Health Communication

Research Proposal

# Social Network Structure and Campaign Message Effect in the Facebook: A Mixed Method

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## 1 Introduction

Social media campaigning has been widely recognized and practiced by health advocacy groups and organizations. Recent anti-smoking promotions and interventions have tapped into the social media landscape, such as “The Real Cost”, the FDA's youth tobacco prevention campaign. Although designed primarily as a mass media campaign, the health promotion increases use of social media as a result of the targeted youth’s media preference.

Despite the increased use of social media by anti-smoking interventional campaigns, it is unclear of the effectiveness of campaign messages transmitted via Facebook, Twitter and other social media and their resultant influence of the actors, the targeted youth audience, and its social networks. Profoundly, social media is an institution where individuals’ beliefs and social norms are formed. It might be equally, if not more informative to look into the campaign effect in the social media platform. Facebook is of special interest in this campaign evaluation study, as 78% of the teens in the United States use Facebook (Pew Research 2013).

By capturing the “The Real Cost” campaign’s evolving network formed by the youth and the campaign messages, this study aims at understanding how social media propagates campaign messages, how target audiences are engaged and influenced, and the effectiveness of the campaign. To accomplish these goals, research will be conducted to analyze the network structure based on Facebook interactions. A mixed method of Social Network Analysis and Content Analysis will yield metrics of frequency, content, density and centrality. These metrics reflect the level of engagement a person has in a campaign, as well as cohesion, solidarity and centralization of a network due to the different types of messages deployed.

To leverage social media in the aforementioned youth tobacco prevention campaign, we must understand the networks structure in which both the targeted group and campaign group are involved, as

well as the user-generated discourse surrounding the campaign messages. The intent of this study is to inform health advocacy groups of the behavior of an audience in response to an organized social media campaign. The ultimate goal is to provide health promoters with valuable guideline in developing social media campaign. To the best of researcher's knowledge, there has not been an in depth examination of health campaign's social media platform. The research proposal will address this gap and contribute to better understanding of social media campaign practices.

# 2 Literature Review

## 2.1 Evaluation of Anti-smoking Media Campaign

It is important to reflect on the general model of the media campaign influence before delving into the effect of "The Real Cost" social media campaign. Hornik suggests there are at least three general paths through which media campaigns may influence behavior. The first, and most notable, involves direct exposure of individuals to the persuasive messages generated by the campaign (Hornik 2003). This path of media effects is derived directly from influential theories of health behavior change, such as the theory of reasoned action (Fishbein & Ajzen, 1975), the theory of planned behavior (Ajzen, 1985), the health belief model (Becker, 1974; Rosenstock, 1990), and the social cognitive theory (Bandura, 1986).

In the second route, campaign messages attract institutional attention. Many campaigns include a media advocacy component that is designed to attract media and policy attention to the intended goals (Wallack, 1990). Social institutions, such as the mass media, schools, the justice system, and religious organizations (Yanovitzky & Bennett, 1999), are the intended benefactors, through whom the campaigns may exercise influence.

The third route of influence relates to campaign-induced processes of social diffusion. Through social interaction with family members, peers, and other community members, people are familiarized with behaviors and routines which are socially acceptable and those which are intolerable. They become aware of the costs and benefits, in social terms, of performing each behavior. According to Hornik, this social information helps to shape their behavioral attitudes, beliefs, and intentions (Hornik 2003).

There is a proliferation of research on the anti-smoking campaign effects. Studies can be categorized as (a) population-based studies of campaign effects and (b) studies comparing message types, using either

population-based or forced exposure methods. Overall, the studies have strengthened the evidence that mass media campaigns, conducted in the context of comprehensive tobacco control programs, can promote quitting and reduce the prevalence of adult smoking, but campaign reach, intensity, duration and message type may influence success (Durkin et al. 2011).

