Stay Connected, Stay Professional:

A Way to Enhance Health Benefits of Social Media in China

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Introduction

The Internet is becoming an increasingly common source of health information, survey shows that over 80% of Internet users seek for health information online in the United States (Fox & Jones, 2009). The use of social media for personal health is also on the rise (Househ, Borycki, & Kushniruk, 2014), and more than 23% of social media users have followed their friends’ personal health experiences or updates on social media (Fox & Jones, 2009). Oxford dictionaries define social media as “websites and applications that enable users to create and share content or to participate in social networking”. Examples include Social Network Sites (e.g. Facebook and Twitter), wikis and photo/video sharing services (see Merolli, Gray, & Martin-Sanchez, 2013). The tidal wave of social media is influencing the health domain in China: more than half of doctors in online communities use social media regularly and over 70% of patients have been reported use the Internet as a source of information to select hospitals (Chiu, Ip, & Silverman, 2013).

Although the definition of social media is diverse, a range of key characteristics of social media have been identified that highlight its potential as a novel setting of health promotion (Loss, Lindacher, & Curbach, 2014), which is the process of enabling people to increase their control over, and thus improve, their health. For example, social media provides social context and social interactions with which individuals can create and maintain personal relationships with others. It also integrates the everyday life of a large population, as most social media users log in daily and spend 0.5 to 2 hours a day on it (see Loss et al., 2014). All these characteristics are important to promoting public health according to the WHO (as published in the Ottawa Charter and the Health Promotion Glossary). There is a widespread assumption that social
media has the potential to transform the pattern of health communication (Eysenbach, 2008), which is significant in public health promotion.

Considerable attempts at incorporating Web 2.0 technologies with health promotion have been made (Van De Belt, Engelen, Berben, & Schoonhoven, 2010). Representative examples of health-related social media based on Web 2.0 include Patientslikeme (PatientsLikeMe, 2014) and Hello Health (HelloHealth, 2014). Users write, review and diffuse health information on a wide range of topics, and interact with other similar patients through those sites. In the Netherlands, the government funded website MijnZorgNet, aims at improving the quality and efficiency of care through enabling communication and interactions between patients and caregivers (van Volksgezondheid, 2008).

Health-related social media has exhibited initial results in health promotion across various conditions and population segments (e.g. Maher et al., 2014; Merolli et al., 2013; Moorhead et al., 2013; Thackeray, Crookston, & West, 2013). We already know that individuals not only feel better informed but also experience enhanced social well-being through the “empowering process” of health-related social media (Van Uden-Kraan, Drossaert, Taal, Seydel, & van de Laar, 2009; van Uden-Kraan et al., 2008). Many research efforts have been focused on the benefits of health-related social media in increasing health knowledge (Bennett & Glasgow, 2009; Tian et al., 2007), enhancing social relationships (McLaughlin et al., 2012; Merolli et al., 2013) and changing behaviors (Lorig, Ritter, Laurent, & Plant, 2008; Maher et al., 2014; Thackeray et al., 2013). However, research in this domain is in its infancy. Many previous randomized control trials (RCTs) have been relatively small and underpowered and did not demonstrate any significant results (Bennett & Glasgow, 2009). Unfortunately, we know little about what factors are associated with the effect size of health-related social media, which may explain why considerable studies in this area have not demonstrated significant results.
Knowledge of such factors would both enhance known benefits, for example increasing health knowledge and improving social well-being, and also help discover new ones.

**Connectedness-oriented communication.** Kuwabara and colleagues made a distinction between content-oriented communication and connectedness-oriented communication. While the former focuses on information exchange, the latter one aims at fostering a sense of connectedness (Kuwabara, Watanabe, Ohguro, Itoh, & Maeda, 2002). It has been reported that individuals may communicate merely to maintain relationships rather than to convey concrete information in mediated communication (Nardi, Whittaker, & Bradner, 2000), for example communication through text messaging. The motivation of connectedness-oriented communication can be explained with belongingness theory, which states that individuals have an important motivation to develop and continue positive social relationship in order to experience a sense of belongingness (Baumeister & Leary, 1995). A recent report demonstrated that the key motivator of Chinese users to use social media is networking, as over 83% percent of users indicate they use social media to communicate with friends (Nielsen, 2012). Failing to create and maintain such relationships has many adverse effects on both mental well-being and health (Cacioppo & Patrick, 2009). In sum, connectedness-oriented communication is a well-defined construct based on belongingness theory and relates to individuals’ health. We mentioned that the social value of social media has not been fully understood, but considering the relationship between connectedness-oriented communication and social benefits (e.g., belongingness), could we link it with the health benefits? That is:

**RQ1:** Will connectedness oriented communication yields health benefits in social media?

**Information Source.** Information source is an important construct in communication research (Sundar & Nass, 2001). Online health information has a potentially complex set of sources (Hu & Sundar, 2010) and the definition of information source varies across contexts, it
does not necessarily refer to the sender of the message, but to the message in itself or the even the channel. For example, when asked to indicate the source of an article about weight loss forwarded by one’s Facebook friends, individuals may give different answers from “Facebook”, the writer’s name, “friend” or even just “online”.

In communication research, information source means the originator of communication (see Sundar & Nass, 2001). However, information receivers do not differentiate clearly between the originator of the information and those who disseminate the information created by others (Chaffee, 1982). Further, gatekeepers have been shown to systematically bias perceptions of the content (Yang, Counts, Morris, & Hoff, 2013). Sundar and Nass therefore created a typology of information sources based on information gatekeepers, the one who delivers the message but not the creator. Since creating health information requires strong medical background and large professional references, it is difficult to claim to be the originator. A classification based on gatekeepers, therefore, is more appropriate for online health information.

