EXPLORING RECIPROCITY AND HEALTH MESSAGES IN THE SOCIAL NETWORK CONTEXT: INTEGRATED SOCIAL NETWORKS AND CONTENT ANALYSES OF WEIGHT-LOSS STRATEGIES IN TWITTER

by

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(Under the Direction of Jeong-Yeob Han)

ABSTRACT

This research will explore user interaction in Twitter in regards to weight-loss strategies. This thesis is guided by uses-and-gratification theory. Characteristics of health information for higher reciprocity and the role of key players who act as agents in information flow in the health community on social networks are also analyzed in this thesis. By employing social network analysis and applied content analysis together, it was found that Twitter users display a pattern of brand and public topic. The results from content analysis show that there are different levels of reciprocity depending on what people talk about and how the information is provided when they are engaged in weight-loss talk. Limitations of the study and a guide to future research are introduced as well.

INDEX WORDS: Reciprocity, Health message, Twitter, Social network, Content analysis

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DEDICATION

Dear God almighty, you have been always there when I needed you. You never let me fall even in times that I did not have faith in you and even myself. Your patience, endurance and unceasing love make me take a step further. I praise your name.

To my mom and dad, It is hard to express how much I feel grateful for your support and encouragement. I am so lucky to have parents like you all. My loving brother Youn, your distinctive sarcasm made me laugh in times I felt desparate. You are the best brother I can ever ask. I love you!

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CHAPTER 1

Introduction

Recently, the population that is obese has been growing rapidly. The WHO (2006) and the CDC (2010) have reported that obesity is considered one of the most pervasive chronic diseases. This growing health problem has become an alarming issue among the general population, and has been harmful to quality of life, as well. People, therefore, must seek a way to overcome this pervasive issue. As a part of this effort, these health organizations have tried to use communication technology to gather the data they need, and have used the information guide their health management.

Communication technology has been developed over time, and it altered the paradigm of information sharing, which changed the direction of information flow on the internet. Social networks are in the limelight due to their interactive nature and they significantly alter the way in which health information is spread. The effect of media has been revealed in providing the public information and to form certain attitudes such as preventive or positive attitudes, regarding a health issue and an agenda with motivation to be healthier (Redman, Spencer & Sanson-Fisher, 1990; Wakefield, Loken & Hornik, 2010), social networks can serve the people by becoming sources of health-related information.

Although obesity has become one of the most serious chronic diseases in the world, little has been studied about the intersection of this health issue and media

(Nazione et al., 2012). Traditional media have dealt with obesity and diet with the emphasis on how media shape certain attitudes towards this issue, such as framing in magazine and news networks, and stigmatization (Gearhart, Craig & Steed, 2012; De Brún, McKenzie, McCarthy & McGloin, 2012; Shugart, 2011; Yoo & Kim, 2013). However, social networks display a different feature from what was revealed from traditional media. Moreover; social networks have become pervasive among the public; therefore, the chances for the public to make the most of potential information sources has also increased by circulating information in a multi-direction manner.

As the flow of information changes, the scope of the media effect becomes wider. Traditional media transmit messages in a designated direction, mostly from the media to the people. However, social media has made ordinary users become alternative information sources by letting them disseminate information. The paradigm shift in information sharing has enabled multi-directional information sharing. As a result, the public becomes another source of information, and this user-created content becomes prevalent within the social media environment (Eysenbach,2008; Han et al., 2009).

With these smart media users and developed communication technology; people have become able to help themselves in health management. Glanz (2008) supported this idea by asserting that health behavior has been influenced by development of communication technology. These behavioral changes from active media users has galvanized changes in policies for health issues: AIDS prevention and education, smoking cessation, obesity and drug abuse (Glanz, 2008). However, little has been studied about what makes those people really participate in the activitiy within social network environments and what it means to individuals or a group of individuals

(Smedley & Syme, 2000). The study and the inquries within this study have started with these questions; what makes people participate in information sharing within the social network, how they share health information, and how well they are helping each other within the network to fulfill a certain need.

Among the social network sites, Twitter has gained great popularity in recent years. The magic of 140 characters made the users share information with succinct messages with an attenuated form of URLs like “tinyurl”s and keywords, which are called hashtags. A simple and precise message is recognized by the user as easy to read and takes little time to read and comprehend. Message clustering by hashtags has made Twitter an active place to create a community of common interests. Within the communities in Twitter, people can share the information by creating connections: following, retweeting and mentioning.

These connections become ties among the people who participate in health-oriented discussions. There are differences in terms of strength of the ties, however; weaker ties have more ability to reach a wider range of populations (Kadushin, 2012). That is, what people talk about become a tie to make more people connected to each other and make information flow in a wider range. Then a few questions arise, what kind of information do people feel are more attractive? Is there any mechanism for having people involved in the health conversation in Twitter? To be more specific, does the information make people work more reciprocally within the network?

In having the people participate in the network so that they become parts of network, the types of information, and who distributes the message are considered important. An interactive communication style that exists within a social network might

have influenced the distinctive characteristic of leadership within social networks when health issues are discussed. The information distributor, who connects other individuals and makes a certain group, plays a significant role in the network in terms of making a cluster of users. The role of this message distributor should be considered to see how health related information is shared among the people in the networks.

This research will examine how people share health information on social networks by looking at the patterns that users display within the network. In order to see the patterns; the users who connect individuals in the networks play a significant role, so these users will be introduced with the concept of structural hole. This research asks a question about what makes people more involved in the conversation. Therefore, it will introduce the concept of reciprocity to explain how well people are involved in the conversation in Twitter. As a result of their interaction, the types of benefit they would obtain will also explicated. By analyzing the role of information distributors, the types of informational leadership is constructed within social networks are also studied in this study. The implication of the study will be about what obesity and weight-loss issues discussed within social network environments mean for individuals and communities in the social network environment. In order to suggest the potential of Twitter as an alternative information source and the place for fostering influential users within the community, the hubs in each community are analyzed in terms of their characteristics.

CHAPTER 2

Literature Review

This chapter will lay out the theoretical and conceptual frameworks for this thesis to address the interest on obesity issues, the role of social media as a tool for information gathering and the relationship among these core concepts and theories. As for the theoretical background, social networks and the concept of the structural hole will be introduced to explain how people interact reciprocably within their community. How social media can serve the public as an arena for sharing health information will be explained with uses-and-gratification perspectives. With the theoretical frameworks, this thesis will address what message types are mostly employed among the information hubs for the best benefit that we can expect. Therefore; In addition to the theoretical background, explications of concepts for research questions, typologies for health messages and reciprocity are also introduced in this chapter.

Problem & Significance

Current nationwide trends on obesity and media

In recent years, obesity has become an increasingly serious health issue (WHO, 2006). The obese population in America has doubled during the last 30 years (CDC, 2010). The improved accessibility of affordable food and the increasingly sedentary lifestyle of human beings has contributed to obesity all over the world. As the obese

population grows, the ratio of patients being diagnosed with cardiovascular disease has increased as well. This phenomenon shows how urgent the health issues from obesity are and also urges scholars in various areas to study how people can reduce the risks from the health issue of being overweight.

People seek out ways to manage their health by utilizing information sources as much as they can. In order to manage health, obesity in particular, the public has sought the assistance of health professionals and media sources, which include print media and broadcast media (Gearhart, Craig & Steed, 2012; De Brún, McKenzie, McCarthy & McGloin, 2012; Shugart, 2011; Yoo & Kim, 2013). The recent rise of social media has led to an exponential increase in the potential to reach the wide public; no matter the message or the purpose.

How has obesity been studied in relation with the media? For 10 years after the new millennium, 8.2 percent of studies from *Health Communication* and the *Journal of Health Communication* were about obesity and its related issues such as healthy eating and exercise (Nazione et al., 2012). Based on a study by Nazione and colleagues (2012), it was found that obesity and its related issues are less studied than other physical health categories.

Obesity and the media have been studied together with a variety of areas of emphasis: mediation (Miles, Rapoport, Wardle, Afuape & Duman, 2001; Vandewater, Shim & Caplovits, 2004), prevention (Haines & Neumark-Sztainer, 2006), attitude (Abramson & Valene, 1991), and health literacy (Livingstone & Helsper, 2006; Rich, 2011). Even though scholars have tried to investigate this health issue from a communication perspective with various topics of interest, how this health issue is really

dealt with in social media environments has not been emphasized or studied as much. Although the significance of weight-loss has increased (WHO, 2006), little is known about how social media provides the users useful information and what makes the users become exposed to the messages.With the information sharing paradigm shift; what causes the public to engage more in interaction needs to be studied more.

Shift in the paradigm of information sharing

Current information use can be explained as sharing open information. This is not an exception for health information in the mass media as well. Many scholars have studied the relationships between media and health. However, the studies about traditional media have some limitations for an explanation of current health information uses of social media.

Previous studies have focused on how traditional media displays and frames obesity in network news and print media such as newspapers, magazines, and photographs (Gearhart, Craig & Steed, 2012; De Brún, McKenzie, McCarthy & McGloin, 2012; Shugart, 2011; Yoo & Kim, 2013). Some studies have also focused on obesity and social media; however, these studies are also about users' perceptions about obesity on social networks (Yoo, 2013). These studies were performed on the premise that the direction of the message being conveyed through mass media is unidirectional. Unlike the unidirectional of messages in traditional media, social network sites are public domains where the user actively seeks out information he or she needs so that the information flow is multi-directional. In this environment, social media plays a different role and influences user behavior in different ways than traditional media (Robledo,

2012). So what makes social media special in terms of the possibility to change users' behavior by utilizing its interaction?

This interactive phenomenon is notably different from the way information was transmitted using traditional media Interactive media environments have made communication cross the border of mere information transmission into a collaborative effort to create and share information (Eysenbach, 2008; Han et al., 2009). With this in mind, how social media makes the users to share information successfully need to be focused, especially within Twitter networks.

Social Network

Structural hole

Successful information sharing can occur with the help from information distributors who possess many structural holes. Structural holes, here, refers to the separation between nonredundant contacts (Burt, 1993). If a person/user is located in between two other separate chunk of individuals, like a bridge, what he/she distributes within the network has more efficiency and effectiveness (Burt, 1993). Podolny and Baron (1997) also asserted when a person plays a role as a bridge in the structural hole, and possesses more non-redundant contacts, its effectiveness increases.

The effectiveness of structural hole refers to how well it functions in terms of engaging the users to the interaction, because the users that work inbetween structural hole plays a role of bridge, and connect to other participants in the interaction. Therefore the effectiveness of the structural holes is measured with betweenness centrality, which indicates how well a user connects individuals within the network. Structural holes are

located at the center of clusters of individuals in the network. By bridging the individuals, the structural holes construct certain clusters and it becomes a pattern. Knowing the pattern is seeing if the engaged users are really reciprocating. What makes the people reciprocate in the social network environment?