Nonetheless, only the first path, direct exposure of individuals to the campaign messages, is well conceptualized and tested in the design and evaluation of many communication campaigns. Typically, when an evaluation compares individuals based on level of exposure, it is assuming this individual model of effect (Hornik 2003). This most commonly tested model can be found in many previous studies. For example, a 4-year longitudinal study examined the effect of baseline exposure to television, radio, and outdoor antismoking advertisements, and found those reporting baseline exposure to television antismoking advertisements were significantly less likely to progress to established smoking (M Siegel 2000). Many of the research studies use multiple logistic regression and controls for age, sex, race, baseline smoking status, smoking by family and acquaintances, television viewing, and exposure to antismoking messages not related to the media campaign for comparison studies (Vartiainen 1998). Moreover, this line of evaluation research has been conducted across countries and cultures, such as Perl et al's research, testing message effects of campaign on people in Senegal, Nigeria, and Kenya (Perl et al. 2014).

In contrast, much less academic efforts are dedicated to investigating the institutional and social diffusion as two integrative pathways of campaign effects. Although there is research on interpersonal communication functions in stimulating change through social interaction and in a secondary diffusion process (van den Putte et al. 2011), very few campaign evaluations further explore the mechanisms of these two pathways of campaign effects.

It is worth noting, however, that the influence on youth behavior was largely based on the effect mass media had as described by Hornik's three mechanisms. The emergence of social media campaign not only prompts us to revisit the model of campaign effects, but also call for a new perspective and approach to campaign evaluation in the context of social media.

### 2.2 Social Media: an Institutional Path

Social media encompasses at least two of the aforementioned pathways of exposure. Not only do individuals get directly exposed to information to form their beliefs, attitudes, and intentions, but social media is an institution that allows these beliefs to adapt and flourish, and eventually form the social norms.

Although the role of social media campaign is less pronounced in health communication, especially when compared to that of political communication, scholars maintain that social media holds great potentials in health campaigns for several reasons (e.g. Sonja Utz 2009, Thackeray 2007). First, at the individual level, social media allows health groups to directly engage their audience in a creative process, in which message co-creation replaces the persuasion paradigm. In this paradigm, targeted groups become creators or co-creators with the health promotion group, as individuals not only get exposed to the health information, but also participate in its spread. Second, at the institutional level, social media, as a large-scale network, may be used to convey health information broadly or in limited fashion that targets the family and acquaintances of an intended audience (Wells, 2008). An essential element of a social media campaign is "providing tools to make it easier to share information" (Thackeray 2007). In all, social media helps to shape behavioral attitudes, beliefs, intentions and social norms. Most importanly, much more than a source of information, social media is an institution where individuals form their beliefs, attitudes, intentions, and a new field where the norms are created and developed further.

In addition to its intrinsic characteristics, the goal of the FDA's campaign also put social media in a unique position - as an advance program to assist in the reduction of youth tobacco use. As "The Real Cost campaign's goal is to reduce the number of youths, aged 12-17, who smoke, social media, especially Facebook, could play a more salient role than mass media, owing to the behavior and media preferences of this targeted audience. An abundance of studies provide evidence for the assumption that peer pressure plays a crucial role in the initiation and maintenance of smoking (Ennett and Bauman, 1993). The strongest and most consistent evidence of smoking adoption is the association between adolescents and friend smoking (Bauman et al. 1984). It is noted that the effect of one's social network plays a prominent role in the induction of smoking, such as prevention, cessation and the perpetuation of

abstinence (Nathan K. Cobb et al. 2010). Stronger social bonds and positive social support are associated with smoking cessation and relapse prevention. Negative social support (e.g., a spouse who smokes or is critical of attempts at cessation) are barriers to cessation (Mermelstein 1986).

Facebook, as the preferred medium of social networking of the target audience, is of special interest in this social media campaign evaluation research. 78% of adolescents in the United States use Facebook, and teens' Facebook friendship connections largely mirror those offline (Pew Research, 2013). 98% of Facebook-using teens are connected with people they know from their schools. On Facebook, increasing network size goes is directly proportional to network variety, information sharing, and personal information management. "Facebook members view their audience as peer group members, as opposed to other institutional members like administration and faculty" (Lampe et al. 2006). Although Facebook is different from traditional interpersonal communities, users associate it with them (J. Ke 2013).