Following the gatekeeper notion and the Web 2.0 spirit, which is all users can contribute to information, a distinction between professionals and laypersons has been recognized in the health domain (Hu & Sundar, 2010). Professionals with a medical background always have overwhelming power over patients and represent authority in conventional medical relationships. Johnson & Meischke (1991) noted that there was 'compelling evidence that respondents perceived the utility of various sources very differently for different types of information' and a professional source is the most preferable health information source (Johnson & Meischke, 1991).

In WeChat, the most popular social media in China, most health education content is sent via the topical-style source (e.g. “健康资讯 (Health Tips)”) and professionals source (e.g. “营
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养师顾中一 (Dietitian Gu)”). From the perspective of content, topical-style sources are similar to layperson sources, as information sent via topical-style sources generally has not been reviewed by a domain expert, and does not claim the source has relevant expertise while most professional sources do. Unlike most layperson-sources named with a real name, topical-style sources are generally anonymous, therefore individuals may have difficulty understanding who the originator of the content is. There is a lack of research on the effects of topical-style sources with regard to knowledge benefits, especially through a comparison with professional sources.

Another common problem of health-related social media research is low engagement. Drop-out rates of 40% - 50% are not uncommon, causing some researchers to argue that it represents one of the “fundamental characteristics” of health-related social media (see Bennett & Glasgow, 2009). Information source has been correlated with credibility and selective exposure, which determine a significant dimension of engagement: content browsing frequency, but the conclusion is contentious (e.g. Hovland & Weiss, 1951; Groenendyk & Valentino, 2002). We therefore explore the effects of information source on content browsing frequency based on previous findings and give special attention the drop-out rate. Another research question is offered:

**RQ2:** Will health education content attributed to a professional source give rise to more knowledge benefits and engagement (content browsing frequency) than its topical-style equivalent in social media?

Current studies are almost exclusively performed within Western cultures. At the same time, social media has become increasingly prevalent in China recently, and only very limited research is available that investigates health-related social media in China. Meanwhile, the fast growing social media provide a huge potential in health promotion. The biggest mobile-based
Chinese social media platform, WeChat, just announced it has 396 million monthly active users. Besides, Chinese demonstrated different attitudes towards health and credibility perception as compared with individuals of a Western culture background. For example they are more likely to view disease and illness as a part of the life cycle and as something out their control which is likely to influence their health activity engagement (see Rosal & Bodenlos, 2008). They are more likely to use information channel (e.g. if it is from television, newspaper, magazine) as credibility indicator when compared with individuals from the United States (Zhu, 1997). It is therefore necessary to study whether social media show any beneficial health effects among Chinese individuals.

To answer our research questions, we conducted a three weeks randomized control trial in Shanghai and manipulated information source and connectedness-oriented communication, and explored their relationships with knowledge benefits (information retention) and health benefits (social connectedness and emotional social support) respectively.

**Literature Review and Hypotheses**

In this section we start by introducing the construct of connectedness-oriented communication and discuss why it is a factor that yields health benefits through social connectedness and social support, and then we discuss how information source influences knowledge benefits and engagement through credibility.
Health Benefits of Social Media

Connectedness-oriented Communication

Kuwabara and colleagues made the distinction between content-oriented communication and connectedness-oriented communication through observing individuals’ behaviors in conventional network communication, suggesting that connectedness-oriented communication makes people aware of each other and helps in maintaining social relationships. One representative example of connectedness-oriented communication is the ‘Like’, mechanism widely used by social media users to express positive feelings. According to Facebook’s Help Center, it is defined as “give positive feedback and connect with things you care about”. There are two reasons why the “Like” is a form of connectedness-oriented communication. First, the positive feedback delivered by “likes” helps foster a sense of connection by showing support and care. The underlying message delivered by a “Like” could be that you are aware of your connections, understand their feelings and situation, or simply express social support. In essence, this is consistent with the use pattern Nardi et al. identified in instant messengers, which is a typical form of connectedness-oriented communication. As a result, the “Like” does maintain a sense of connection of others. Second, it is very difficult to defend that a single ‘Like’ button is sufficient to exchange concrete information. Although a ‘Like’ sometimes conveys complex information more than merely positive feelings, for example when a user like a product, they may want to convey the message from “I want to buy it”, “I want to tell my friends” to “I bought it and liked it” (Bustos, 2011), it is about subjective personal feelings rather than concrete information, especially when compared with a more conventional communication approach such as text messages. Hereby with respect to its effectiveness in maintaining the sense of connection and insufficiency in exchanging information, the “Like” is a form of connectedness-oriented communication.
For most laypeople without a medical background, sharing a post or commenting on a post could be connectedness-oriented as well. As previous research shows, individuals may use text messages just to foster a sense of belongingness; it would not come as a surprise that they also use the comments in social media for the same purpose. Sharing and commenting may help to enhance relationship salience, an important dimension of social connectedness, via expressing care and concern. Besides, individuals’ insufficient competence with regard to medical knowledge makes them more likely to want to have more extensive information exchange based on content.

**Social Connectedness (Hypothesis H1.1)**

Social connectedness is a “positive appraisal of the quality (intimacy) and quantity (network size) of interactions within ongoing social relationships” (IJsselsteijn, van Baren, Markopoulos, Romero, & De Ruyter, 2009). Same as the notion of connectedness-oriented communication, relevant research often refer to the theory of belongingness (Baumeister & Leary, 1995), which emphasizes belongingness as a fundamental need of humans. Sometimes social connectedness has been operationalized as the objective absence or presence of social ties (e.g., social isolation), but it also has a more subjective psychological component (see Ashida & Heaney, 2008). It emphasizes the affective experience of belonging to a social relationship or network. A lack of social connectedness may be experienced as feelings of loneliness and a desire for companionship (Rook, 1990).