The concept of reciprocity

The basic mechanism that works within the social network environment is reciprocity. Gouldner defined what reciprocity is in his article *"A norm of reciprocity: A preliminary statement"*, which says that reciprocity is a mutually contingent exchange of benefits (Gouldner, 1960). Nowak and Sigmund (2000) thought reciprocity as a cooperation in the society. Recently, Molm (2010) defined reciprocity as "the giving benefits to another in return for benefits received." With these definitions of reciprocity in mind; it becomes clear that benefit between the users in the social network environment works bilaterally and cooperatively. With the concept of structural hole and its role in social network, how well the interaction is mediated by the bridges in the network becomes important. Therefore, measuring betweenness centrality can provide us with information on how well reciprocal interactions can occur, and how densely the users in the network interact are measured by density, which is the numerical index that shows how cohesive the interactions are. In this environment, then, what benefit would people expect from the endeavor they put within the social network environment? What kind of interaction do they display for obtaining mutual benefit? In order to answer these questions, reciprocal exchange of benefit needs to be addressed and explicated.

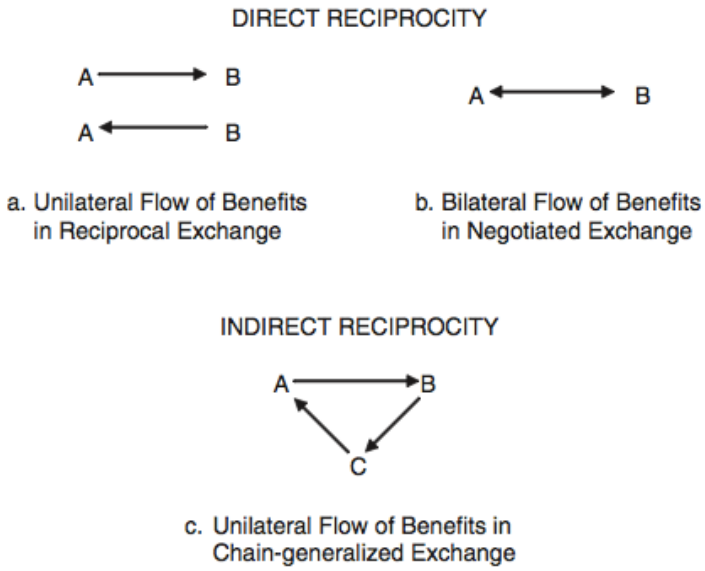

Figure 1. The structure of reciprocity in three forms of exchange (Molm, 2010)

Molm (2010) explained how reciprocity is provided within a network of people. People construct a certain network and the information sharing is done with designated directions which are multi-directional. In Twitter networks, people show unilateral flow of benefit in reciprocal exchange, because they construct a network by following or retweeting. Following and retweeting can be made without the permission to be followed or retweeted. A good example of bilateral flow of benefit is found on Facebook, in which people make connections by friendship and requires permission to be friends. Then, how does benefit exchange work in this system?

This study has to be mindful of what kind of benefits the users would obtain when they are engaged in interactions within the social network environment. Users obtain certain benefits from their interaction within social network environments. From interactions that share health related information on social networks, the users obtain messages from distributors who are connected to many users. These message distributors

can acquire a certain role within the environments and the users who look for information about a certain health issue can fulfill their informational needs to be better at their health status. That can be illustrated in the diagram below.

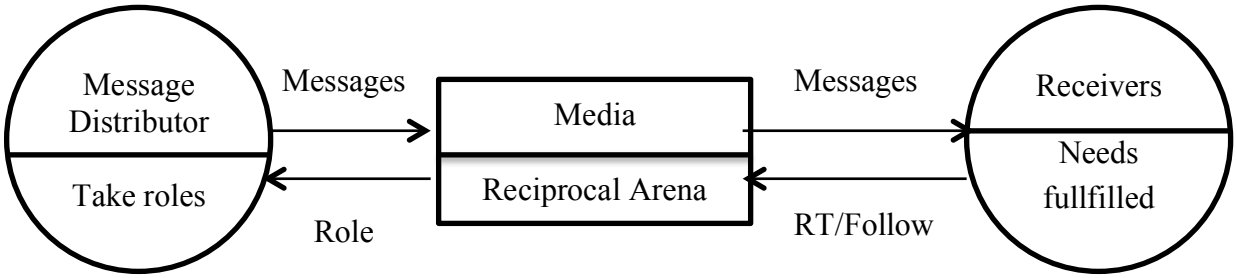

Figure 2.
Roles of health message distributers and Audiences' fulfillment of informational needs

Message distributors obtain a certain role in terms of the types of information they send out throughout their connections they have. Depending on the types of information they distribute to people, their roles within the social network environment are stipulated. For instance, if they send out the messages that have informational content, such as hyperlinks to the relevant news articles, they play roles as informational message leaders among the people who construct a cluster of subscribers within the networks.

This study defines what *reciprocity* is in the social network context as the cooperation of people for benefit exchange. That is, the message distributors benefit by obtaining certain roles depending on what types of messages they distribute, and the audiences or message receivers benefit by fulfilling their informational needs by following the message distributor and have themselves searched for and read the information they are interested in. The media plays a role as a reciprocal arena in which

the engaged users, including message distributors and the message receivers, acquire the benefits. This exchange from the interaction is addressable with the uses-and-gratification theory in terms of gratifying involved users throughout the interaction.

Uses-and-gratification

Thanks to the development of media, people have now become more capable of utilizing digitalized tools to fulfill a certain need. Especially with the help of the internet, people have become more "active audiences" rather than "passive audiences" that were explained by the scholars with early perspectives of uses-and-gratifications (Katz, 1959; Katz, Blumler & Gurevitch, 1973; Ruggiero, 2000; Sundar & Limperos, 2013). Uses-and-gratifications theory was coined and used by communication scholars to explain attentive and purposive user behavior with media (Katz,1959; Katz, Blumler & Gurevitch, 1973; Sundar & Limperos, 2013). That is, this theory provides explanation of the relationship between the two variables: needs to use media and gratification obtained from the use.

Sundar and Limperos (2013) applied uses-and-gratification theory into current media use. They explained how uses-and-gratification perspective is applied to current media by asserting interactivity based gratification. Interactivity based gratification is satisfying the users' needs or wants through the interaction within social media, so that the benefit exchange among people was enabled under this circumstance. That is, the reciprocity among the people increases as they try to yield the best benefit they can expect.

Theoretical extensions with relevant concepts: hubs, communities and ties

Hubs, leaders of communities: Who tweets what? Informational leadership-inferential significance.

Knowing influential individuals in a Twitter information network helps choosing proper keywords for information dissemination with a certain purpose (Hansen, Shneiderman & Smith, 2011). These influential individuals are more likely to play roles as bridges within the network. They are the message distributors. Health professionals, health care providers and the public, therefore, need a proper strategy to achieve a certain goal in regards to their health issues, andese message distributors can help the health professionals by letting them know how the health issue is talked within the network.

With the perspective of reciprocal interaction among the users in social network environments, the influential individuals, message distributors, take certain roles as their rewards. They distribute health messages to the others who are connected to them, so that they become information hubs, because of their informational leadership in the communities. What they are doing is not exactly same with the concept of leaders in previous communication research on the concept of leaders.

What is the difference between opinion leaders and appearing leaders in social networks? Opinion leaders are distinguished by their characteristics of message filtering and rendering (McQuail, 2006). They obtain information from the original information sources, then they edit it and render the messages, targeting the audiences. Opinion leaders' subjective perspectives can be reflected in the distributed messages. However, leadership appearing within the social network might show different message distribution and show different leadership. For instance, when we think about "retweeting", the

function of this behavior focuses on message transmission rather than provision of the subjective opinion of the leader. Some questions about the leader in the social network, so-called hubs in the cluster of individuals, arise. What types of roles do they play in terms of the information they distribute within the social network, particularly, about diet/weight-loss issues?

Twitter allows people to construct a community of common interests: Communities as functional arenas

The Oxford dictionary defines community in two ways: "a group of people living in the same place or having a particular characteristic in common" and "a feeling of fellowship with others, as a result of sharing common attitudes, interests and goals" (Oxford, 2014). Weinberg and colleagues (2013) asserted that community study is to emphasize collaboration and knowledge sharing. As business scholars, they expanded their idea of community on social media to alternative form business. With this definition and application of community in mind, this study defines the community as group of participants in the network, where exchange of benefit occur. Therefore modularity from social network analysis is used to see how distinctively the communities are constructed. It also will allow us to see if the benefit exchange occurs in a cohesive manner.

Recently, Himelboim and Han (2012) studied visiting communities and core communities about cancer topics on Twitter. They conceptualized twitter communities as "a group of interconnected users who share an online space and talk about common interest" (Himelboim & Han, 2013). Their study found there were different levels of density between core communities and visiting communities. There are also different

levels of density among the visiting communities, as well. The results focused on the types of communities and their different level of density, however, this thesis takes a more in-depth look at the communities to see the specific pattern that communities within the network display.

Looking patterns of the communities lets us know how information within the network is consumed. For instance, if a major community cluster appears, it means the information flow depends on the major hubs. However, if there are relatively small communities and a disconnected pattern within the communities of the network; it means that there are no dominant interactice clusters. This shows that the reciprocity among the communities would be relatively lower than the ones with major clusters. In that case, more strategies for need to be proposeed. The above explains that clusters within the network play a significant role in showing distinct patterns within users engaging within social networks.

Many scholars have studied and concluded that that people have been sharing information together for mutual benefit.Webster and colleagues (2013) have asserted that supportive local communities can make a great impact by providing a positive influence in physical leisure activity. The WHO (1986) highlighted the importance of people's control over health conditions by galvanizing participation and intersectoral cooperation. Based on this idea, WHO launched the Healthy Cities movement to raise public awareness of this issue and the ability to cooperate with each other to achieve goals in health management (Glanz, 2008).

As communication technology such as the Internet has developed, communities which are geographically apart also have been studied. The studies of online support

groups (Lieberman at al., 2003; White & Dorman, 2001) have shown how much effect those online support groups have on health promotion, and the effect of reciprocity in those support groups was studied as well. However, those studies have some limitation in terms of explaining individuals' characteristics and cues to actions because those studies focused on groups instead of individuals. Noting Han's(2011) study of interactive health communication system, the effect on health status through media is up to how people use what is given to them.

