fusion Tables.

Results A total of 23,100 tweets were captured with a final total of 2,968 usable tweets from 763 separate accounts. Two hundred and twelve tweets were from dental practices, with 107 classified as low engagement, 99 medium, and 45 high engagement (39 of those tweets were from organisations allied to oral health). Interactive maps were created to give a visual representation of the relationship between those participants producing 'high' impact tweets and the level of dental decay in five-year-olds and deprivation levels.

Conclusion The majority of tweets did not promote any specific preventative behaviour. Dental practices in England were not contributing to National Smile Month via Twitter in a way that would improve regional oral health inequalities. In areas of high-need there is evidence of proactive engagement with NSM via Twitter by local authorities and their healthcare partners.

Introduction

National Smile Month (NSM) is an annual oral health campaign organised by the Oral Health Foundation (OHF), which is an independent charity working to improve oral health around the world. The OHF's goal is to improve people's

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lives by reducing harm caused by oral diseases.[1] Poor oral health is an important public health problem in England, costing NHS England nearly £3.4 billion annually, despite the diseases being largely preventable.[2] Regional inequalities in general health across the UK are well documented and there is significant evidence to show that oral health and general health are interlinked.[3,4] Inequalities in oral health are often unjust, related to social status, wealth and education.[5,6] Every year the OHF aims to help people improve their oral health by providing educational materials and resources, advice and information, and by organising campaigns and events. One of the OHF's longest and most recognised campaign is NSM.[7] What began in 1977 as the 'Smile 77' project and a single week-long campaign, is now the largest and longest running oral health campaign in the United Kingdom; it is aimed

at educating and engaging people about the importance of good oral health. Through NSM, the foundation aims to work more closely with oral health educators, health professionals, schools and workplaces to increase the delivery of oral health education; especially in disadvantaged communities and regions of known poor oral health. The campaign aims to encourage participants to promote good oral health through organised events and interventions in their local community.[7] NSM incorporates several social media initiatives alongside the event, including running a Twitter feed linked to the campaign.

Twitter is a popular social media application for online news and social networking. The platform is about discovering interesting, influential people and organisations online by following their burst of messages. Twitter encourages people and organisations to tweet

(to communicate) their opinions and ideas on events and current affairs without barriers in 140 characters or less (this character limit has since been increased to 280 characters in November 2017). Tweets can contain video, photos and links as well as text. It is proposed that Twitter has 330 million active users 'tweeting' about breaking news, entertainment, sports, politics and everyday interests. Twitter is popular among celebrities and politicians, and the use of Twitter has become commonplace through many nations in self-promotion, advertisement and to influence, as well as in political discussion.[8]

When it comes to health campaigns, social media platforms including Twitter have been used successfully to encourage those seeking support to tackle obesity;[9] Slimming World, for example, has attracted thousands of people to engage in their online app to share stories, tips and to give advice and support. Similarly, to improve the wellbeing of new mums,[10] Netmums has a huge following and is now in the top 50 websites and blogs for new parents. Twitter has also been used to decrease the experience of isolation in people suffering from chronic pain, through online communities that share and discuss their experiences and give support.[11] Collectively, these campaigns and blogs reveal that social media can be highly effective in raising awareness and motivating participants to make small changes. Through Twitter, participants of NSM are encouraged to access the latest updates on the campaign by following the Oral Health Foundation's Smile Month (@nationalsmilemonth) and then become involved on Twitter by using specific hashtags (a short keyword prefixed with a #). Tweets on Twitter are public unless users specifically mark their tweets as private, and thus is created a rich source of information on beliefs, attitudes, reactions and opinions from a broad range of people. The campaign also uses other forms of social media, such as Instagram and Facebook, to encourage people to get involved and spread positive oral health messages.

The use of social media in public dental health campaigns supports the view expressed by Sheiham and Watt who stated that the role of the dentist in the twenty-first century should no longer be merely to concentrate on the 'one to one' aspect of patient care but to take into consideration the wider community.[12] Research is now shedding light on ways to reduce health inequalities through workforce innovations that increase access to preventative health care services.[13,14,15] Many of these innovations

recognise the need for the promotion of dental services outside the traditional dental office environment, in non-dental community-based settings and targeting 'hard to reach' groups.[14] Thus, it has been suggested that health communicators should step further into social media engagement and embrace the 'social' nature of social media which is 'all about "virtual" engagement', participation and relationship building.[15] However, how Twitter is currently being used in oral health promotion and the benefits to the population's oral health has been underexplored.