## 2.3 Evaluating the Real Cost Campaign: a Social Network Approach

- **Limitation of the Current Evaluation Design**

Due to the fact that "The Real Cost" campaign is designed primarily as a mass media campaign, its effects in the social media platform might be overlooked by FDA's current evaluation design.

According to FDA, the current evaluation will be conducted through a multi-year, in-person, nationwide study, assessing changes in key tobacco-related knowledge, attitudes, beliefs and behaviors over time. The results will be used to determine if exposure to the campaign is associated with a decrease in smoking among youths aged 12-17. This strategy might be useful for evaluating the campaign effects in mass media; however, it is not applicable to measure the effectiveness in the social media platform.

Inadequate or incomplete theorizing might lead evaluations to erroneous conclusions concerning campaigns' influence on targeted behaviors (Hornik 2003). The failure to find effects can reflect a true failure of the campaign, however, it may also reflect inadequately theorized - and thus inadequately realized - evaluation design.

As mentioned above, the impact of social media campaigns may go beyond individual cognitions and behaviors level, and include effects on communities, institutions, organizations, and social networks. If this is true, evaluations that look for evidence by comparing individuals who vary in personal exposure

to anti-smoking messages might not the expected effects, underestimating the success of communication campaigns. Once social media is viewed as an institution, it requires a social network approach, treating social media as more than a variable in the models of behavior change, information processing, and message effects.

- **Social Network Theory**

Social network theory is crucial for this research, as it emphasizes on the structure of relationship in a social network and view the network as a whole. In this perspective, behaviors are analyzed from the whole structure of a network as opposed to the individual contributions among it (Easley and Kleinberg, 2010).

Social network is a social structure composed of actors and dyadic ties between the actors (Snijdersa et al.2010). Social Network Analysis (SNA) is perspective-based analysis that emphasizes the importance of relations and structures among a network. Ties, also called edges, are connections or relationships, which are achieved in the course of interaction, or in the processes of various activities. Nodes, or vertices, are actors who could be members of communities, organizations, regions, and so on. The relationships can be positive or negative, such as friendship, with conflicts or hostilities.

Moreover, depending how the relationship is defined, the ties can be directed or undirected. For example, Network of Collaboration could be undirected, because the connection only exists when dyads are involved in the collaborative relationship. In contrast, Network of Information Flow could be directed, because the information sent from one actor does not necessarily involve a response from the other. The social relationship between sender and the recipient can be symmetric or asymmetric. With respect to SNA, the relationship can be reciprocal or singular.

A network including one category of node, or actor, is called a "unimodal network," such as networks connecting users and users. But, networks can encompass various categories of nodes to create multimodal networks. Networks including two categories of node, or actor are bimodal networks, such as a network with users and the written content they create therein (Hansen, Shneiderman, &Smith, 2011)

Graph-theoretic method based on mathematical theory is most widely used in SNA (Foster et al. 1983). A graph composed of nodes and edges, can reflect social relations among actors in a network. Network

structure can be analyzed in terms of frequency, content, density and centrality (Giorgos, 2010). "Frequency" is the level of a person's engagement. "Intensity" and "centrality" indicates the degree of cohesion, solidarity and centralization of a network due to the different involvement of members in these networks (Streeter & Gillespie, 1992). A more detailed description of this approach in terms of the metrics and implications will be provided in the methodology section.

It is noted that SNA has been used in the health domain for investigating actual health behaviors and online community networks. For example, studies have been conducted to investigate the relationship between peer group social structure and adolescent cigarette smoking (Ennett et al. 1993), and the collective dynamics of smoking in a large social network (NA Christakis, JH Fowler 2008). In the context of computer mediated communication, Cobb et al. analyzed a large online community for smoking cessation, and derived multiple subgroups, such as key players and integrators, from connections and communication patterns (Cobb 2010).