Heaney (1991) has mentioned that social ties exist among the people who construct a community and, even further, that a society has much untapped potential. This statement tells a lot of things to researchers who work in the area of social network and society. In order to maximize its effect, the individuals participating in social networks have to make the most of their information sources. Indivisuals who have more connections than others can serve as hubs, so as to connect members in the community to transmit information and stimulate the public for certain purposes, especially weight-loss in this research.

In the long-term perspective, distinguishing the characteristics of influential individuals would be useful for a provision of guidelines for social media users in terms of obtaining the support they need (Heaney & Israel, 2008). This research wants to focus on the individuals who have many edges (connections) to the others, otherwise known as hubs.

The clusters are enabled on Twitter networks, which are arenas of reciprocal interactions, This is where people engage themselves in the interactions expecting a certain benefit from the interaction. The benefit is contingent upon their interaction;

Twitter is therefore playing a role as a venue where the message receivers fulfill their informational needs and message distributors obtain a certain role as leaders. This function is studied with the systematic social network and content analysis of tweets. Therefore, the first research question is presented. By answering this research question, this study will find how they interact and construct a community when they talk about weight-loss within Twitter networks.

RQ 1. What patterns do the information hubs and their subscribers display when they talk about weight-loss within Twitter network?

What we talk about becomes a tie to engage people in a group: Social ties, messages

In analyzing social networks, researchers can expect various social functions of social networks: social influence, social support, social control, social undermining, social comparison, and companionship (Heaney & Israel, 2008). Among these functions from social networks, this research will focus on the concept of social support by observing reciprocity and its causal relationship with message content. As a tool for measuring the relationship between reciprocity and what people really say, tweet, network and content analysis are employed.

This research is to explore what types of information shows more reciprocity among the people within the social network environment. Therefore, how information benefits individuals involved in the interactions on social network has to be studied. Heaney and Israel (2008) introduced the concept of informational support, which is

bilateral and benefits message senders and receivers in a certain ways through information.

The information people share becomes a social tie to connect people. Granovetter (1973) asserted that there are two types of social ties: strong and weak. His research proposed that those two ties have different effects in a community/group. Strong ties are demonstrated with the bonding function in the community. That means strong ties become explicit when there is solidarity within the group. On the contrary, weak ties become bridges between individuals and play a role as connections, which mean individuals who possess more weak ties are more likely to have flexible participation in information sharing within social network environments (Sutanto, 2013). Within Twitter networks, connections are made by following relationships and retweeting, which represent strong and weak ties. Although the following relationship refers to stronger ties than retweeting does, this study will focus on retweet relationship, which can explain how reciprocity is triggered by information sharing. In the center of information sharing, there are information distributors who send out information. There are also others who respond to the messages the distributors send out. Is there any unique pattern that the users display in terms of health information sharing? What makes people respond to the message distributors? What types of health information do people share? How should the information/weight-loss strategy be distributed and introduced to make the reciprocal information sharing? This thesis, therefore, analyzes how health information is disseminated on Twiter, with an emphasis on “what” and “how” these messages are spread.

Health messages on Twitter

What kind of information is retweeted so that it creates higher reciprocity? In other words, what types of health information do reciprocal networks share? In Twitter networks that concern weight-loss strategies in general; people look for weight-loss information mainly in two branches, energy intake and energy consumption. Both of them include many subsets of how to lose weight; for instance, energy intake includes food planning, such as taking protein shakes, eating vegetarian food and cutting back on calories, and so forth. The other strategy, which is energy consumption, includes exercising, receiving personal training, and other daily physical activity.

As summarized above, information about weight-loss or diet diverges into two main branches: energy intake and energy consumption(James, 2012; Utter et al., 2012). It becomes the bottom-line tailoring strategy for the information providers regarding this health concern because people seek out weight-loss strategies considering their health status. That means people look for information depending on whether they have to focus more on exercising or eating habits. There are some exceptions like smoking habits or medical treatment, such as undergoing surgery (Utter et al., 2012); however, the ratio of these strategies are relatively low.

This research is to observe how weight-loss strategies are talked about and shared within social network environments. It also explores how well these strategies are shared, by analyzing users' reciprocity via social network analysis.

RQ 2. What kind of weight-loss strategies display higher reciprocity among the users?

- What information does a message provide?

Snyder and Hamilton (2002) have suggested types of health messages distributed through health information channels. The types of health messages are to provide health campaign planners proper strategies for the campaigns. The message types are enforcement, new information, services, and role models. These categories are important in this thesis in terms of finding out the characteristics of hubs and their functions within the social network.

Table 1.
Categories of health campaign messages and examples

Messages	Categories	Examples
Health campaign (Snyder & Hamilton, 2002)	Enforcement	Messages contains negative sentiment. "If you take more than 2mgs of sodium per a day, the possibility of cancer would increase."
	New information	Messages with detailed information, which including rephrasing what it was already known.
	Service	Messages with solution for a certain health issue. "For your success on your diet, see a health professional who can help you!"
	Role model	Messages tell a story of an individual who experienced health improvement.

In order to explain why health messages contain sentiments of enforcement, Snyder and Hamilton cited Kelman's (1958, 1961) research on social influence. Kelman asserted that social influence begins with a trial to coerce compliance. Messages with the notion of negative effect of a certain behavior might cause the message to be more effective to the target population. Therefore, enforcement information about weight-loss on Twitter will contain words that have sentiments of warnings and coercive appeals.

The new information category can be distinguished by noting the detail of health issues. Snyder and Hamilton (2002) explain this type by providing an example of the new information. If a message carries reasons to change their health behavior, or a restatement of old information, this message is classified in new information.

Service messages contain information noting the detail of how health issues can be resolved. For instance, the messages contain words and phrases with the sentiment of recommendations are considered as service information. If information is about consulting individuals and suggesting them visiting the clinic and seeing a health professional, or providing direct messages about how to improve their health condition, the information is categorized as service information.

Role model information includes feature stories about the people who changed their health behavior and obtained positive health results. The role models can contribute to an increase of motivation to change their health behavior and be healthier (Snyder & Hamilton, 2002).

Depending on the information the hubs distribute in social network environments, the types of information that individuals sensitively respond will be found. Also, if the hubs' characteristics are found, it would be helpful for general Twitter users

who seek out strategies for their health purposes in terms of setting proper goals to achieve. Therefore, the following research questions are presented below.

Although many scholars have studied about how information is shared and who plays a role as opinion leader, little has been studied about whether the public sphere provided from the Twitter environments really works as a good source of health information. If Twitter does not function well as an information source in terms of its reciprocity of the users within the networks and messages that flow throughout the networks, it fails to become an alternative information source for health purposes. By looking at how coherent the communication is and what makes communication work within the Twitter networks, we will find if Twitter works as an alternative information source for their health management, which proves how the functional use theory works.

Particularly, what this thesis focuses on is how weight-loss information is diffused and what types of information have more potential on constructing higher reciprocity, and allowing social media to become a reciprocal venue to gratify the users who participate in the discourse. Therefore, the following research question is presented below.

RQ 3. Will the communities with in the Twitter networks show different levels of reciprocity, depending on the types of information distributed by the hubs (e.g., enforcement, new information, services and role models) (Snyder & Hamilton, 2002)?

With the answers from the analysis, this study will be able to propose what influences the network to have higher reciprocity, how people use information about

weight-loss on Twitter, and what types of information are mostly shared. In order to answer the research questions, social network analysis and content analysis are employed.

In the next chapter, the detailed explanation about methodology for the analysis of this study. Precisely, the details about social network analysis and applied content analysis will be introduced. Throughout the measurement, how the research question would be answered will be followed.

CHAPTER 3

Method

In this chapter, methods for this research are explained. In order to answer the research questions, social network analysis of the Twitter network and content analysis of the weight-loss talk (tweets) are employed. Explanations for each methodology and why they are employed for this thesis are also introduced in this chapter.

Social network analysis

Social network analysis has its origin in the research on ties. The most frequently cited article of social network research in relation to ties is that of Granovetter's (1973) (Prell, 2012, p.76). Granovetter's research demonstrated weak ties work better as an information source than strong ties do since strong ties are usually found in close relationships like with family and friends. The content of the information within this social circle is not widespread, but redundant (Prell, 2012). That is, social network analysis is a suitable tool to answer the research questions given in the previous chapter.

This thesis deals with the ties that connect individuals within a social network environment. How weight-loss information is shared among individuals in a certain community and the characteristics of hubs in the community as information sources are specific foci of this thesis.

This research targets Twitter networks. In order to gather data about the relevant information within a social network, NodeXL, which is developed by Microsoft to gather

and analyze data on social networks, is used. NodeXL provides proper metrics that is applicable to explain certain characteristics of a cluster of individuals and the hubs that play a role as an information source. By measuring the metrics given below, the characteristics of weight-loss communities are analyzed.

The data was collected from the Twitter network by employing NodeXL. The data contains the recent information from the day of data collection about the keywords. Since obesity is considered one of the chronic symptoms and people are pervasively interested in the weight-loss and diet, this data collection can capture a description of what people do with social media for their weight management. In order to avoid possible bias on the data, the data collection was performed a total of four times. The data was gathered on 5/31/2014, 6/4/2014 and 6/10/2014 respectively.

Keywords for data gathering

This research will explore the characteristic of communities that are constructed in Twitter networks in regards to weight-loss. Considering the topic, scholars have suggested that important ways of weight-loss are energy intake and energy consumption (James, 2012 & Utter et al. 2012). The keywords for this research will, therefore, consider these two strategies. The most typical way to consume energy is to exercise. As for the energy intake, "food" will be another keyword to gather the data.

Table 2.
Search strings for data collection

Date	Search strings	Node	Links
5/31/2014	Diet weight loss	690	597
6/4/2014	Diet OR weightloss food OR eat	3161	3050
	Diet OR weightloss exercise OR workout OR training	820	777
6/10/2014	Diet OR weightloss exercise OR workout OR fat	537	443
	Diet OR weightloss food OR eat	952	842
	Diet OR weightloss exercise OR eat	987	856

Metrics to discern the characteristic of a weight-loss community.

Density: Cohesive communication, How well they support each other?

How well the community is functioning as a support group is predicted by how cohesive their communication is. Scholars have asserted that cohesive communication and reciprocity are closely related to each other (Hanneman & Riddle, 2005; Kadushin, 2012). The density in this research becomes one of the measures of the reciprocity because it represents how much the individuals are interconnected to each other in each cluster (Himelboim & Han, 2013). Where more interactions occur, higher density appears.

Modularity: How distinctive are the communities?