At the time of this research, there were very few studies that had explored the role of Twitter in a health campaign. A literature search of electronic bibliographic databases was undertaken in August 2018 to identify any relevant research published since the initial search in March 2016. Using the EBSCO Discovery database, a 'social sciences' search was conducted using the following four keywords 'Twitter' 'health promotion' 'regional inequalities' and 'oral health'. The search revealed that there have been several studies that have explored the use of Twitter as a tool for health promotion. For example, McClellan *et al.* researched the use of Twitter to monitor mental health discussions,[16] Gough *et al.* investigated the ability of Twitter to induce attitude and behaviour change in skin cancer prevention,[17] and Gabarron *et al.* examined the use of social media for health promotion in diabetes.[18] Chung analysed the sharing of tweets (retweeting) of health messages, specifically around Breast Cancer Awareness Month.[19] However, the search did not reveal research that specifically explores Twitter's ability to address dental health through health promotion or regional health inequalities. However, all these studies reveal that Twitter and social media are quickly becoming important tools for improved public health communication.

The purpose of this research was to understand how effectively Twitter was being used by dentists and dental care professionals during NSM and whether it had the potential to address regional oral health inequalities by answering the following questions:

1. What was the frequency of tweets received during NSM from dental practices, oral health educators and organisations in England?
2. What was the content of these tweets?
3. What was the reach and impact of these tweets across different socioeconomic geographies?

Methods

The research involved a cross-sectional study and used a mixed method approach as to the influence of Twitter. This can be conceptualised as both extensive, relating to a quantitative analysis of the spread and reach of the campaign, and intensive, referring to the qualitative assessment of the campaign's impact and participant's reaction to it.[20]

Twitter was chosen as the most appropriate social media platform for this research as most social media activity by health professionals happens on Twitter.[21] Twitter is a free and popular platform with an open and accessible application processing interface (API). An API is a set of functions and procedures that allow the creation of applications which access the features or data of an operating system, application, or other service. Because of the platform's simplicity, developers have been able to create many easy to use online applications for social scientists which enable the capture and collection of tweets from Twitter. The Twitter hashtag enables sorting and analysis of data using keyword searches. Due to the 140 character word limit, at the time of the research, content analysis was relatively straightforward. Tweets can be collected in 'real time' thus producing a time series analysis of the frequency of tweets over a set period of time. Other social media platforms currently do not have these applications that enable simple methods to gather such a rich source of information.

To measure the frequency of Twitter posts linked to the campaign, tweets were collected using a free Windows program for keyword content analyses of social media texts (Mozdeh). This program was used to collect data for one month during the NSM campaign from 15 May 2016 to 16 June 2016, using the following key words that were related to the campaign: '#MySmileySelfie'; '#NSM16'; '#NSM'; '@smilemonth'; and '#nationalsmilemonth16'.

To measure reaction, a content analysis of the tweets was performed and tweets were manually classified based on Neiger's model of social media engagement.[22] Neiger *et al.* proposed an evaluation hierarchy and applied the developed hierarchy to a hypothetical promotion campaign using Twitter as the main campaign vehicle. Neiger *et al.* proposed that engagement types can be classified into three stages: low, medium and high. Examples of the classified Tweets using this hierarchy can be viewed in Table 1.