However, there is a lack in SNA use in the health campaign evaluation study. The social network approach is distinguished from the previous analysis techniques in two major aspects: First, the unit of analysis differs. The previous analysis focused on individuals and their exposure to message, whereas SNA looks into the network as it incorporates health promoters, audience, and message. Typically, statistical techniques such as NOVA are used to test the associations of message and an audience's characteristics. SNA is different from usual statistical techniques as the data of social network blatantly violate the premise of being statistically independent (Foster and Seidman 2008). Second, traditional approaches typically set a definite timeline for outcome evaluation, whereas the SNAs approach treats network structure as continuously evolving - not only with respect to time and volume of exposure, but also to the extent that audiences are engaged. It goes in saying that SNA complements, rather than replaces, the established models of campaign evaluation.

## 3 Research Goals and Questions:

There are two major goals of the research. First, to capture the network structure of the expanding Facebook network based on the interactions between "The Real Cost" campaign and its target audience. Second, to determine what types of campaign messages are more effective in the social media platform.

What are the key structural and functional characteristics of a large, evolving community for smoking prevention? What kind of information is more likely to be frequently spread and reach more people? In order to address the mechanism of social media campaign effects, this study seeks to:

1) Characterize and visualize the social network of the Facebook community,
2) Describe its structure and identify key participants in the network that influence information diffusion,
3) Interpret the metrics of the networks and determine the effectiveness of different messages,
4) Based on the response to the campaign message, identify subgroups whose existence and characteristics might inform the design of cessation interventions.

This study is intended to establish the necessary foundation for subsequent investigations into the effectiveness of online social networks in influencing campaign outcomes, as well as to advance understanding of social network effects in youth tobacco intervention.

# 4 Methodology: A Mixed Method

This study aims to examine the social structures of the communities in Facebook, and then further explore the mechanism of campaign effects. To accomplish this, a mixed method of Social Network Analysis (SNA) and Content Analysis will be used. In the following, the process of data collection, and the techniques including SNA and content analysis will be discussed.

Based on the Facebook page of “The Real Cost" campaign, data that will be collected include nodes (users, message), ties (comments, and sharing) and their characteristics. The data will then be used to construct a graphical network to show how youths interact with each other. The computer software “NodeXL” was used for the network formulation. Based on the measure metrics and network visualization, structures across different message types and key persons will be identified.

Finally, a statistical technique will be used to test whether differences across messages and other social network metrics are significant. This would help to determine what kind of information is more likely to be shared more and reach more people.

In order to better illustrate the methodology, a preliminary test analysis is conducted.

## 4.1 Methods

- **Define Networks by the Nature of Nodes and Edges**

At least two types of network structures can be generated to explore the mechanism of "The Real Cost" campaign effects in the Facebook.

The first type is the unimodal network, where all the nodes represent the Facebook users. Based on who comments on the campaign's Facebook page, a unimodal network will be identified that connects "The Real Cost" and the other users. The edge is defined by the commentation behaviors among its users, and to whom the comment is directed. This network is also an egocentric network, as all the other users are connected to "The Real Cost" (Graph 1).

The second type is bi-modal network, where one category of nodes represents users and the other category represents Facebook posts associated with the campaign's message. The edge is defined by the sharing behavior. The direction of an edge indicates the flow of information (Graph 2).

Major network metrics will be calculated and interpreted in the context of campaign effects evaluation. Measures that are used for will be shown in the Table 1.

- **Measure**

Table 1. Measure and Implications on the Effectiveness of Campaign

| Indicator | Network Metric | Definition | Implication |
|---|---|---|---|
| Edge | Edge weights | Edges represent interactions and relations. Edge weight indicates strength of this connection. | There is more interaction between the users with larger edge weight. |
| Paths | Shortest paths Length | A path connects two different nodes. There are many paths between nodes but the shortest path between them has the smallest number of edges. The length of a path will decide the speed of communication. | There is more possibility that an individual gets information exposure, if the path from one to "The Real Cost" is shorter. The first-degree connection is under direct exposure to the campaign message. |
| Centrality | Number of In-degree and Out-degree | Degree is the number of users that one can reach directly. In-degree is the number of ties going toward a person. Out-degree is the number of ties coming from a person. | A user with higher in-degree indicates higher popularity of a person.<br><br>A message with higher out-degree in the sharing network means it is shared more frequently. |
| | Betweenness Centrality | The total number of shortest paths between all nodes that go through | Higher value indicates greater node importance. A user or a campaign message |