Social connectedness has been related to health in multiple ways. The lack of social connectedness, social isolation, has been found as a direct risk factor of obesity, high blood pressure, cancer, and diabetes (Cacioppo & Hawkley, 2003). Social connectedness roots in social relationship, which impacts health through diverse approaches, for instance, social relationships are capable to create healthy norms and provide health knowledge (Kim,
Subramanian, & Kawachi, 2006). From the perspective of health behavior change, social connectedness has shown its influence in self-efficacy, which is a person’s belief in his or her ability to complete tasks and reach goals (Bandura, 2001), through social identification and social capital (Phua, 2013). Considering its direct and indirect relationships with health, we regard social connectedness as health benefits in itself.

Research has demonstrated close relationships between social connectedness and social media use, and we believe that connectedness-oriented communication in social media could influence social connectedness. First, it has been found that the mediated environment of social media is not an obstacle to delivering social connectedness, and the perceived social connectedness derived online can be associated with health benefits (e.g., less depression) as well (Grieve, Indian, Witteveen, Anne Tolan, & Marrington, 2013). More importantly, previous research has clearly established the relationship between usage of Twitter, a popular social media product, and increase of social connectedness (Riedl, Köbler, Goswami, & Krcmar, 2013). Researchers collected data on participants’ Twitter usage and a series of constructs including social awareness, referring to users being conscious about the activities of others in social media, network size and frequency of use, and identified a causal relationship between social awareness and social connectedness (Riedl et al., 2013). That is, individuals will experience a stronger social connectedness if they were more conscious about the activities of others in social media. Meanwhile, connectedness-oriented communication could make individuals more conscious about other’s online activities, as one of its purposes is monitoring other’s availability. Looking back to the “likes” example, those who received “likes” are more conscious about other’s existence by knowing that someone is caring and supporting them in social media. Combining the relationship between social connectedness and connectedness-oriented communication, we hypothesize:
**H1.1** participants who are engaged with more connectedness-oriented communication will perceive a stronger social connectedness than those who have less connectedness-oriented communication.

**Social Support (Hypothesis 1.2)**

The provision of social support is one of the most functional benefits of social relationships (Heaney & Israel, 2002). It has been widely accepted that social support can be categorized into several subtypes including emotional social support (“expressions of empathy, love, trust, and caring”), instrumental support (“tangible aid and services”), and informational support (“advice, suggestions, and information”) (House, 1981). The Internet is able to reach broad numbers of users simultaneously and it facilitates social integration and interaction to a large extent. In online support groups (OSG), social support has been found to empower individuals through enhancing social well-being (van Uden-Kraan, Drossaert, Taal, Shaw, et al., 2008). Other evidence indicates the findings are generalizable across cultures. For example, a study conducted in a Japanese online community shows that patients do perceive higher social support after joining specific online support group as well (Setoyama, Yamazaki, & Namayama, 2011).

Social support and social connectedness are two related notions and have been studied together. For example, having a companion was considered a form of support in one study while loneliness, the absence of social connectedness, has been studied in the context of social support. Other research has indicated that perceived loneliness is moderately negatively correlated with social support (Ashida & Heaney, 2008). Social support, however, does not equal to social connectedness. Some research suggests that the perceived availability of companionship and loneliness are only moderately correlated with social support. Individuals can feel socially disconnected while being surrounded by support providers. For
example, a study on chronically ill children who received care from mothers shows that the children’s feelings of loneliness was not significantly correlated with the perceived availability of social support (Florian & Krulik, 1991). Therefore, it is worthwhile to study social support together with social connectedness, and reasonable to expect a common change.

Communicators of connectedness-oriented communication are social support providers, especially emotional social support. Intimate relationships (e.g., ties with families and close friends) have been found to be better than other relationships, such as relationships with professionals (e.g., doctors, physicians, etc.) in providing emotional social support (Blanchard, Albrecht, Ruckdeschel, Grant, & Hemmick, 1995). A Pew survey also suggests that over half of respondents indicated that intimate relationships are most helpful in providing emotional social support for dealing with a health issue or a quick remedy for an everyday health problem (Fox & Jones, 2009). Intimate relationships also contribute to connectedness-oriented communication in social media. Connectedness-oriented communication conveys a high level of intimacy (IJsselsteijn et al., 2009), it mostly happens within intimate relationships, as it hardly make any sense to frequently check availability of strangers or weak ties. Through connectedness-oriented communication, intimate relationships can provide emotional social support, which is often studied together with social connectedness, we hypothesize:

**H1.2** participants who are engaged with more connectedness-oriented communication will perceive stronger emotional social support than those who have less connectedness-oriented communication.
**Knowledge Benefits of Social Media and Information Source**

In this study, we refer knowledge benefits to health information retention. In most health-related social media research knowledge benefits were not regarded as primary health benefits (see Bennett & Glasgow, 2009). Consider the influence of knowledge on health behavior change and health promotion, we regard it as health benefits but use the term knowledge benefits to distinct it from the discussed health benefits focused on social relationships. In the following section we will first discuss the notion of information source, source credibility, selective exposure, with which we then relate information source with knowledge benefits.