Table 1 Classification of tweets and examples		
Classification of tweets	**Indicators**	**Example**
Low	One-way closed messages, devoid of educational information, self-promoting	We are really happy to be celebrating @smilemonth with activities at the practice. #smiles #nsm16
Medium	Beginning of dialogue. Engaging, encouraging a response/reaction educational information, infographics, links to blogs and healthy tips	Advice on sugar and children's oral health to keep their teeth in tip top condition! Ready for @smilemonth! #nationalsmilemonth16
High	Activities organised as a direct result of the campaign outside of the virtual environment with direct benefits to the local community	#MySmileySelfie – OHP team promoting NSM at Asda Blackburn #nsm16

To explore whether NSM was being used by dental practices to engage communities in areas of high dental need through events linked to promoting good oral health, the postcodes from the tweets classified as high were manually collated from the website link in the user's Twitter profile. The Ministry of Housing, Communities & Local Government's postcode lookup tool was used to obtain deprivation data and the Lower Super Output Area (LSOA) code in which each postcode was located.[23]

The choropleth map is a useful tool that can visually emphasise relationships between different variables, that is, deprivation and a geographical location. In order to produce a visual display of the data, choropleth maps were developed using digital boundary data obtained from the Office for National Statistics in a 'shapefile' which contained the information for mapping the local authority boundaries of England. A shapefile is a simple format for storing the geometric location and attribute information of geographic features. The shapefile was then converted into a Keyhole Markup Language file (KML) using Shape Escape and imported directly into Google Fusion Tables (GFT). GFT is a powerful mapping tool that enables the user to create interactive maps; it maps data from postcodes (geocode) or geospatial information via KML files. Keyhole Markup Language is an encoded notation for expressing geographic annotation and visualisation within internet-based, two-dimensional maps and three-dimensional Earth browsers.

In order to explore the association of tooth decay in children and Twitter engagement, the tweets classified as 'high engagement' and the data from Public Health England's 'Dental Public Health Epidemiology Programme' 2014/15 (DPHEP) oral health survey of five-year-olds was collated.[24] The data were then merged with the shapefile data into GFT. To create the colour gradient in the choropleth map, the data were split into quintiles (buckets) that were matched to the percentage of decay
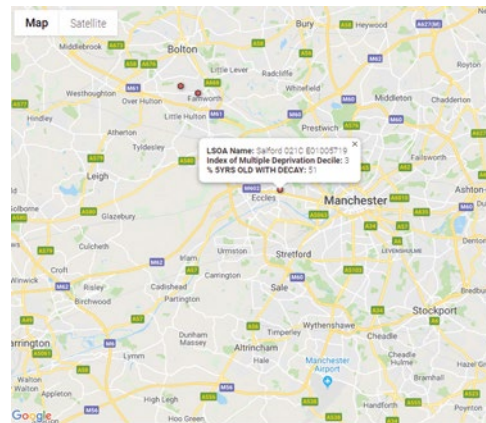
Fig. 1 Map showing geolocation of 'high' engagement tweet, deprivation decile and percentage of decay in 5-year-olds. Map data ©2019 Google

in five-year-olds. The higher the percentage in that location, the darker the colour.

To display the location of the tweets classified as 'high' engagement on the map, the postcodes of where the tweets originated from were uploaded into the GFT. The GFT automatically recognises locational information such as postcodes and will geocode the data and display a marker in the correct geographical area.

The same process was conducted for the map created for the Indices of Multiple Deprivation (2015) data which is captured at the Lower Super Output Area (LSOA) level. The information required for the GFT was obtained using the data that Alasdiar Rae, of Sheffield University,[25] created for public use by merging the geographical boundaries of England with the Indices of Multiple Deprivation 2015 data.

In order to visibly explore the association between neighbourhood deprivation, levels of tooth decay in five-year-olds and the location of those dental practices'/organisations' tweets classified as 'high engagement' in NSM, the Google Fusion Layer Wizard web application was used. The application enabled the layering of the two maps created from the 'high' classified participants' postcode (47

tweets) and the interactive choropleth maps of deprivation and the data from the DPHEP 2014/15 survey of decay in five-year-olds. All the maps created were interactive so they enabled the user to reveal more details of a specific geographical location. Figure 1 shows the association between deprivation, decay levels and Twitter activity classified as 'high' in that region.