| | | | |
|---|---|---|---|
| | | a node. | with high Betweenness Centrality might play an important role in the network |
| | Eigenvector Centrality | If two nodes have equal degree but one is connected to a more connected node it will have a higher Eigenvector Centrality. | Messages with higher Eigenvector Centrality might have a bigger potential to get disseminated as it connects with more connected users. |
| | Closeness Centrality | It is a measure of the speed of information dissemination. | Messages with lower Closeness centrality have higher diffusion speed. |
| Reciprocity | Reciprocity Rate | The ratio of the number of reciprocated relations to the total number of relations in a network. It reflects the degree of social cohesion of a network. | Can be used to determine what type of audience "The Real Cost" replies back to more often. |
| Clustering | Clustering Coefficient | The density of a node's neighborhood. It represents the presence of sub-communities in a network. | For the sharing network, high Clustering Coefficient of a node shows the user share the campaign posts several times. It is inferred that these users are crucial for the network, as they might be campaign information broker for their circles. |

- **Collect Data**

For the first type of network that, based on the sentiments and content collected from the "Recent Activity" section of the Facebook page for "The Real Cost", a content analysis study will be conducted to code the comments as "Positive"," Doubtful", "Asking for help", "Negative", "Expressing concerns for friends", or "Being mentioned". By doing this, users in the network can be differentiated by their attitudes towards the campaign. In the future, Natural Language Processing, a computer-assisted analysis could be used for large-scale research.

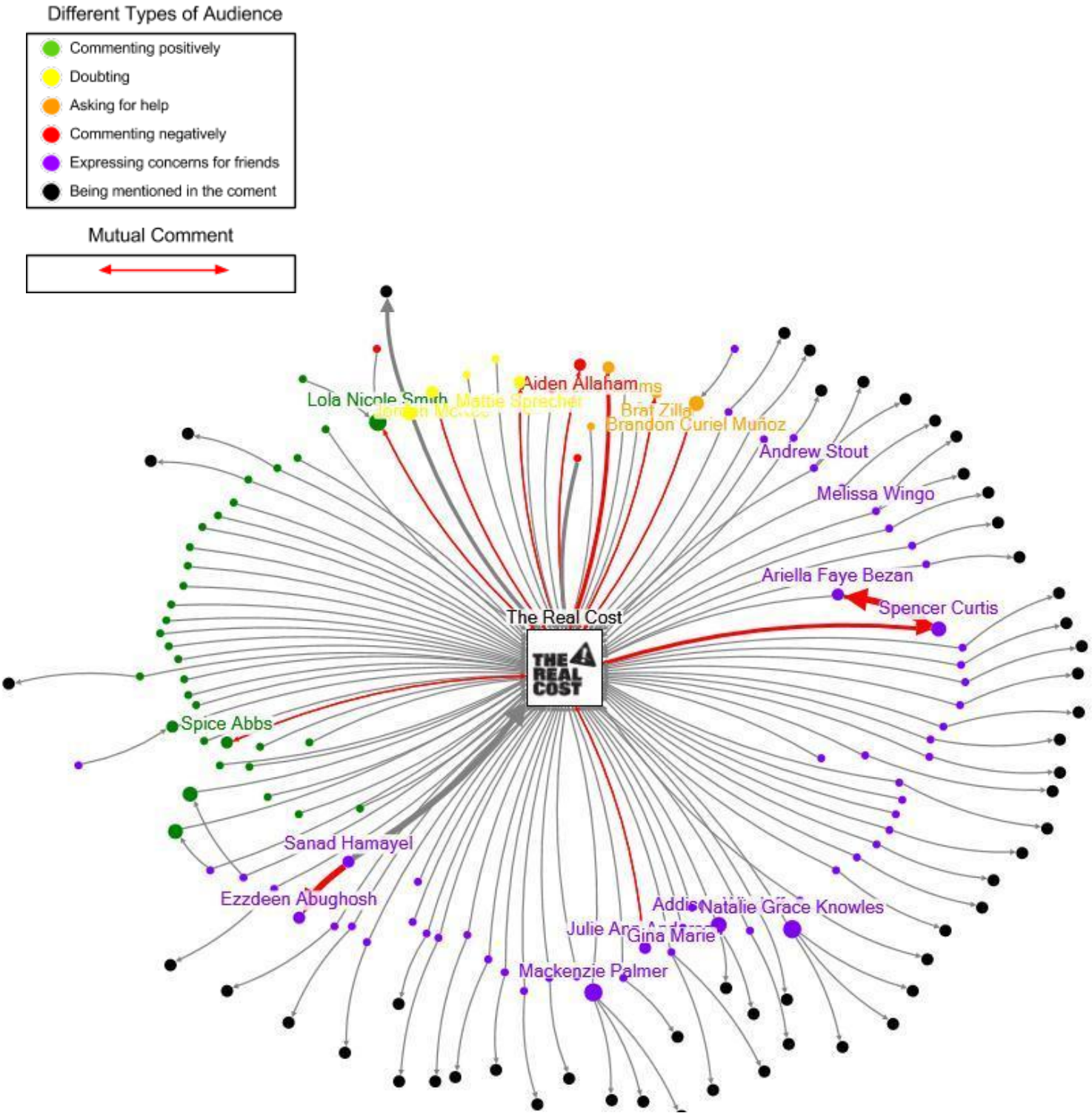
Due to Facebook user's privacy regulation, not all of the comments are available. It is assumed that there is no systematic difference of privacy regulations among the users of different attitudes.