*Source Credibility*

Most research on information source focusses on source credibility, a term commonly used to “imply a communicator’s positive characteristics that affect the receiver’s acceptance of a message” (Ohanian, 1990). Hovland and his colleagues developed the source-credibility model based on their landmark research in 1953. They extracted two factors as the “building blocks” of source credibility: expertise and trustworthiness. Expertise is “the extent to which a communicator is perceived to be a source of valid assertions,” and trustworthiness is “the degree of confidence in the communicator’s intent to communicate the assertions he considers most valid” (Hovland, Janis, & Kelley, 1953). In another words, expertise is communicators’ qualification or perceived ability of knowing truth about a given topic, while trustworthiness is conceptualized as perceptions of communicators’ motivation to tell the truth about a topic.

The Internet has lowered the cost of information production and proliferation, therefore it greatly increases information abundance, as a result, its information may also be more prone to be obsolete, incomplete, or inaccurate (Metzger & Flanagin, 2013). Individuals may
evaluate credibility form different aspects. For instance, Flanagin and Metzger (2013) argue that information in itself, namely its quality, accuracy and language intensity, could alter an individuals’ credibility perception. They developed the notion of source credibility by referring to the research on message discrepancy decreasing credibility and individuals’ tendency to believe information reaffirm existing knowledge, (Metzger, Flanagin, Eyal, Lemus, & McCann, 2003). Besides, research shows that people rarely engage in effortful evaluation of the online content, but evaluate credibility based on factors like web site design and navigability. Fogg et al. (2003) point out that the visual design elements of web sites are the main consideration in credibility assessment online, rather than content or source information.

The elaboration likelihood model (ELM) (Petty & Cacioppo, 1986) and heuristic systematic model (HSM) (Chaiken, 1987) are widely used and cited approaches for understanding individual’s information processing, and they both pointed out that except attending to the arguments provided by the message (central processing), individuals also use heuristics to evaluate message (peripheral processing). Based on this, Metzger et al. suggested that individuals use heuristics to evaluate information credibility online (.Metzger & Flanagin, 2013), and one important heuristic is reputation heuristic, which is “whether the source [of a website] is an official authority or not” (Sundar, 2008). This is supported by Koh and Sundar, who, by manipulating web site reputation, found significantly higher trust ratings for sites with high level of reputation (Koh & Sundar, 2010). The conclusion also extends to online health information, as individuals revealed they judge the information credibility based on the source reputation because it may be difficult to evaluate from the content directly (Eysenbach & Köhler, 2002).
Professional sources, however, do not always achieve higher credibility ratings than layperson sources. For example, Hu and Sundar recently did not find direct support of the notion that a professional, operationalized as a doctor, is more credible than a layperson as health information source (Hu & Sundar, 2010). This can be explained with homophily (or source-receiver similarity), which is the degree of perceived similarity an information receiver ascribes to an information source. Interpersonal similarity impacts the evaluation and influence of health information, as perceptions of similarity among online support group users has been correlated with credibility (Wright, 2000). This view point was echoed by Wang et al., who suggested that perceived similarity of other members influence people’s perception of information in online support group (Wang, Walther, Pingree, & Hawkins, 2008). It is easy to understand that information from people with similar experience is more appreciated, as Preece (1999) pointed out: “Physicians can provide the facts, but other patients can tell you what it really feels like and what to expect next, in a way that only someone with personal experience can” (see Wang et al., 2008).

**Topical-style Source versus Professional Source (Hypothesis 2.1)**

Following the typology of information source of Sundar and Hu (2010), we define professional source as information gatekeeper who has professional expertise, for example domain expert, and define layperson source as gatekeepers do not possess such expertise. Earlier research also identified two sources in the U.S. based on the name of information gatekeepers: *topical-style* (e.g. “Political_news”) and *internet-style* (e.g. “Akalala99”) (Yang et al., 2013). They reported that while topical-style source was regarded as a more credible political source than internet-style source, it was a less credible health information source (Yang et al., 2013). Their study illustrated a credibility comparison between layperson source and topical-style source in China.
First, as Flanagin and Metzger (2013) pointed out that the reputation heuristic plays an important role in credibility evaluations. Comparing with professional sources, which always have official or relevant institutions in the background, topical-style sources are less reputed and therefore would be evaluated as less credible. Second, topical-style sources are less similar with general individuals than layperson sources. It is difficult to defend that individuals would expect a source named with specific topic, for example “Healthy Diet Tips”, to share any comments with them at a personal level. Finally, topical-style sources have been suggested to be perceived by Chinese users as less credible than layperson sources respect to health information (Yang et al., 2013). Even if we assume a professional source to be equally credible to a layperson source, it is still more credible than a topical style source. Accordingly:

**H2.1** health information attributed to professional source will be perceived as more credible than topical-style source

**Information Source and Engagement (Hypothesis H2.1)**

A common problem of health-related social media is low engagement. Roughly 50% or more of users who sign up fail to stay in the intervention for its duration, and for those who do, engagement is generally low (Maher et al., 2014). Individuals are reported more likely to consume information than to contribute to the dialog when using social media for health purposes (Thackeray et al., 2013). Specifically in health education, low engagement always occurs in the form of low content browsing frequency, and the reason is likely not elusive: participants simply lose interest over time (Bennett & Glasgow, 2009). It has been suggested that adding a “social layer” (e.g. user’s activities feeds and networking features) to static health education content could increase content browsing (Baghaei et al., 2009). Freyne and
colleagues purposely designed a health-related social media to facilitate social networking, and found an obvious increase of content browsing (Freyne, Berkovsky, Kimani, Baghaei, & Brindal, 2010). However, from the health information in itself, for example information source, it is unknown if it influences the significant dimension of engagement: content browsing frequency.