Results

A total of 23,100 tweets were collected over the duration of the campaign. Once the marketing tweets, tweets from individuals and unrelated tweets were removed, there were a total of 2,968 usable tweets from 763 separate Twitter accounts. Of which, 212 were from dental practices and 107 of these were subsequently classified as low engagement, 99 medium and six high, according to the system outlined in Table 1. As the level of tweets classified as 'high' from dental practices was so low, it was decided to include the high classified tweets from other publicly funded organisations allied to oral health during NSM 2016; such as NHS oral health promotion teams and local authority wellbeing teams. This gave an extra 39 tweets,

Fig. 2 Frequency graph of tweets (16 May 2016 to 16 June 2016)
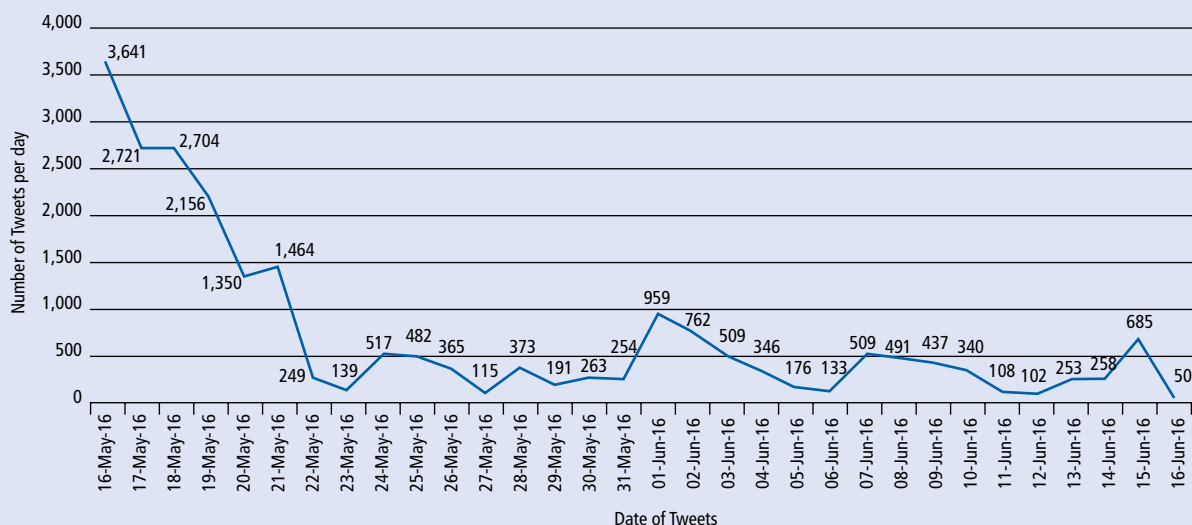
equalling a total of 45 tweets classified as high. Figure 2 shows the volume of tweets received from all participants over the NSM month, which included individuals, organisations and businesses.

The Twitter activity followed a classic decay curve, showing that initial interest in tweeting about NSM was popular at the start of the campaign but then the number of daily tweets tapered off quickly (Fig. 2). On the first day of the NSM Campaign 3,641 tweets were captured, that declined steadily and by the second week, on the 23 May, only 139 tweets were captured. There was a slight increase in tweets from 31 May that peaked on 1 June during the 2016 school half-term, when 959 tweets were captured.

To explore the relationship between the tweets classified as 'high', neighbourhood deprivation and decay in five-year-olds, a Google Map was created using GFT. Figure 3 is a choropleth map that was created as the base map; this is a thematic map which is shaded in relation to the percentage of decay in five-year-olds, the darker the blue the higher the decay rates.

This map (Fig. 4) was generated by layering four Google Fusion Tables: 1) base map, DPHEP survey of decay in five-year-olds (Fig. 3); 2) indices of multiple deprivation index; 3) high classified tweets from dental practices (green markers); 4) high classified tweets from organisations allied to oral health (red markers).

The map (Fig. 4) provides a visual representation of the area's deprivation rank and level of decay in five-year-olds. The locational marker (red and blue dots) of tweets classified as 'high' during NSM 2016 depict the relationships between the geographic location level of deprivation and the percentage of decay in five-year-olds. The map illustrates that local authorities across England are engaging more with partners to tackle oral inequalities. More NSM community events via Twitter were organised in deprived areas of high decay in five-year-olds.