Modularity shows how distinctive the clusters are within the network. If the modularity is high, each cluster is distinctive from one another. It means people tend to subscribe to a designated cluster rather than subscribing to other clusters altogether.

Betweenness centrality: as a measure of a functional aspect of information hubs

Betweenness centrality refers to the number of the shortest paths between two users in the networks (Hansen, Shneiderman & Smith, 2011). Betweenness centrality is a measure of the functional aspect of information hub and a measure of reciprocity of the networks as well. It means that if a user displays higher betweenness centrality than others, that more essential information passese through him or her.Therefore, betweenness centrality becomes one of the essential metrics that should be provided for this research in order to observe if the message distributor works well and allows the users to work reciprocally.

The data is clustered with the Clauset-Newman-Moore algorithm, which enables modularity, the numerical indicator of how distinctive each group is, and displays the how reciprocal the clusters are. If modularity is high enough (>.6), it is considered the clusters in the network are quite distinctive.

Applied Content analysis of Tweets

In order to answer each research question, coding for content analysis is performed. Two coders including the researcher herself coded the collected tweets in regarding the two message categories; weight-loss strategies and campaign messages.

The research questions are looking at whether there is a relationship between the measured reciprocity and the message content. Further, this study will try to find what types of messages would contribute to higher reciprocity among the clusters of Twitter users who talk about obesity and weight-loss issues.

Content analysis is considered one of the most important methods in communication research. According to Lasswell, this method is a quantification of what people communicate. This method is performed within the verbally expressed data analysis. Traditionally, it has been performed with verbally recorded data through mass media such as newspaper, magazines, books, radio broadcast, films, etc. (Krippendorff, 1989). As for the current media occasions; the applicability of this method is expanded to the internet, which records the discourses, articles and even pictures automatically and almost permanently.

How should the data be coded?

Two coders (male and female coders) are trained to code Twitter data to analyze the content of tweets, which are coded in two different variables: weight-loss strategies and information types. In order to calculate the intercoder reliability, 10% of the data is randomly sampled and distributed to each coder. Cohen's kappa is calculated for reliability. The measurement of intercoder reliability is performed twice. From the first measurement of intercoder reliability, Cohen's kappa was .80 for weight-loss strategies, and .84 for the health campaign message category. After the first measurement, the coders discussed about disagreements that happened during the first coding and updated the coder's manual and measured Cohen’s Kappa once again.

In main coding, Cohen's Kappa for weight-loss strategies was improved up to .88. The Cohen's Kappa for health campaign message category improved up to .91.The coders were given coding sheets and data that were collected by Node XL, which allows researchers to analyze social network data by providing its visualization and necessary metrics. The data was collected in three consecutive weeks, 5/31/2014, 6/4/2014 and 6/10/2014 respectively. The date for the data collection was also randomly selected.

Data cleaning and random sampling

This study looks at how people interact and what types of benefit they acquire. The purpose of the study supports that the data of self-loop cannot be included for this study. Therefore, the data should show the connections between users that can be interpreted in reciprocity.

In order to make the quantity of data manageable, random sampling for content analysis was performed. Node XL randomly collected data from the Twitter network based on the given keywords for data collection. From the previous social network analysis, the top 10 hubs in each data set were selected for the content analysis.

By searching the usernames of top network hubs, what they had recently tweeted about the topic, "weight-loss" or "diet" was collected. In order to make analysis manageable, random sampling for the tweets was also performed. The maximum number of collected tweets from a user was randomly chosen but analyzed the most recent 60 tweets, which let us see the data in two-month cycles, for manageable analysis. However, users sometimes might not tweet for obesity information frequently or on a daily-basis,

so the number of collected data from a user varies in each hub. The tweets for content analysis were randomly selected and analyzed.

When selecting the message hubs, the number of in-degrees is considered important, and what they have tweeted about weight loss or diet is considered as well. For instance, if one of the top hub reveals higher reciprocity than others that means that the people in that hub have not been constantly interested in the health issues. However having lots of followers would hamper proper analysis for this study. For instance, if a celebrity tweeted and said, "I am going on a diet from today!" or "I will try to lose weight from now on!" and thousands of his/her follower retweeted, this retweeting activity might not be defined as obtaining information about weight-loss or work reciprocably with eatch other. However, Twitter networks display different clusters of users and information flow each day. Therefore, the Twitter analysis was performed with the major hubs displayed in the network analyses.

As for the content analysis, a coding sheet was distributed to the coders. The coders code the data in terms of weight-loss strategies (controlling energy consumption or energy intake) and types of messages. Providing tips for weight-loss or diet with a limit of 140 characters might be a difficult task to complete, so hyperlinks are widely used by the users in Twitter networks. Therefore, coders also able to code whether the tweets contained hyperlinks and what content the hyperlinksn shared; which was also coded in the coding sheet, as well.

Coding scheme

Coding for the content analysis is performed considering relevant variables for this study. The coding sheet for the coding is attached in the appendix 1. The details are presented below.

- Tweet #: Randomly assigned number of each tweet, was presented at the end of the columns

- Coder: you have to fill in the initial of your first and last name. e.g., Andrew James, AJ
- Weight loss strategies :
    - Energy consumption : 1
        - This information is about how to consume the energy. For instance, how to burn fat or information about exercise are included in this category.
    - Energy intake: 2
        - This information is about how to take in energy. For instance, how to eat well for diet or information about the food with low calorie, and low sodium content are included in this category.
    - Two and more : 3
        - If the tweet has both of the information or more, it is included in this category
    - Others: 4
    - N/A :0

        - If the tweet is not applicable to any of the categories above, which means the tweet is not about weight-loss or Diet, it is included in this category

- Campaign: What campaign strategy is employed? (Snyder & Hamilton, 2002)
    - Enforcement: 1
        - The message contains negative sentiment. E.g., “If you take more than 2 mgs of sodium per a day, the possibility of cancer would increase.”
    - New information: 2
        - Messages with detailed information, which includes rephrasing what was already known. E.g., “You already know that having oatmeal for your breakfast can help prevent heart disease, what’s more?” or providing instructions for food or exercise.
    - Service: 3
        - When a message hasa solution for a certain health issue, it is a service message. E.g., “For success on your diet, see a health professional who can help you!”
    - Role model: 4
        - When a message tells a story of an individual who experienced health improvement. E.g., “This is the story of Tony Brook, who shed 50 pounds and got a new life!”
    - N/A: 0

        - If the message is not applicable to any other category,

- hyperlink: Does the twit contain the hyperlink?
    - Yes:1
    - No: 0
- Content: what sort of content does a hyperlink connect to?
    - Research article: 1
    - News article: 2
    - Blog page: 3
    - Photograph: 4
    - Video: 5
    - N/A:0

After the coding, the coded data was to be analyzed statistically by using SPSS (Statistical Package for the Social Sciences). The results are introduced in the following chapter.

CHAPTER 4

Results

In this chapter, the research questions are answered based on the data analysis. the research questions are answered in order, and backed up by the proper evidence. This thesis answers the research questions by employing two different methods, social network analysis and content analysis.

Social Network Analysis

In order to observe the pattern of how people talk about weight-loss or diet within the Twitter network, social network analysis was performed by employing NodeXL, which is a Microsoft add-on that analyzes and visualizes the interaction between the users within social network environments.

- Data collection

Data collection was performed during three consecutive weeks. The date for data collection was randomly selected in the weeks. The search strings were categorized into three areas: energy intake, energy consumption and general information on diet and weight-loss. Three data sets were collected for each category. Each dataset captures the talk on weight-loss or diet for a day or a couple days from the date of data collection.

The keywords for data collection were introduced in the table given above (Table. 2). The keyword selection was to include as much information as possible, so the

search strings were consistent with the keywords of diet, weight-loss and each respective strategy. Data collections were performed on randomly-chosen days in three consecutive weeks, 5/31/2014, 6/4/2014 and 6/10 2014. Some of the data that was collected on 5/31/2014 collapsed, so additional data collection with the keywords was performed on 6/10/2014 so that the number of each data set stayed the same. The number of nodes that describe the number of individuals who are involved in the discourse about diet or weight-loss varies from 537 to 3161 (M=1191.167, SD=979.387). The number of unique edges varies from 597 to 3050 (M=1094.167, SD=971.327).

After the data collection from the Twitter network, analysis of the clusters was performed. The collected data were clustered with the Clauset-Newman-Moore algorithm, which allows us to see the modularity; the numerical indicator explaining how distinctive each cluster is. There are distinctive clusters that have meaningful edges and measurable group reciprocity. As introduced in the method chapter, the measure of reciprocity is based on density, number of in-degrees and betweenness centrality.

From each data set, the top ten hubs were selected based on their numbers of in-degree, and betweenness centrality measurements. This is because the number of in-degree shows how much the subscribers of the hubs respond to the hub actively. The betweenness centrality explains how well the hubs played roles as information distributor to the subscribers. This means it shows how well interconnectedness will be displayed. The selected ten hubs from each data set show the highest numbers in in-degree and the highest value of reciprocity.