Information source has been correlated with engagement through credibility. Individuals are less likely to keep following an information source sending improper information. Gratification theory (Fiske, 1990) suggests that audiences have complex needs that it seeks to gratify through the use of various media, and people are active seekers of information to gratify the need for cognition: the need to know, curiosity, the desire to be informed with high quality information. As health information seekers frequently lack access to clear and sufficient information, information needs becomes more salient in health domain (Matsuyama, Kuhn, Molisani, & Wilson-Genderson, 2013; Neumann et al., 2011). Wilson pointed out that credibility is a main aspect of information quality, and states that what and who people believe to be credible constitutes the potential pool of “cognitive authorities”, which influences thoughts that people would consciously recognize being proper (Wilson, 1983). Hence, due to the modest quality of online health information, individuals will be motivated by their cognitive needs to continually follow the sources of which the information has been regarded as proper and credible.

Besides, in mass communication research there is a long history on selective exposure and credibility. The general conclusion is that individuals have the tendency of favoring highly credible sources exposing themselves more to it, while seeking alternatives information sources if the source is perceived as less credible (e.g., Hawkins et al., 2001; Wheeless, 1974; Zillman & Bryant, 1985). If topical-style source is less credible than professional source as we
suggested, individuals will selectively expose themselves to professional sources more than topical-style sources, which means they will browse the health education content more often. We thus offer the hypothesis,

**H2.2** participants who receive health education content via a professional source will browse it more often than who receive the content via a topical-style source

**Information Source and Information Retention (Hypothesis H2.3)**

The relationship between information source and information retention has been found contentious. During earlier research the effects of information source and communication effectiveness were investigated. No significant effect was identified (Hovland & Weiss, 1951; Petty & Cacioppo, 1979; Watts & Holt, 1979). For example, by manipulating communicators’ name and the content respectively, Hovland found that individuals exposed to a highly credible source did not necessarily acquire and retain more information than those exposed to a less credible source (Hovland & Weiss, 1951). That is, the information retention, which is knowledge benefits in our study, is the same across all participants regardless of the information source. In contrast, subsequent research suggested that people are likely to remember the arguments and information contained in the message sent through a more credible source (Groenendyk & Valentino, 2002).

In Hovland’s experiment, individuals were exposed to the information only once, hence lack of long-term information selection process. Besides, as Hovland pointed out that his conclusion is limited to the experimental setting and individuals themselves do not have control over their information exposure. When exposed to a credible information source in relatively long-term and naturalistic conditions where individuals could control their information exposure, the effect of information selection based on source credibility is more
likely to be salient. If a professional source engages individuals more as we expected, it will increase information exposure time, consequently achieve better knowledge benefits by increasing information acquisition and retention.

**H2.3** participants who receive health education content from a professional source will have higher post knowledge level than those who receive the content from a topical-style source.

*Behavioral Intentions (Hypothesis H2.4)*

An important goal of health-related social media is initiating positive behavior change (Ahern, K., & Phalen, 2006). Survey results have shown that people take actions towards health information they obtained online (see Sundar & Nass, 2001). Research in this field has the challenge of measuring actual behaviors, and a frequently measurement is self-report. Due to the inaccuracy of self-report, behavioral intention could serve as an alternative measurement since the theory of reasoned action argued that it is the “best and most proximal psychological predictor of actual behavior” (Fishbein & Ajzen, 1975). Following Hu & Sundar (2010), in our study behavioral intention refers to taking actions based on the advice given by health education content.

Information source has been identified as an important factor of persuasive power (e.g., Petty & Cacioppo, 1986). It has been widely accepted that a highly credible source is more persuasive than a low-credibility one (see Pornpitakpan, 2004), therefore leading to more behavioral compliance (e.g., following given advice) than the less credible source. The effect, that is attitudes and intentions to respond in a constructive manner to persuasive messages, is moderated by individuals’ perception of self-efficacy (Bandura, 1977; Witte, 1992; Thompson, Compeau, & Higgins, 2006). We expect:
H2.4 participants who receive health education content from a professional source will have higher behavioral intentions than those who receive the content from a topical-style source.

Method

Background on WeChat

Wechat, initially released in 2011, is a mobile text and voice messaging communication service developed by Tencent in China. WeChat had around 300 million registered users, of whom 70 million are outside of China. It is the largest standalone messaging app by monthly active users (Wikipedia, n.d.). Wechat allows its users to manage relationships among each other and thus establish an online social network.

At the heart of the Wechat network is the “Moment” feature (figure 1.), users can share broad information including photographs, short text and subscriptions with connections. It also integrates social networking services such as those run by Facebook and Tencent QQ. Similar with other social media (e.g., Twitter), the messages exchanged on the Wechat can be classified as mostly consisting of status updates of what users are doing, where they are, how they are feeling, or hyperlinks to other sites (subscriptions) (Kietzmann et al., 2011). WeChat’s design is based on close relationships for example good friends and family members, which provides great potentials for connectedness-oriented communication.

Fig 1. The “Moment” feature of WeChat
Experimental Design

An online study was conducted from Shanghai through WeChat to investigate the effects of connectedness-oriented communication on social benefits of health-related social media, and the effects of information source on knowledge benefits of health-related social media. In line with previous research (Freyne, Berkovsky, Kimani, Baghaei, & Brindal, 2010), our study lasted 3 weeks, during which three questionnaires were sent to participants. Semi-structured interviews were conducted in the end to check effectiveness of manipulations and collect feedback.