Discussion

This research analysed the engagement via Twitter in NSM from dental practices and organisations to help address oral health inequalities. Twitter is currently the most popular microblogging social media platform and is a useful way of bringing together like-minded communities that share a common goal.[26] Despite this, the tweets captured during the NSM campaign in 2016 indicated that participation on Twitter was mainly superficial (classified as low and medium engagement) and used as a one-way communication/ recruitment tool by dental practices in NSM, which alone will not help towards tackling oral health inequalities. There is a psychological explanation for this type of behaviour. Online viral campaigns have been said to mainly leverage 'extrinsic' incentives to do 'good' such as following NSM, tweeting or retweeting information, rather than cultivating an internally sourced 'intrinsic' motivation to help others in the real world.[27] This behaviour was

evidenced in the initial peak in tweets followed by a steady decline. This trend is comparable to results reported in research exploring the use of Twitter to raise awareness of breast cancer.[28] In other words, the optimistic use of social media to propel positive social change is balanced by the shallow, short-lived nature of engagement with anything 'viral'. The majority of viral campaigns draw their success from the psychology of 'consensus', (ie the number of followers, tweets and retweets) but the nature of NSM requires a deeper engagement such as activities outside of the virtual environment. Research has shown that activities which engage and educate people on oral health 'outside' of the virtual environment are more likely to have impact in the local community.[29] Any real effort to help address oral health inequalities would require dental practices to engage in activities that promote good oral health outside of their clinical walls, such as street campaigns, local fetes and events as well as outreach services for the 'hard to reach' population. Many local authorities, who are now responsible for public health in their areas, are attempting to better meet the needs of their local population through evidence-based approaches such as water fluoridation schemes, community-based fluoride varnish schemes and supervised toothbrushing in early years settings.[30]

The number of dental practices registered in England was 10,130 in March 2015 and there are estimated to be 32,900 dentists working in general dental practice in the UK as well as 43,350 registered dental care professionals.[31]

Only 201 dental practices participated in NSM 2016 via Twitter, which constitutes only two percent (1.98%) of dental practices in England. A British Dental Association (BDA) report in 2008 suggested that the 2006 NHS contract has created unfair pressures and uncertainty for dentists with around 500 dentists lost within the first year of the new system.[32] This consequential uneasiness and anxiety has done little to encourage a greater number of dentists to work for or devote more time to NHS dentistry. Recent responses to a BDA survey in 2017 suggest that 58% of young dentists intend on leaving the NHS.[34]

To address oral health inequalities, targeted dental practices in areas of high-need/deprivation could be given the resources and financial incentives to be more proactive in campaigns like NSM. A more balanced distribution of efforts and resources along with the full range of intervention points from the downstream curative to the upstream structural healthy policy is the goal to successfully working towards tackling oral health inequalities.[5] The NSM campaign encourages dental health professionals to establish links with homeless shelters, community and day-care centres, residential homes and hostels during NSM month; these relationships are valuable in helping to address regional inequalities. Local authorities and their health care partners could consider collaborating more during NSM with dental practices to help spread the 'prevention' message.

Limitations

The results of the research should be interpreted according to the following limitations. This research only takes into the account the Twitter element of NSM. Many dental practices may not use Twitter and/or could have participated in the campaign with other activities, talks and displays outside the realms of social media.