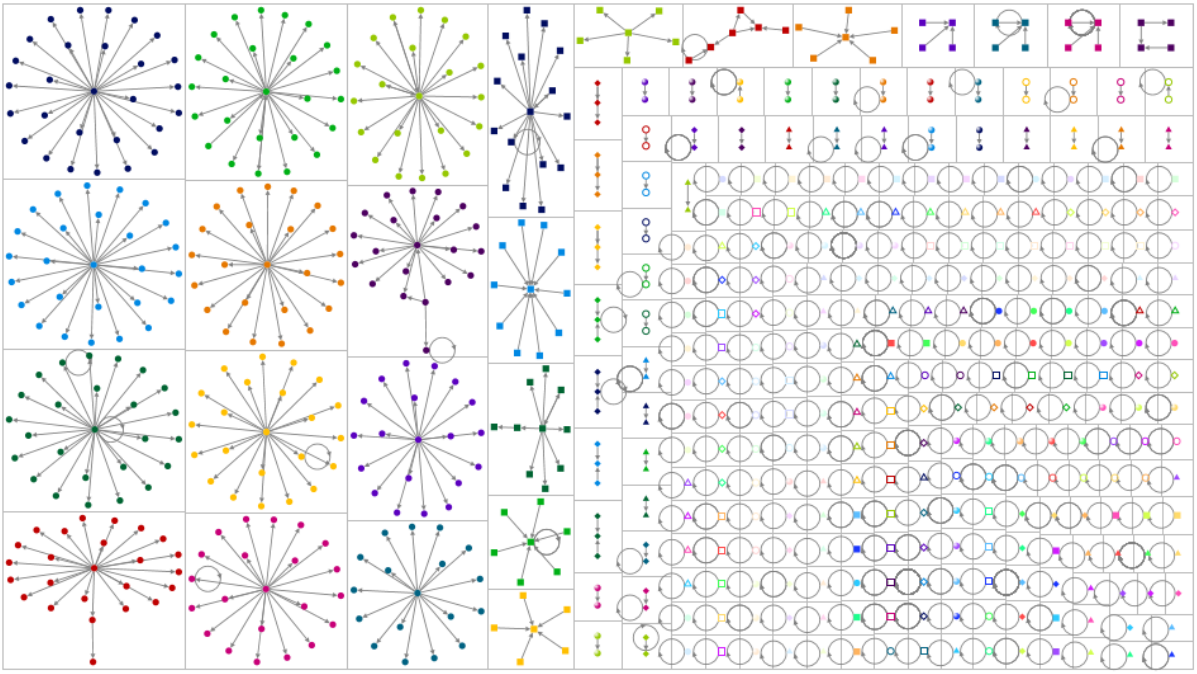

Figure 3. Network map of *20140531 diet weight-loss* data

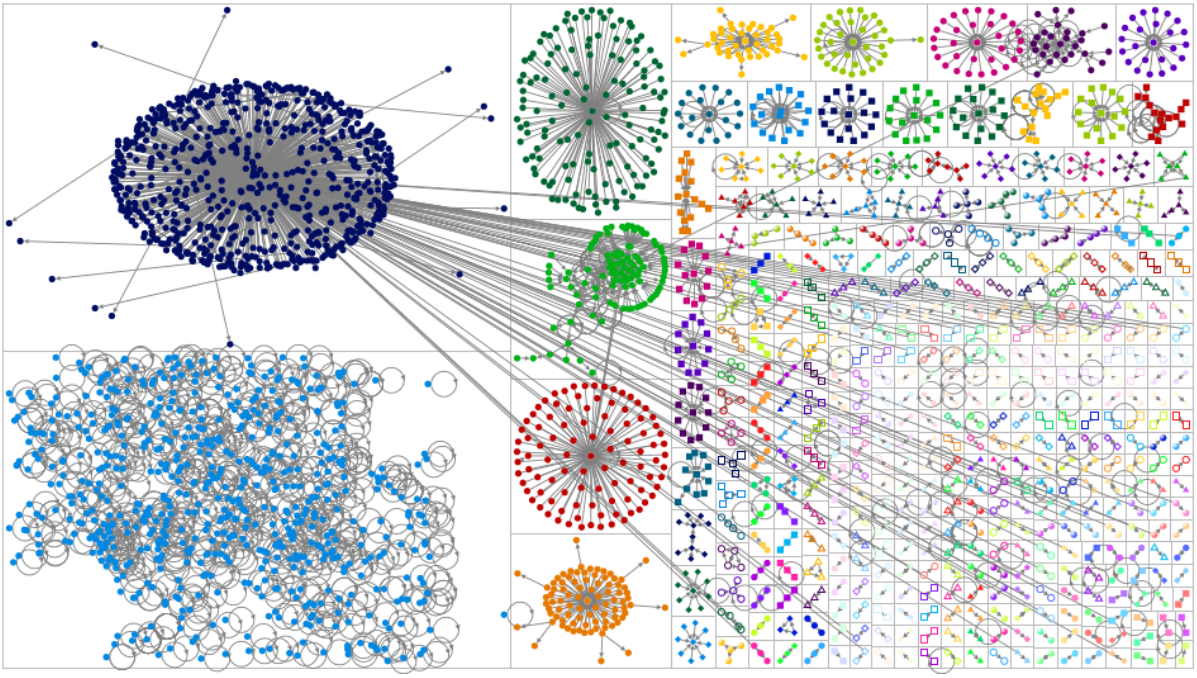

Figure 4. Network map of *20140604 diet weightloss food eat* data

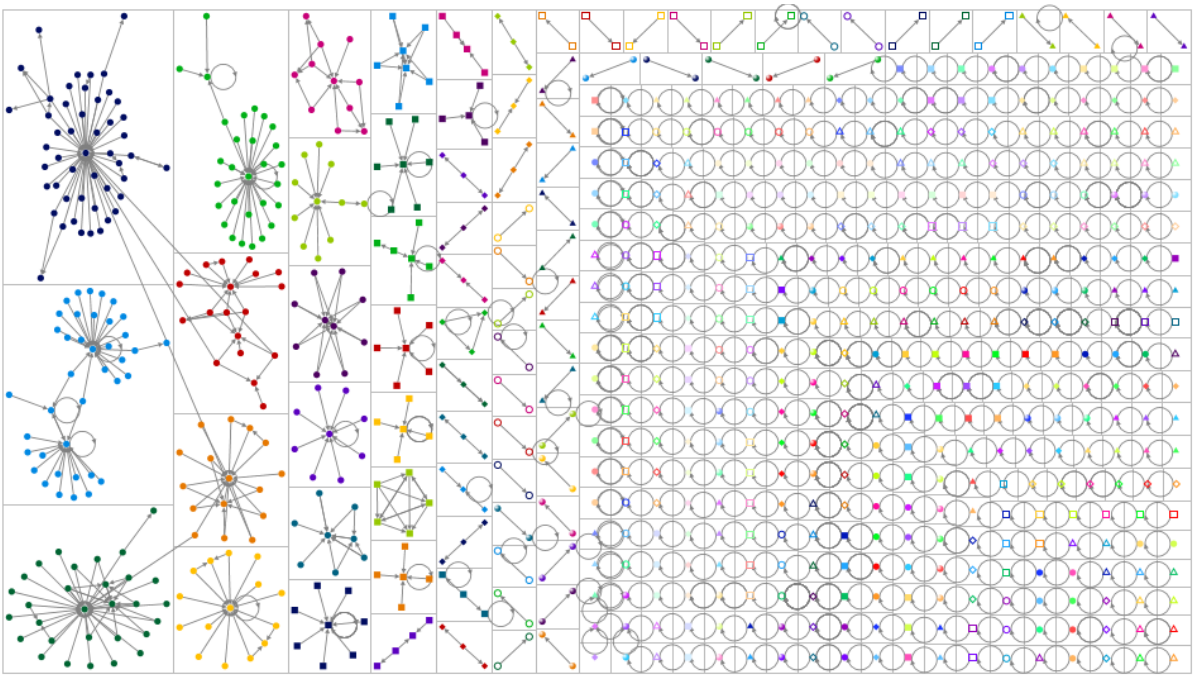

Figure 5. Network map of *20140604 diet weightloss workout exercise* data

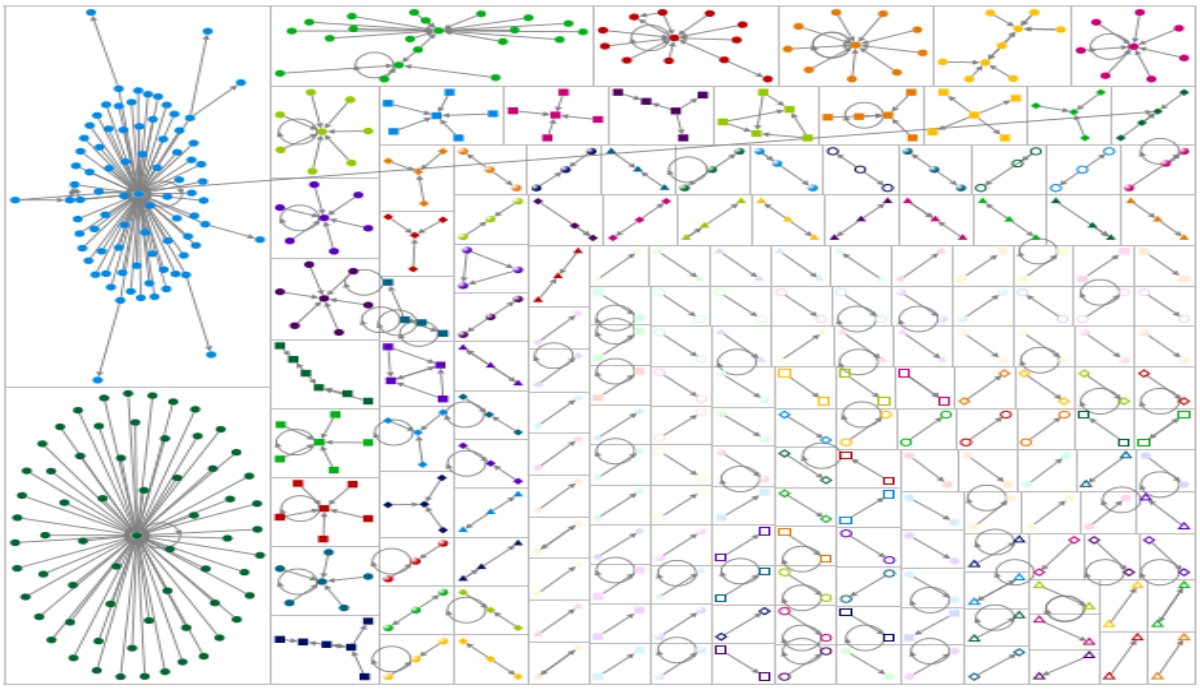

Figure 6. Network map of *20140610 diet weightloss exercise eat* data

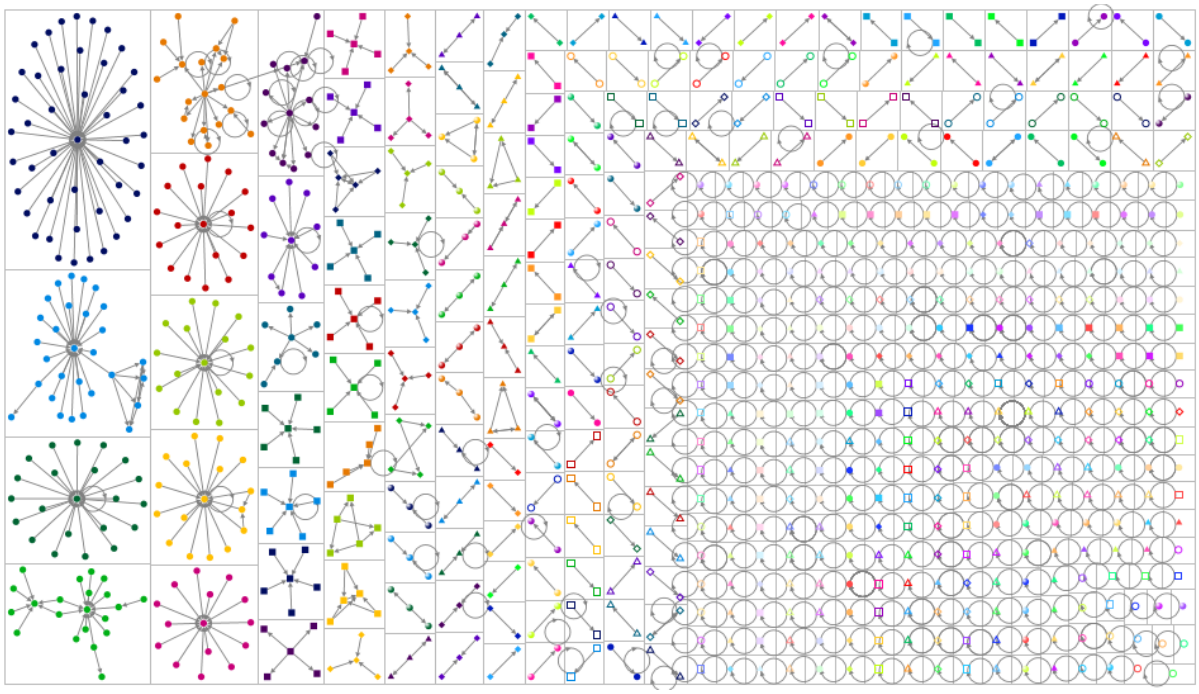

Figure 7. Network map of *20140610 diet weightloss food eat* data

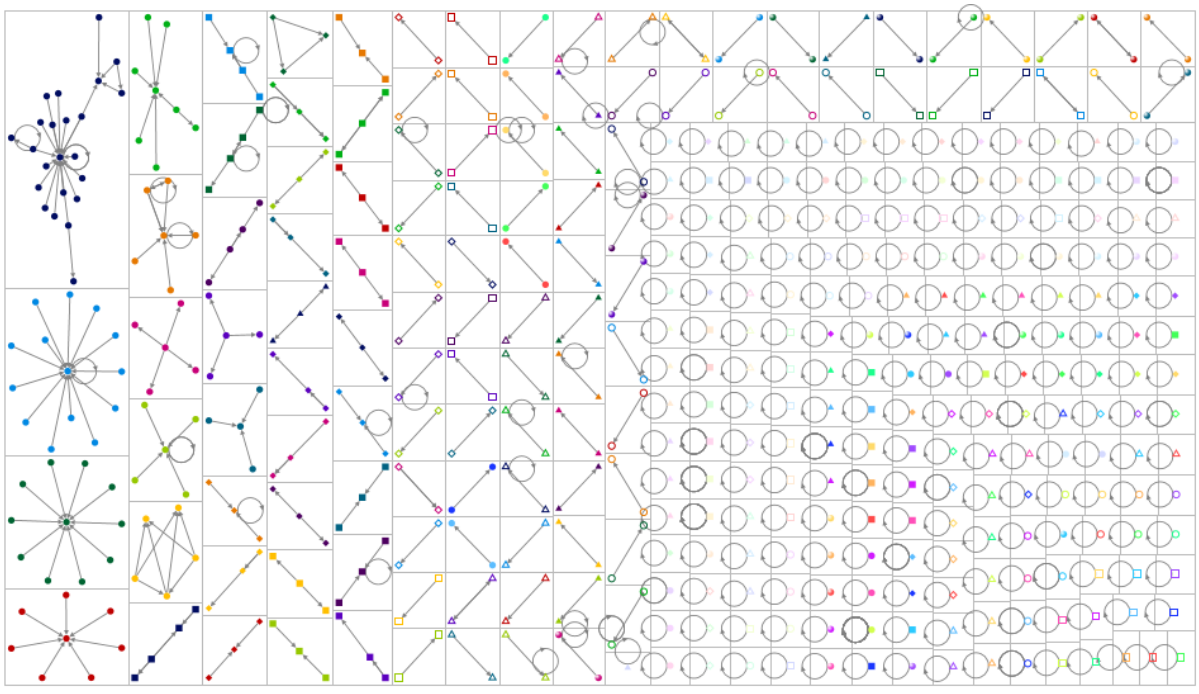

Figure 8. Network map of *20140610 diet weightloss workout exercise fat* data

Table 3. *Graph metrics with the search strings of data sets*

Date	Search strings	Modularity	Top hubs (in-degree)
5/31/2014	Diet weight loss	0.639	Mensfitness (n=10)
			Givingnews (n=7)
6/4/2014	Diet OR weightloss food OR eat	0.713	Cuteemergency (n=739)
			Sgag_sg (n=101)
	Diet OR weightloss exercise OR	0.625	Timehealth (n=45)
	workout OR training		Reuter (n=29)
6/10/2014	Diet OR weightloss exercise OR	0.647	Proftimnoakes (n=17)
	workout OR fat		Thegymgirls (n=14)
	Diet OR weightloss food OR eat	0.703	Theadly (n=44)
			Ellemagazine (n=23)
	Diet OR weightloss exercise OR eat	0.467	Time (n=75)
			Audreykitching (n=64)

Table 4. Graph metrics of top hubs from *20140531 diet weight-loss* data

Top hubs (Affiliation)	In-degree	Graph density	Betweenness centrality
Mensfitness (Magazine)	10	0.091	90.000
Givingnews (News)	7	0.143	30.000
Fitnessmagazine (Magazine)	5	0.167	20.000
Heaithdaily (News)	5	0.167	20.000
Organicrawfood (Private blog)	4	0.250	6.000
Huavandat2101 (Private)	4	0.250	6.000
Nytimes (News)	3	0.250	6.000
Kxly4news (News)	3	0.200	8.000
Wellnessmuscle (Blog)	3	0.333	2.000
Active8_health(blog)	3	0.200	8.000

Table 5. Graph metrics of top hubs from *20140604 diet ightloss food eat* data

Top hubs (Affiliation)	In-degree	Graph density	Betweenness centrality
Cuteemergency (Page)	752	0.001	1032117.000
Sgag_sg (Private)	101	0.010	194724.000
Womenshumor (blog)	77	0.012	7120.000
Ipupsdaily (News)	37	0.023	1708.000
Markleggett (Private)	35	0.028	1188.000
Vickygshores (Celebrity)	23	0.042	506.000
Kimkardahshian (Celeb Fan account)	18	0.056	272.000
Hotmesslife101 (Humor)	16	0.063	210.000
Fitness_247 (Magazine)	13	0.075	195.000
Fitislife (Blog)	12	0.083	110.000

Table 6. Graph metrics of top hubs from *20140604 diet workout exercise training* data

Top hubs (Affiliation)	In-degree	Graph density	Betweenness centrality
Timehealth (Magazine)	45	0.023	10208.667
Reuters (News)	29	0.051	5608.000
Apa (News)	26	0.034	744.000
Peterattiamd (Health professional)	23	0.027	1134.000
Caloriesproper (Blog)	15	0.027	760.000
Reuters_health (News)	15	0.096	7002.000
Thestalwart (Blog)	15	0.086	172.000
Barrysbootcamp (training service)	9	0.200	28.000
Abccbnnews (News)	9	0.111	56.000
Bendwalsh (Private)	9	0.136	64.667

Table 7. Graph metrics of top hubs from *20140610 diet eightloss exercise workout fat* data

Top hubs (Affiliation)	In-degree	Graph density	Betweenness centrality
Proftimnoakes (Health professional)	17	0.045	438.000
Thegymgirls (Blog)	14	0.071	156.000
Georgenbennett (Private)	10	0.091	90.000
Albatfitness (Blog)	7	0.125	42.000