Independent variables included connectedness-oriented communication (low level vs. high level) and information source (topical-style source vs. professional source). The study was based on a 2 by 2 between subjects design. As we did not see strong support to expect an interaction between independent variables, while having the risk of small sample size for each cell due to practical reasons during recruitment, we excluded the cell with high level of connectedness-oriented communication and professional source. Dependent variables included: knowledge benefits, social benefits (social connectedness and social support) and
behavioral intentions. We also measured user engagement (content browsing frequency and participant’s retentions) and compared it across each group.

Referring to previous research (Boontarig, Chutimasakul, & Papasratorn, 2013; Freyne et al., 2010; Hu & Sundar, 2010; Riedl et al., 2013), our analysis controls for factors including age, gender, education and network size that are related to one or more dependent variables.

**Treatment Conditions**

All health education content was delivered via the subscription account of WeChat, through which users received most recent daily subscriptions. All groups received exactly the same health education content as subscriptions, which provided basic scientific facts and operational advice, for example the definition and examples of aerobic exercise and anaerobic exercise, the acceptable daily intake of salt and low salt cooking recipes. Here is a translated sample of the content:

“Aerobic exercise (also known as cardio) refers to exercise carried under the situation where the human body has an adequate supply of oxygen. The body arrives in a physiological equilibrium as oxygen intake meets the demand for physical activities. It has a relatively long exercise time (at least 20 minutes) and middle or higher intensity (55-75% of maximum heart rate)…. 

... Most aerobic exercise includes periodical limb movement, and representative examples are walking, jogging, cycling, and swimming. Such exercises are generally simple, less demanding, and easy to grasp. Most ball games involve aperiodic movement and contain both aerobic and anaerobic exercise, but they are categorized as aerobic exercise.”
For the control group, the content was sent via the name of a topical-style source, and no incentives are provided, which is the most common situation in WeChat therefore serving as a good comparison. In group A, the only difference with the control group was that participants were incentivized to achieve high level connectedness-oriented communication. That is, sharing more health education contents and asking for the “Likes”. The only difference between the control group and group B was the information source, as the content was sent via a professional source in group B (see Table 1).

**Table 1. Experimental Conditions Overview**

<table>
<thead>
<tr>
<th>Experimental Group</th>
<th>Control Group</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Source</td>
<td>Topical-style source</td>
<td>Topical-style source</td>
<td>Professional source</td>
</tr>
<tr>
<td>Connectedness-oriented Communication</td>
<td>Low level</td>
<td>High level</td>
<td>Low level</td>
</tr>
</tbody>
</table>

**Manipulations**

**Information Source.** WeChat provides two types of public account: subscription account and professional account. To sign up for a professional account applicants need to provide relevant documents to prove he/she has relevant expertise. For subscription account applicants can sign up freely in that sense, but the functions of the two types of accounts are almost the same. Users could share the posts sent by public account in their “moments” (timeline), where their WeChat connections could “like” and comment on the posts (Figure 2.).

Topical-style source was operationalized as a health-related subscription account, named as “Tips on healthy diet and physical activities (运动营养生活)”. Professional source is
operationalized as a local professor (also dietitian) who has a good reputation and extensive expertise in dietary and physical activity research. A professional account was signed up and verified (Figure 3).

Fig 2. the “Likes” and comment features in WeChat

Connectedness-oriented Communication. As we have discussed, for most laypersons, the “Like” can be categorized into connectedness-oriented communication. Since individuals are less likely to engage with health-related social media, not to mention communicate in a connectedness-oriented way, we incentivized participants to share the posts sent through our public account and collect “likes”. Collecting “likes” is a prevalent advertising campaign in WeChat. It is generally initiated by a public account, encouraging users to share specific posts (mostly advertisements) and asking their connections to “like” the posts. The posts will achieve a better dissemination, while users will receive a small financial incentive after collecting a certain amount of “likes” for the posts. The more “likes” participants collected after sharing health-related post, the larger chance they had to receive financial incentives. Participants were
required to send screenshots which contained the shared posts and the “Likes” to the researcher. The number of the “Likes” was calculated and the top 5 participants received a Philips soymilk maker (market price 35 euros) and top 6 – 15 participants could select the incentive from a Philips shaver (market price 15 euros) and a Philips hair dryer (market price 15 euros) in addition to the base payment (15 euros).

**Fig 3. Screenshot of Information Source and Articles**

Professional Source
(Prof. Lu)

Topical-Style Source
(Healthy Life Tips)

Participants

All participants were Chinese and most of them came from Shanghai. A screening process was conducted to ensure participants reached certain requirements, which included education level (above high school), age (30 - 60), income (more than 2000 RMB/month,
approx. 250 euros/month) and computer literacy (installed WeChat and post at least once a week). A total of 178 participants who fulfilled the requirements were recruited by a local agency and randomly assigned to one of the 3 experimental treatment conditions. 12 participants dropped out right after passing the screening process. 31 participants dropped out halfway (13 males and 18 females). Thus, the effective sample size was 135 participants.

All participants received 15 euros as base payment at the end of the study, and participants in group A were incentivized in the way described in the manipulation section. 46.7% of participants are between 30 to 40 years old. There are 58 males and 77 females, all above high school education level, and without self-reported physical or sensory impairments. The purpose of the study was explained as improving social media product experience in the beginning, and more details were disclosed in the de-briefing process.