For the second type of network, based on the sharing behavior of different campaign message posts, data of users are collected from "People Who Shared This", and each post is treated as an individual node. Likewise, it is also assumed that there is no systematic difference of privacy regulations among the users sharing different type of campaign posts.

- **Preliminary Test**

Based on Facebook data from November 18 to November 24, 2014, a preliminary test was conducted. Future research will build on these initial findings about the audience and delve into the campaign effects, coupling with the established evaluation techniques.

**Graph 1. Network of Youth with Different Attitudes Based on the Comments**



**Initial Findings Based on Cementation Unimodal Network:**

Subgroup of Facebook users who interact with "The Real Cost" campaign: Excluding the null commenters who are merely mentioned by their friends comments, it was found that the major (54.6%) group of the commenters is those who are "expressing concerns for a friend's" (or a family member) smoking behavior, followed by those comments deemed "positive" (30.6%), "doubtful" (5.6%), "asking for help" (5.6%), and "negative" (3.7%). By identifying the audience's attitude towards the campaign, a more tailored message can be designed. Future research will trace the change of the subgroups overtime. Change of attitude among them is one of an indicator of campaign's effectiveness in the Facebook.

Reciprocity of comment: The reciprocity rate was highest between "The Real Cost" campaign and the target audience members who were "asking for help" or were "doubtful". It is of interest to test the association between Reciprocity and change of attitude.