Therock (Celebrity)	6	0.125	40.000
Demerick_ (Private)	6	0.233	18.000
Th3fit (Blog)	5	0.200	12.000
Mailonline (News)	4	0.045	118.000
Hicksgym (Training service)	4	0.250	6.000
Lets_moveUK (Non-profit organization)	3	0.333	2.000

Table 8. Graph metrics of top hubs from *20140610 diet weightloss eat exercise* data

Top hubs (Affiliation)	In-degree	Graph density	Betweenness centrality
Time (News)	75	0.013	7068.000
Audreykitching (Private)	64	0.016	3960.000
Fittimsrn (Blog)	16	0.048	360.000
Momtrends (Blog)	10	0.091	106.000
Flt365 (Blog)	10	0.100	72.000
Dapperhouse (Blog)	8	0.111	42.000
Arlettecrystal (Private)	8	0.125	42.000
Tobefithealthy (Blog)	7	0.125	30.000
Veganvibeco (Organization)	6	0.143	20.000
Yahooph (News)	6	0.143	20.000

Table 9. Graph metrics of top hubs from *20140610 diet weightloss food eat* data

Top hubs (Affiliation)	In-degree	Graph density	Betweenness centrality
Theadly (Celebrity)	44	0.022	1892.000
Ellemagazine (Magazine)	23	0.042	734.000
Gymblble (Private)	22	0.045	420.000
Timesofindia (Magazine)	17	0.059	240.000
Laurajoanneviva (Private)	17	0.066	235.000
Fittipsrn (Blog)	14	0.067	182.000
Guardian (News)	13	0.050	335.000
Herbalife (Product)	10	0.111	70.000
Jayrayner1 (Celebrity)	6	0.050	141.000
Sorellevalliere (Private)	6	0.167	20.000

Research Question 1. What patterns do the information hubs and their subscribers display when they talk about weight-loss within Twitter network?

Figure 3 and Figure 6 represent how general information about diet and weight-loss was displayed (data collected on 5/31/2014 and 6/10/2014 with the keywords; diet OR weightloss OR exercise). The modularities of two data sets were considered medium (*M*=.553). In the tables 5 and 10, the top 10 information hubs for general information about diet and weight-loss from each data set are introduced. The metrics for those data sets are introduced in the table, as well.

Figre 4 and figure 7 display (data collected on 6/4/2014 and 6/10/2014 with the keywords; diet OR weightloss food OR eat for both days), the users who talk about energy intake and show the pattern of brand and public topic. The modularity for these data sets were considered high (*M*= .708). It means the communities that talked about food for weight-loss were quite distinctive from one another. The communities were less likely to interact with each other than the ones that display less modularity.

Figure 5 and figure 8 show that the users who are interested in energy consumption look for information about how to lose weight by comsuming energy and exercising (data collected on 6/4/2014 with the keywords; diet OR weightloss exercise OR workout OR training, on 6/10/2014 with the keywords; diet OR weightloss exercise OR workout OR fat). The pattern of the users are also considered as brand and public topic patterns. The modularity was considered high (*M*= .636). This value refers to the communities that are sharing information only within the communities. The structural holes play a role of small groups, and hardly connect to the other communities. Since the

communities are distinctive from one another, the role of information hubs became significant for the communities and so did the information from the message hubs.