Mozdeh, an API search software, was used to collect the tweets. Twitter states that the search API is 'focused on relevance and not completeness. This means that some tweets and users may be missing from search results. If you want to match for completeness you should consider using a streaming API instead'.[33] Subsequently, this data should only be considered a 'snapshot' of the Twitter activity surrounding NSM. It is also possible that the number of tweets during NSM was underestimated because they were not covered by the selected key words. The postcodes captured for this data were linked to the tweet
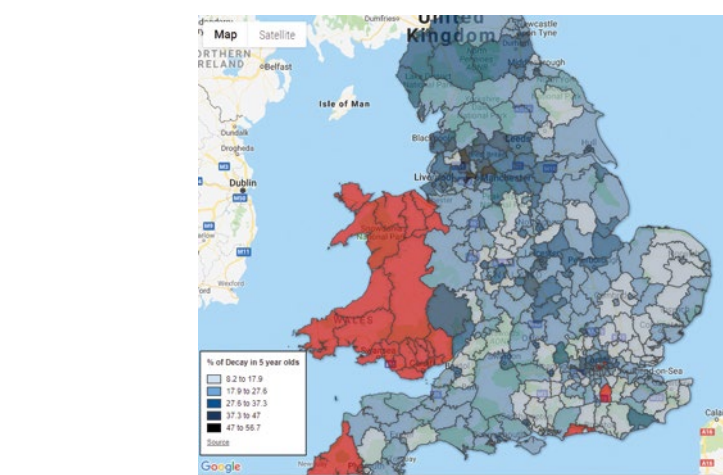
Fig. 3 Choropleth map of DPHEP survey of percentage decay in 5-year-olds (red areas = no data). Map data ©2019 Google
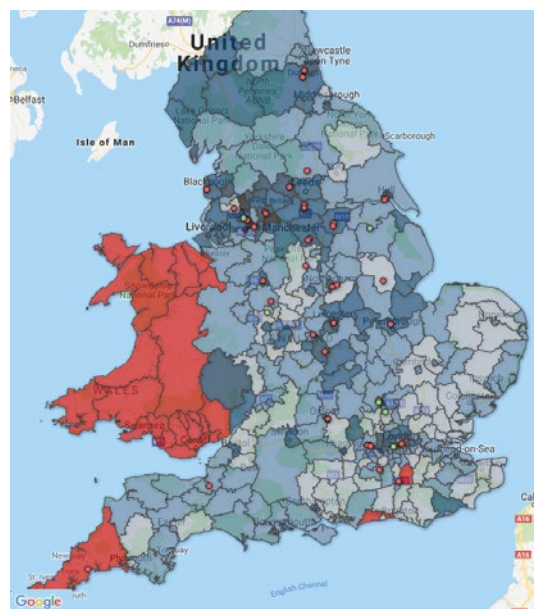
Fig. 4 Layered map depicting the relationship between decay in 5-year-olds, indices of multiple deprivation and geolocation of high tweets. Map data ©2019 Google

and not the actual event itself. Some of the tweets were lost due to 'unmatched' data in the postcode lookup tool.

The data from the Dental Health England epidemiology study of five-year-olds[24] survey was conducted at local authority (LA) lower-tier level and not at the Lower Super Output Area level. Many LA districts can have areas of affluence and areas of deprivation; this will affect the overall estimates of disease trends. The epidemiology survey of five-year-olds also relies on an 'opt in' basis and this relies on parents/guardians completing a consent form for their child to take part in the survey. This may lead to potential underrepresentation

of lower socioeconomic groups as some sections of the community are more likely to provide positive consent than others. The survey examined the dental health of 111,500 children whose parents and carers 'opted in' to the survey.

Notwithstanding the limitations, this research, for the first time, has developed a simple method in which to evaluate the geographic reach of an online campaign. All the tools needed to replicate similar research of an online campaign can be done using free, open source web applications. Very little research has been conducted in the value of social media as a tool to tackle oral

health inequalities. The use of social media to help tackle oral health inequalities is largely unexplored and contributes to the originality of this research.

Conclusions

Engagement with NSM 2016 on Twitter was mostly superficial and did not raise awareness of the importance of improved oral health via this social media platform. The results from this research indicated that dental practice teams are not fully engaging with social media in a way that would encourage good oral health to the population beyond their surgery. Of the dental practice teams which did engage with NSM, the majority of their tweets did not promote any specific preventative behaviour. The research provides evidence that publicly-funded organisations allied to oral health were more proactive in NSM via Twitter by targeting their NSM activities in areas of high need. To increase more meaningful participation in NSM from dental practices, the NHS needs to create a dental service that financially rewards dentists for the implementation of oral health promotion that is inclusive for the whole community. Local authorities could work more closely with their health care partners and local dental practices to improve the oral health of the local population through interventions and community-based programmes and events.

The maps are created to be viewed online and a folder containing the Google Fusion Tables and Maps can be found by cutting and pasting this link into your browser:

https://drive.google.com/open?id=1V4t_ZRet1bY_3gX5ze5ljHZ4eeEUyOmH

Use Google Layer Wizard to overlay the maps

https://developers.google.com/maps/documentation/javascript/layers#FusionTables.

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