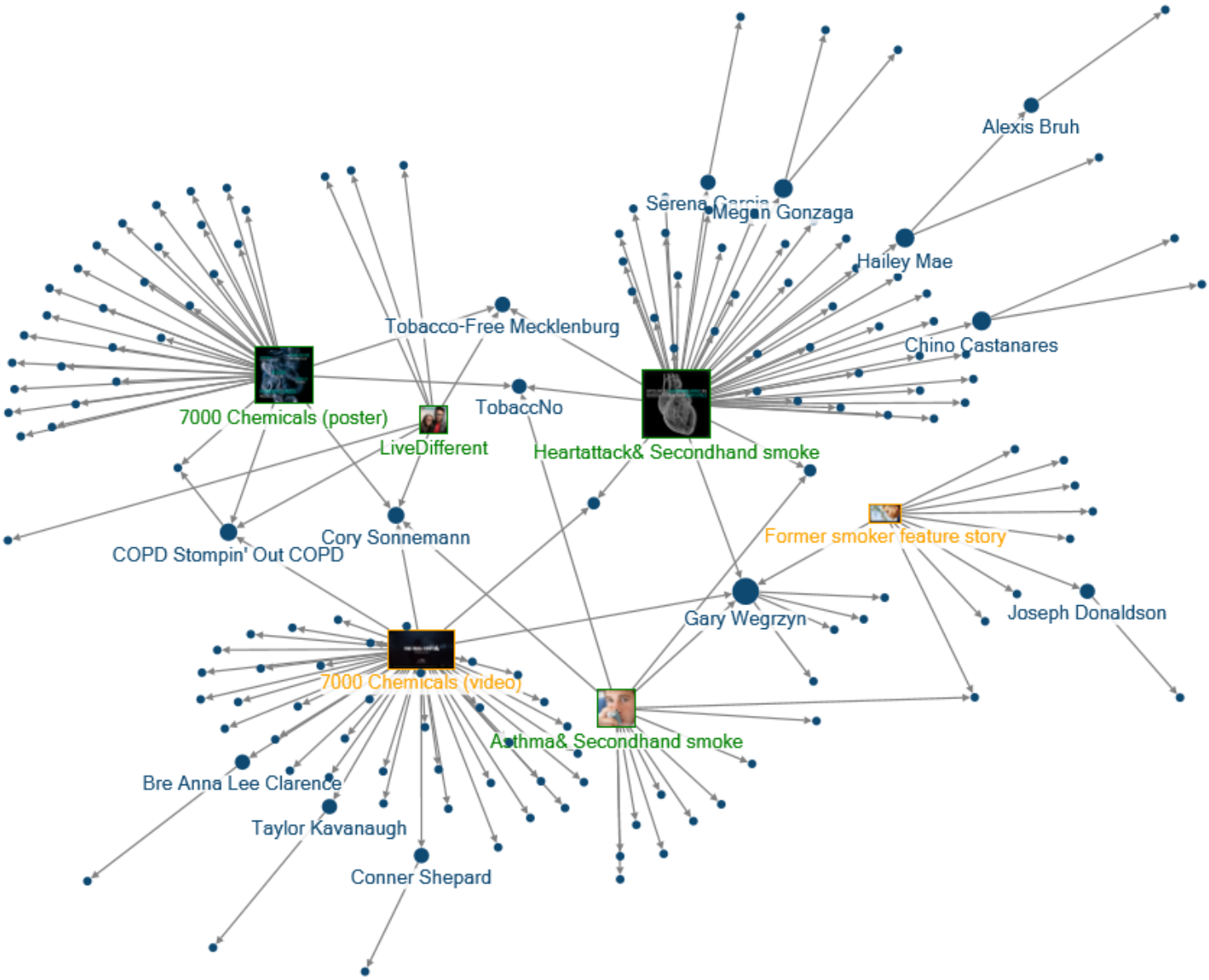
Key commenters in the network: The general network metrics helps with finding important users in the campaign's Facebook comment networks (Table 2). Those commenters deemed important are relatively more engaged in the campaign, and most of them are from the group who are concerned with their friend or family's smoking behavior.

**Table 2 General Network Metrics of Key Commenters**

| Vertex | In-Degree | Out-Degree | Betweenness Centrality | Closeness Centrality | Eigenvector Centrality |
|---|---|---|---|---|---|
| Mackenzie Palmer | 0 | 4 | 954.000 | 0.003 | 0.009 |
| Natalie Grace Knowles | 0 | 4 | 954.000 | 0.003 | 0.009 |
| Lola Nicole Smith | 3 | 1 | 638.000 | 0.003 | 0.009 |
| Addison Wiedoff | 0 | 3 | 638.000 | 0.003 | 0.009 |
| Andrew Stout | 0 | 3 | 638.000 | 0.003 | 0.009 |
| Gina Marie | 0 | 3 | 638.000 | 0.003 | 0.009 |

| | | | | | |
|---|---|---|---|---|---|
| Melissa Wingo | 0 | 3 | 638.000 | 0.003 | 0.009 |
| Brandon Curiel Muñoz | 2 | 1 | 320.000 | 0.003 | 0.009 |
| Sanad Hamayel | 1 | 2 | 320.000 | 0.003 | 0.009 |

**Graph 2. Network of Campaign Message Dissemination Based on Youth Sharing Behavior**



**Initial Findings Based on Sharing Bimodal Network:**

Different Rate of Dissemination by different type of message: According to the network metrics, the campaign message focused on "heart attacks and secondhand smoking" is the most disseminated one, as dictated by the the highest out-degree value; it also has a higher potential to get broader attention among Facebook users as dictated by the highest Eigenvector Centrality value. A higher Eigenvector Centrality value indicates a greater connection to users who share the campaign posts most often. For the next phase of research, it is important to differentiate the messages by format, motif, etc., and identify types of messages that are more impactful in terms of reach of audience.