Measurement

**Connectedness-oriented Communication.** Connectedness-oriented communication was measured based on the number of “Likes” they received. Since WeChat does not provide background statistics of the number of “Likes”, we used two self-report items as a measurement. Participants were asked to report the frequency with which they received “Likes” and comments under the posts they shared. The response scales had a 6-point range from “I received almost no “Likes” for the posts I shared” to “I received “Likes” for each post I shared”. They also were asked the number of posts they shared. It ranges from “less than 5”, “6-10”, “11-15”, “16-20” to “21(shared all)”. Pairwise correlations showed that the two measures were significantly correlated ($r = .691, p = .000$) and hence were averaged to measure the number of “Likes”.
Social Connectedness. Based on the measurement of loneliness, several measurements of social connectedness have been developed in the past decades (IJsselsteijn, van Baren, Markopoulos, Romero, & De Ruyter, 2009; Lee & Robbins, 1995; van Bel, Smolders, IJsselsteijn, & de Kort, 2009). It has been suggested that social connectedness can be de-composed into several dimensions (van Bel et al., 2009), of which the most important one is relationship salience. Our study focused on this dimension and adapted four items on Social Connectedness from the ABC-Questionnaire (IJsselsteijn et al., 2009) into WeChat as the measurement. Sample questions include “Even when we are not in each other’s company, I often feel "together" with my connections in WeChat” and “Aside from our contact, I often feel "together" with my connections in WeChat somehow”. The response scale were as follow: (1) “completely disagree”, (2) “somewhat disagree”, (3) “neither agree nor disagree”, (4) “somewhat disagree”, (5) “completely agree”. Four items were averaged as the measurement (Cronbach’s α = .85, N = 135).

Social Support. A considerable number of measurements of social support have been developed, as its definition varies across different contexts. With respect to our study, which focuses on belongingness and connectedness, we used the Interpersonal Support Evaluation List (ISEL)(Cohen & Hoberman, 1983) as the measurement. Specifically, Cohen and Hoberman identified four subscales of social support, namely tangible support, belonging support, self-esteem support and appraisal support. We selected and adapted 4 items of belonging support into our study, sample questions include “When I feel lonely, there are several WeChat connections I can talk to”, “There are several different WeChat connections I enjoy spending time with”, and “If I decide one afternoon that I would like to go to a dinner that evening, I could easily find someone in WeChat to go with me”. Items were measured 5-point Likert-type ranging from completely disagree to complete agree (Cronbach’s α = .90, N = 135).
**Credibility.** This study used two items that have consistently emerged from the literature on perceived message credibility (Eastin, 2001; Flanagin & Metzger, 2007; Sundar, 1998, 1999; Sundar & Nass, 2001): accuracy and believability. Specifically, this study asked respondents to rate the extent to which they thought the information they just read was “accurate” and “believable” on 10-point Likert-type scales ranging from 1 (not at all) to 10 (extremely). Pairwise correlations showed that the two measures were significantly correlated ($r = .928, p < .0001, N = 135$) and hence were averaged to measure credibility.

**Behavioral Intention.** The study adopted a multidimensional method to measure behavioral intentions (Boulding, Kalra, Staelin, & Zeithaml, 1993; Cronin & Taylor, 1992; Wang et al., 2008), asking how likely the respondent was to (a) act on the advice that is offered in the message and (b) recommend the advice he or she read in the passage to another person. How likely the respondent was to (c) forward the message to his or her acquaintances online. The three items were measured on 10-point Likert-type scales ranging from 1 (extremely unlikely) to 10 (extremely likely). A factor analysis with varimax rotation yielded a single factor with an Eigenvalue greater than one. The items were averaged to create a behavioral intention scale (Cronbach’s $\alpha = .88, N = 135$).

**Knowledge Benefits.** A specific quiz (multiple choice formats) with 10 questions was developed by a professor and dietitian. The quiz tested knowledge of information that was made available to participants during the study. We also used the self-report items from van Uden-Kraan (2009) to check participants’ subjective perception of their own knowledge increase. Sample questions included “After subscribing to the public account in WeChat, I understand my health status better”, “… I have a clearer picture about my health status.” Items were measured using a 5-point Likert-type scale ranging from ‘completely disagree’ to ‘complete agree’ (Cronbach’s $\alpha = .94, N = 135$).
**Engagement.** Engagement was measured with content browsing frequency. Participants were given a list with all titles of article and asked to tick those they have read with three options: “read”, “unread” and “cannot remember if it is read or not”. For each article we coded “read” option was 1, “unread” as 0 and “cannot remember if it is read or not” as 0.5, and then we added scores of all articles together as the content browsing frequency measurement.

All survey questions were first translated by two bilingual scientists (Chinese and English) independently, and then the two translated versions were used by another bilingual scientist for reverse translation. After a general discussion with all three scientists in the end the translation was finalized.

**Procedure**

The study was conducted online during a 21-day period (Table 2). The screening questionnaire was e-mailed to the participants; participants who qualified according to our pre-determined criteria (regarding education, age, income, and computer literacy) were assigned randomly to one of the three conditions. Participants did not have interactions with each other, and were blind to others’ treatment conditions. They were informed they were engaging in a screening procedure of a social media study. A brief introduction of the study was included. Initially, participants viewed the welcome page and screening questions on the page. After filling in their answers to relevant questions and clicking the “confirm” button, they were informed about their qualification of the study.

Qualified participants were given an informed consent form including information on how personal data was handled and detailed introductions of the study via email. Those who agreed to sign the information consent received a passage of instructions explaining the
procedure. For the participants in group B, the incentive mechanism was explained additionally.