The networks show the patterns of brand and public topic,which shows that obesity, weight-loss and diet are quite pervasive among Twitter users who talk about weight-loss or diet. There are many small groups with disconnected individuals. According to Lieberman (2014), groups that did not show meaningful connections in their conversations were more likely to be targeted by health campaign practitioners and health care providers for effective strategy implementation. However this means that it is difficult for health campaign practitioners and health care providers to capture real trends in the population. However, the patterns in each data set show consistent patterns which means that it can let us know actual trends in weight-loss , given that the analysis is accumulated for a designated time.The data sets were made to describe how people talk about diet and weight-loss into three categories: diet and weight-loss in general, diet and weight-loss with energy intake strategy and diet and weight-loss with energy consumption strategy.

Applied content analysis

In order to observe the types of health information that are shared and what contributes to higher reciprocity among the users in Twitter networks, content analysis from the top information hubs was performed.

For this content analysis, a total of 1100 tweets was analyzed. The tweets were collected from the top ten hubs from all the data sets, which numbered 60 in total. With the information from those top hubs talk about weight-loss and diet, 52.4% (576) which

was about how people should eat for their weight management, and 21.8% (240) of what they talked about was how people should consume the energy they have taken in. A total of 8.5% (94) of the information dealt with more than two weight-loss strategies, and 7.2% (79) of the information suggested other weight management methods, like having medical treatment or emotional supports. 10.1% (111) of information from the hubs was not directly talking about how people should manage their weight. The tweets contain "diet," "weight-loss," "eat" or "exercise" and so forth, however, those messages did not provide information about what people should do for their health but unnecessary information, such as jokes or information for pets.

In order to observe what types of health message strategy the hubs mainly employed, content analysis was performed as well. A total of 48.6% (535) of the information employed new information strategy which rephrased the information that people already knew, or provided new findings of research and detailed information. A total of 15.2% (167) of tweets employed enforcement strategy for weight-loss message distribution. Messages with information about certain services, health professionals, medical institutes, or a certain program from a gym or food professional take up 8.2% (90) of the entire messages. Tweets that have messages about inspiration from an individual who experienced their success on weight-loss or diet were classified in the role model category, and take up 12.5% (138) of the data. Messages that were classified as not applicable (N/A) category take up 15.5% (170) of the entire messages that were analyzed.

Among the data that were analyzed, 71.5% (786) of the tweets contained a hyperlink to another web page. The hyperlinks were mostly (56.7%, 446) used to connect to the relevant news articles with the original tweets. Blog pages (17.4%, 137) and

photographs (16.2%, 127) also followed. Research articles (8%, 63) and videos (1%, 8) were also connected to the original twits. Based on these values, answering research questions 2 and 3 have to be performed prior to answering the research question 1, which encompasses the other research questions.

Research Question 2. What type of weight-loss strategies display higher reciprocity among the users?

As a metric for reciprocity, this study used density, which represents how cohesive communication is and how interconnected they are within the group. In order to compare the extent of reciprocity in each data set, an independent samples t-test was performed. This method was employed since this question is comparing the reciprocities in two weight-loss strategies: energy consumption (data collected on 6/4/2014 and 6/10/2014 with search string "diet OR weightloss food OR eat" in both days) and energy intake (data collected on 6/4/2014 and 6/10/2014 with search string "diet OR weightloss exercise OR workout OR training" and "diet OR weightloss exercise OR workout OR fat").

The analysis of the comparison means of graph density from two categories found that there is a significant difference between the densities of energy consumption category (M=.115, SD=.086) and energy intake category (M=.054, SD=.038, p=.006, <.05). For this analysis the graph densities of top hubs were analyzed. From each data set, the graph density of top ten hubs were averaged. In order to observe the equalities of variances of the data, Levene's test for equality of variances was also performed (p=.003, <.05, df=38), which showed that the data for both weight-loss strategies are different.

Based on the value of the test, this study can say that there are meaningful differences between the graph density in each weight-loss strategy; when people talk about how to eat for weight-loss, and how people are more likely act reciprocally within Twitter networks.

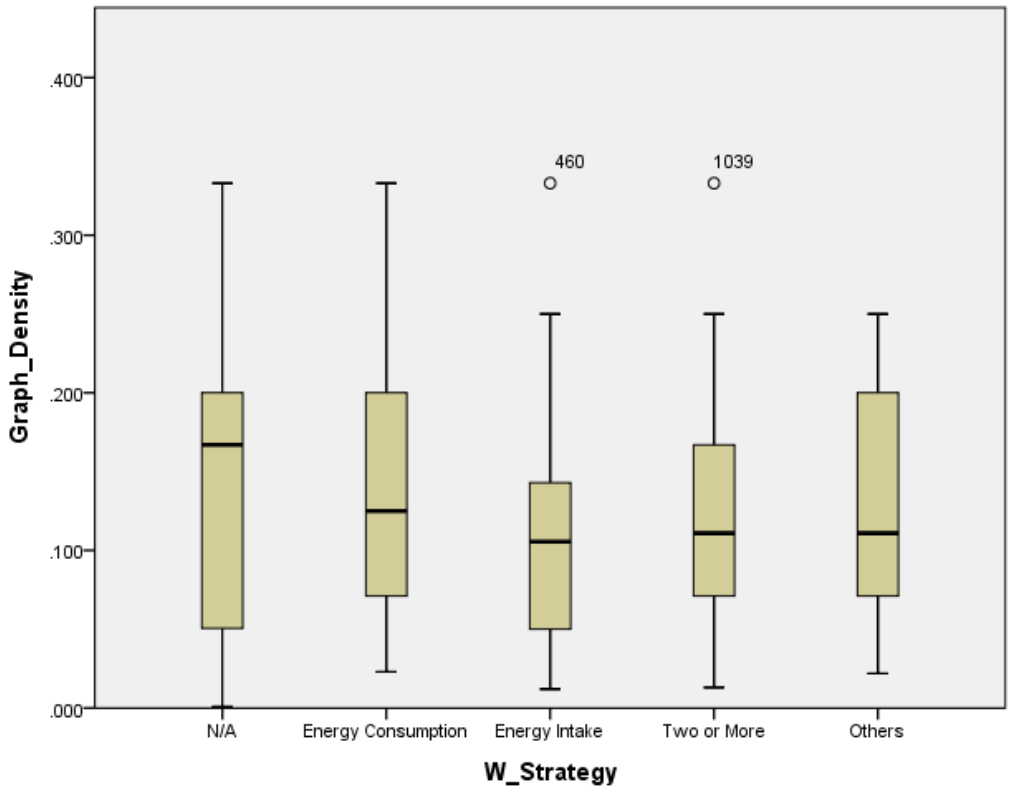

Figure 9. Density by weight-loss strategies

Based on the value from the analysis, weight-loss strategies display different levels of reciprocity. When people talked about how to lose weight by exercising or working out, the interactions displayed higher reciprocity than when people talked about how to eat properly for their weight management.

Research Question 3. The communities within the Twitter networks will show a different level of reciprocity, depending on the types of information distributed by the

hubs (e.g., enforcement, new information, services and role models) (Snyder & Hamilton, 2002)?

The third research question inquires about whether the types or information distributed by the information hubs influences reciprocity. In order to answer this question, content analysis of top information hubs and the messages they have distributed about the health issue was performed. Data from all of the collected tweets were coded and analyzed. In order to find if there are different levels of reciprocity/graph density, depending on the types of health information within the Twitter network, univariate analysis was performed. It showed that there are different levels of reciprocity depending on the types of health message distributed in the networks (F=10.064, $sig.$<.05*)*. The reciprocity of enforcement (M=.109, SD=.063, N=167), new information (M=.108, SD=.067, N=535), service (M=.170, SD=.080, N=90) and role model (M=.161, SD=.178, N=138) turned out different when they are applied in weight-loss messages on Twitter.

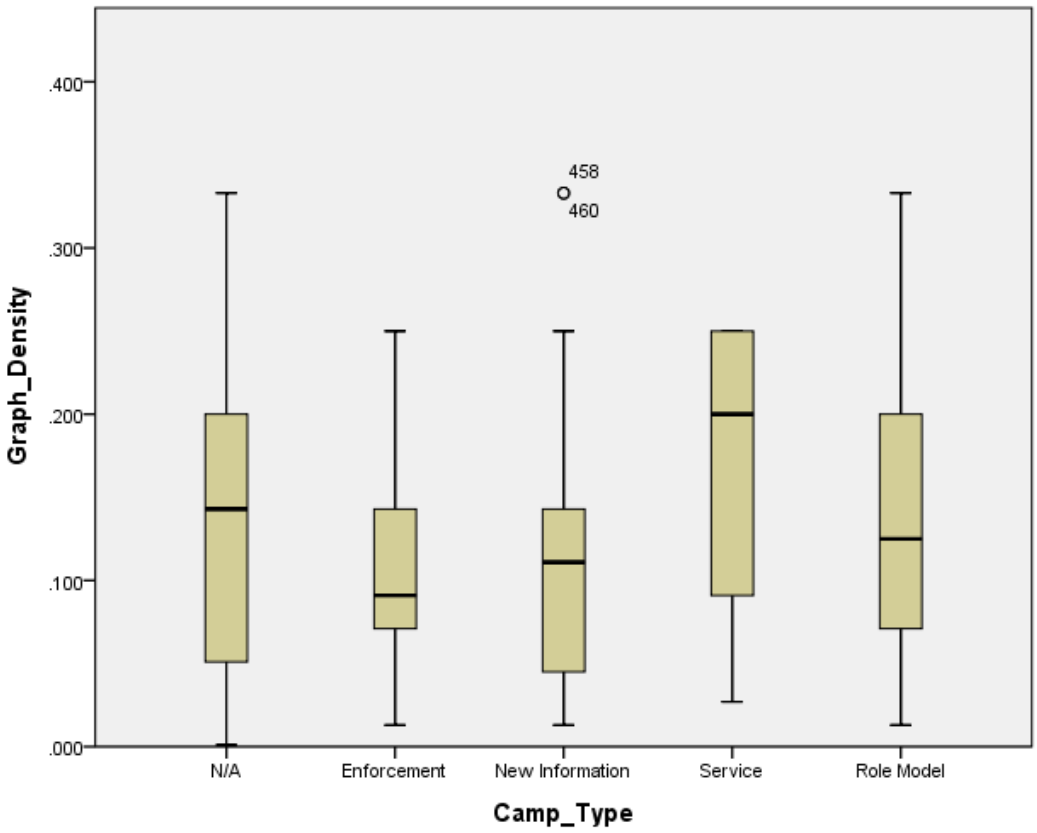

Figure 10. Density by health message types

The values tell us that when message distributors talk about how to lose weight, people are more likely to be engaged in the talk when service and role model message types are used. Rather than employing new information or enforcement types for message distribution, two other health message types; service message and role model message, are more appropriate to involve people in the interaction.