**Table 3 General Network Metrics of Sampled Messages**

| Vertex | Out-Degree | Betweenness Centrality | Closeness Centrality | Eigenvector Centrality |
|---|---|---|---|---|
| Heartattack&Secondhand smoke | 46 | 13645.452 | 0.003 | 0.019 |
| 7000 Chemicals (video) | 44 | 12285.990 | 0.003 | 0.013 |
| 7000 Chemicals (poster) | 32 | 8113.038 | 0.002 | 0.005 |
| Asthma& Secondhand smoke | 14 | 3622.143 | 0.002 | 0.003 |
| Live differently | 7 | 1324.852 | 0.002 | 0.002 |
| Former smoker feature story | 10 | 2830.524 | 0.002 | 0.001 |

Key sharers in the network: The key sharers are also identified by the network metrics. Users, such as Gary Wegrzyn, Amber Tinsley, TobaccNo Tobacco-Free Mecklenburg, COPD Stompin' Out COPD share the post from "The Real Cost" campaign very often. It is interesting to find many of them are fellow anti-smoking campaign group. The collaboration among the anti-smoking campaign groups in the Facebook network might be of interest for next phrase of research.

**Table 4 General Network Metrics of Key Sharers**

| Vertex | In-Degree | Out-Degree | Betweenness Centrality | Closeness Centrality | Eigenvector Centrality |
|---|---|---|---|---|---|
| Gary Wegrzyn | 4 | 4 | 7085.114 | 0.003 | 0.022 |
| Amber Tinsley | 2 | 0 | 2284.033 | 0.002 | 0.018 |
| TobaccNo | 3 | 0 | 2534.924 | 0.002 | 0.015 |
| Tobacco-Free Mecklenburg | 3 | 0 | 2298.733 | 0.002 | 0.014 |
| Shawniqua Thomas | 2 | 0 | 378.738 | 0.002 | 0.013 |
| Cory Sonnemann | 4 | 0 | 2978.624 | 0.002 | 0.012 |
| Hailey Mae | 1 | 2 | 940.000 | 0.002 | 0.011 |
| Chino Castanares | 1 | 2 | 630.000 | 0.002 | 0.011 |
| Megan Gonzaga | 1 | 2 | 630.000 | 0.002 | 0.011 |
| COPD Stompin' Out COPD | 3 | 1 | 1887.833 | 0.002 | 0.011 |
| Serena Garcia | 1 | 1 | 316.000 | 0.002 | 0.011 |

### 4.2 Tools

NodeXL is a network analysis tool, which supports visuals and analytics, and integrates with ubiquitous Excel spreadsheet software, designed for non-programmers. It is capable of drawing and visualizing data from various social media, such as Twitter, Facebook and YouTube.

SPSS is a statistical analysis software package. It is capable of analyzing Descriptive statistics, Bivariate statistics, Prediction for numerical outcomes, and Predictions for identifying groups, among many others.

## 5 Significance of study

Social media campaigning has been widely recognized and practiced by health advocacy groups and organizations. One of the most successful examples was the “Ice Bucket Challenge" campaign initiated by the ALS Association, which “has lit social media on fire, raising both money and awareness for ALS disease” (New York Times 2014). However, not all the health campaigns in the social media platforms are as effective and influential. Unfortunately, there is a shortage of academic literature that provides guidelines for real world campaign practices. This research will contribute to reducing this gap, inform the design of messages for health campaigns in the social media platform, and contribute to a more socially oriented agenda of research and social practice.

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