Summary

Within Twitter networks, people displayed a consistent pattern of brand and public topic. Since obesity is considered a pervasive health issue among Americans, this pattern reflects how the general population perceived this health issue.When people who use social media as another information source or channel for their weight management,

information about how to eat properly is more likely to be visible in the Twitter network. The result of this study shows that hyperlinks to other news articles was the most common. The top hubs, which distribute health messages to the users, employ different health campaign message strategies depending on how the weight-loss should be performed.

The results of this study found that there are some distinctive characteristics that top information hubs within Twitter networks demonstrate when considering or dealing with weight-loss and diet information. Within Twitter networks, how to eat was more likely to be talked about than how to exercise or how to work out for weight management. However, the communities that talked about how to work out or exercise for their weight management showed higher density than the others. From the independent t-test of the graph density from the data sets, it was found that the differences between the densities of energy consumption communities and energy intake communities are significant. Therefore, information hubs that talk about weight-loss, diet or weight management provide better information about how to lose weight or manage weight by consuming energy, such as information about gyms, trainers, or how to do work outs.

Considering both of the weight-loss methods, message strategies were also differently employed within Twitter networks. Rephrasing what is already known to the audience provides a new finding of healthy eating that is easily found within the communities that talk about how to eat well for weight-loss or diet within Twitter networks. Different from the energy-consumption communities, what the top information hubs employ for their message distribution is new information. A new information

strategy is rephrasing what the audiences already know, for instance, providing a recipe for a low-fat lunch, or information about beneficial nutrients or food for weight-loss such as catechin green tea or Garcinia Camborgia extract.

As for the energy-consumption messages, new information strategies were commonly employed; however, what is distinctive is that the messages were more likely to employ role model strategy than other weight-loss methods, such as providing inspirations from role models by suggesting a picture of them or a quotation from them. Enforcement strategy follows after role model strategy among the energy-consumption communities. This is the case when a hyperlink delivers a news article about potential dangers from lack of exercise or energy consumption. Although there is not a hyperlink to the other cyberspace, 140 characters can provide simple but strong messages like, "Train insane or remain the same", and "If you don't hydrate yourself while you are exercising, it might affect mental health." These messages try to provide a proper way of exercising for weight-loss and health management.

The results for research question 3 demonstrates that there is a different level of reciprocity, depending on the types of health information distributed among Twitter users. Although new information messages are the most visible in Twitter when people talk about weight-loss, it does not always guarantee the highest reciprocity. That means; the prevalence of the health message type does not always guarantee the best effect.

Based on the values yielded above, there are some message strategies that are notable in communities with higher reciprocity. How people should lose weight and how their diet should be for higher reciprocity to yield the best mutual benefit within the Twitter communities will be discussed. A detailed discussion follows in the next chapter.

CHAPTER 5

Discussion

This chapter will talk about what the results of the analysis mean for society and how health messages for obesity solution should be given to the public within social network environments. As an extension of the previous research from the literature review, what this study highlighted will be addressed as well. This chapter will also talk about what kind of limitations this study had and how this study can be developed to another dimension as well.

Previous research on obesity and media were mostly about how media affects how obesity is perceived, how obese people picture themselves and stigmatization (Gearhart, Craig & Steed, 2012; De Brún, McKenzie, McCarthy & McGloin, 2012; Shugart, 2011; Yoo & Kim, 2013). The studies focused on how powerful media is for the people so that it cultivates some images or stereotypes about the health issue. However, as the paradigm of information flow has been changed, the research on obesity and media has to focus on this new information flow. This study tried to focus on how people actively share health information and what types of health messages would make the people more engaged to the information sharing. Although it is a little step ahead, this would be a meaningful step towards the research on interactive information sharing within social network environments.

This line of study would be helpful to study how social support for weight-loss communities is constructed. This study presented the kind of roles the information distributors take and the potential fulfillment of information needs of the public. The role of message distributors would be able to apply to understanding the informational leadership within the social network environment, and the subscriber's needs for fulfillment would be understood as obtaining social support from the interaction or the message distributors.

Effective health message for reciprocity

From the interpretation of the results, this study found that the top information hubs distribute health information within their communities with different message strategies, depending on what they talk about. The new information strategy is the dominant message strategy. When the top information hubs talk about how to lose weight by exercising or any other forms of energy consumption, they try to employ role model strategy or enforcement strategy for higher reciprocity and for the most benefit. When the top information hubs try to send out information about how to eat well to lose weight, or manage their diet, they also employ new information strategy and additionally employ enforcement strategy to make the most of reciprocity that they can expect. Considering the result, health professionals or health care providers should be able to employ health campaign message types wisely so that the messages would make people more engaged in the message sharing within Twitter networks.

So, mutual benefit within the networks?

From the benefit exchange model that was proposed at the beginning of this study (Figure 1.), what kind of reciprocal arena Twitter should become needs to be considered at this point. Moreover, kinds of roles message distributors take depending on what kind of information they distribute, and how message receivers fulfill a certain informational needs depending on what they are exposed to or subscribing, should be considered.

Based on the results yielded from this study, message distributors who talk about weight-loss strategies, act like tutors or strict trainers based on the message strategies they mostly employ. From their roles, message receivers might fulfill their informational needs from a role of mentorship within the information hubs. It means Twitter is not only an information source but also plays a role of being boot camp for the Twitter users who talk about how to lose weight or how to do a diet. By providing communities different message strategies and weight-loss method; Twitter allows the users to choose and to subscribe to what they are interested in. The communities are quite distinctive from each other, based on the high densities.

Limitation and Avenue to the future study

This study was to observe how health messages should be delivered to draw higher reciprocity within social network environments. This study tried to eliminate as many limitations as possible to envision this research; however, this research on health information within computer-mediated environments has some limitations that should be discussed. Du Pre (2010) talked about the drawbacks of online health information, which was asserted by Stree, Gold and Manning (1997). The limitation of online health information includes, lack of credibility, failure to consider nonverbal feedbacks, and

uncertainty of prompt benefit to the information consumers. Their assertion and the limitation of this study are significant.

First of all, it is hard to distinguish whether the information from Twitter is false or true. It will always take extra time to see if the information source a tweet uses is valid. So it takes a longer time to prove the effect of health messages on Twitter, rather than in other types of media.

Twitter information provides very prompt messages, so new information becomed obsolete in a very short period of time. Information flows so quickly that it does not guarantee benefits for the user. Sometimes, the user might encounter unnecessary information, and it might happen quite frequently. Encountering unnecessary information was found in this study, as well. Overall, 10% of the non-applicable messages show this dynamic of Twitter. Therefore, whether the information on Twitter benefits the users who are exposed to the information needs to be studied. If message filtering can be well employed for better analysis of health information, the quality of the study will improve.

This study does not fully explain if the message or the interaction influences health improvement by providing different types of messages. This study captures how information is shared and what types of information make the people more engaged in the interaction.

The frequency does not always guarantee higher reciprocity within social network environments. Although some of the message types are less employed than new information messages, they yield higher reciprocities, which are represented by density within the clusters. This study found that the service messages and role model messages in weight-loss information displayed higher reciprocity within the Twitter network.

However, there are some other elements that would contribute to reciprocity. For instance, demographic elements, such as gender, level of education, and income, can be considered as a cause of reciprocity. Moreover, individuals' different emotional states, or even body mass index (BMI) might cause higher reciprocity in social network environments.

In future research, the detailed study of the top information hubs can be performed by employing survey instruments to measure their self-efficacy as information distributors. In relation to this, comparison between how the top information hubs consider themselves, and how their subscribers perceive the information hubs would be a worthwhile topic for discussion, because it would allow us to see what should be recommended for the message distributors and their. These topics would also be helpful to deepen the knowledge of users' interactions on Twitter.

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Appendix A

Coding sheet

Tweet #	Coder	Weight-los strategies	Campaingn	Hyperlinks	content type

Appendix B

Coders' manual for content analysis

Coding instruction (Revised on June, 12th, 2014)

Thanks for participating in the coding process of my master's thesis.

The thesis is to explore the relationship between health message on twitter and users' reciprocity within the twitter network. As a part of the research process, content analysis for health message is performed.

The health messages are mainly about diet and obesity. To be more specific, the messages are about weight-loss. The messages are randomly selected from the twitter network. The messages are from the main hubs in the network clusters.

As you see the coding sheet, which is also distributed together with the data, you have to put a proper code for the data in the assigned cell in the coding sheet.

- Tweet #: Randomly assigned number of each twit, It is presented at the end of columns
- Coder: you have to fill in the initial of your first and last name. e.g., Andrew James, AJ
- Weight loss strategies :
    - Energy consumption : 1
        - This information is about how to consume the energy. For instance, how to burn fat or information about exercise are included in this category.
    - Energy intake: 2
        - This information is about how to take the energy. For instance, how to eat well for diet or information about the food with low calorie, low sodium are included in this category.
    - Two and more : 3
        - If the twit has both of the information or more, it is included in this category
    - Others: 4
    - N/A :0
        - If the twit is not applicable to any of the categories above, which means the twit is not about weight-loss or Diet, it is included in this category

- Campaign: What campaign strategy is employed? (Snyder & Hamilton, 2002)
    - Enforcement: 1
        - The message contains negative sentiment. E.g., "If you take more than 2 mgs of sodium per a day, the possibility of cancer would increase."

    - New information: 2
        - Messages with detailed information, which including rephrasing what it was already known. E.g., “You already know having oatmeal for your breakfast can keep you from heart diseases, what’s more?” or providing instruction for food or exercise.
    - Service: 3
        - When a message has solution for a certain health issue, it is service message. E.g., “For your success on your diet, see a health professional who can help you!”
    - Role model: 4
        - When a message tells a story of an individual who experienced health improvement. E.g., “This is the story of Tony Brook, who shed out 50 pounds and got a new life!”
    - N/A: 0
        - If the message is not applicable to any other category,

- hyperlink: Does the twit contain the hyperlink?
    - Yes:1
    - No: 0

if the twit contains hyperlink, please follow the hyperlink and perform the coding for content.

- Content: what sort of content does a hyperlink connect to?
    - Research article: 1
    - News article: 2
    - Blog page: 3
    - Photograph: 4
    - Video: 5
    - N/A:0

* If you have any further question, contact the investigator, Songyi Lee by email at Songyi.lee07@gmail.com