**Table 2. Procedure Overview**

<table>
<thead>
<tr>
<th>Start-up</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screening process &amp; Randomization</strong></td>
<td><strong>Baseline Questionnaire</strong></td>
<td><strong>Mid-term Questionnaire</strong></td>
<td><strong>Post Questionnaire</strong></td>
</tr>
<tr>
<td>1. knowledge quiz</td>
<td>1. credibility perception</td>
<td>1. knowledge quiz</td>
<td></td>
</tr>
<tr>
<td>2. social connectedness</td>
<td>2. engagement</td>
<td>2. social connectedness</td>
<td></td>
</tr>
<tr>
<td>3. social support</td>
<td>self-report</td>
<td>3. social support</td>
<td></td>
</tr>
<tr>
<td>&amp;</td>
<td></td>
<td>4. engagement self-report</td>
<td></td>
</tr>
</tbody>
</table>

Experiment Period: 3 weeks

*main activities: read/share subscription posts and fill questionnaire*

After reading the instructions and following the public account in WeChat, the participants answered a list of questions regarding health, including nutrition self-efficacy, and perceived control of health. Participants clicked the “Next” button to fill out the second page of baseline questions, including perceived social support via social media, perceived medium credibility and social connectedness via WeChat. Finally, the last page included a quiz to test participant’s health knowledge level (prior to exposure). Demographic information was taken from the screening questionnaire.

After 10 days, participants received another online questionnaire to measure their perceived credibility of the health education content, their interactions activity (self-report on the number of “likes” and comments they received on the posts they forwarded), also the number of dropout was documented. In the end (21st days), another questionnaire (same as baseline) was given to measure the change across the various variables of interest, before versus after the study. Participants were able to exit the study at any time by sending an
email to the local recruitment agency. All participants received a de-briefing message on the study once it was completed.

In the end, 4 participants were interviewed to understand their perception and attitudes towards incentive manipulation and collect general feedbacks.

Results

The analysis procedure was as follows: firstly we had look on the drop-out data and outliers, then we performed a manipulation check to verify its effectiveness, followed by descriptive analysis, comparing means of relevant variables with respect to all participants, during which we also inspect the group difference of some demographic variables to check our randomization. Finally, in hypotheses testing, we performed analyses from ANCOVA, multiple regression and t-test with respect to specific hypotheses.

Table 3. Sample Size & Drop Out

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Incentives</td>
</tr>
<tr>
<td>Recruited</td>
<td>60</td>
<td>59</td>
</tr>
<tr>
<td>Dropout</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Effective</td>
<td>42</td>
<td>43</td>
</tr>
</tbody>
</table>

Analysis on the drop-outs with limited data revealed that more than half of them are between 30 to 40 years old, and relatively lower pre knowledge level ($M = 3.71, SD = 1.92, N = 31$) than those do not drop out ($M = 4.03, SD = 1.58, N = 135$). Of the total 43 drop-outs, 23 participants dropped out in the first week, and group B achieve a better retention than the other two groups (Table 3). With an outlier check on important variables including social
connectedness, social support and knowledge level, we did not obtain enough supports to exclude any data.

**Manipulation Check**

We increased connectedness-oriented communication by incentivizing participants to share health education content and collect “Likes” (figure 4). To check if the incentives worked, we ran a T-test between control group and group A. Results show that participants who received incentives significantly had more connectedness-oriented communication ($M = 3.56$, $SD = 1.26$, $N = 43$) than participants who did not receive incentives ($M = 2.88$, $SD = 1.152$, $N = 42$), $t (83) = -2.58$, $p = 0.011$. Therefore the manipulation appears effective.

We also checked if our manipulation triggered unwanted changes. A multiple regression [independent variable: post knowledge level, predictors: group dummy, pre knowledge level, the number of “Likes”] yields to a significant results, $F (3, 81) = 10.894$, $p = .000$, adjusted R^2 = .287. Group membership was found to be a significant predictor ($beta = -1.216$, $t (84) = -2.966$, $p = .004$), while the number of “Likes” was not ($beta = -1.216$, $t (84) = -2.966$, $p = .068$). It indicates that our incentive-based manipulation increase the number of “Likes” while leads to a lower post knowledge level, therefore we excluded incentivized group (group A) when analysis knowledge level and only use data from control group and group B.
Descriptive Statistics

Most participants selected 40 -50 minutes when asked about the time they spend on WeChat each day ($M = 4.95, SD = 1.76$). 68% of participants obtained at least a college degree, and over 73% of them had a monthly salary higher than 4000 RMB. A significant difference in income was observed, the control group has higher income than the other two groups, $F (2, 132) = 5.12, p = .007$.

The pre social connectedness for all participants ($M = 3.93, SD = .56$) was significantly lower than post social connectedness ($M = 4.14, SD = .69$) according to a t-test, $t (134) = -7.452, p = .005$, 95% CI [-0.310, -0.059], while the pre social support for all participants ($M =$
3.44, \(SD = .43\) was significantly higher than post social support \((M = 3.29, SD = .44)\), \(t(134) = -3.121, p = .002\), 95% CI [0.055, - .245]. Participants were also more informed after the study, \(t(134) = - 6.482, p = .000\), as the pre quiz score \((M = 4.03, SD = 1.58)\) was higher than the post quiz score \((M = 5.13, SD = 2.20)\). Participants showed a relatively high behavioral intentions \((M = 7.56, SD = 1.97, N = 135)\) and perceived credibility \((M = 8.25, SD = 1.38)\).

Notably, no participants rated the source credibility lower than 5 (ranges from 1 to 10). Out of the 21 items of health education content, participants reported that they read most of them \((M = 18.19, SD = 3.45)\). Besides, we obtained a significant difference in pre knowledge level between control group \((M = 3.40, SD = 1.59)\) and group B \((M = 4.82, SD = 1.21)\), \(F(2, 132) = 11.77, p = .000\).

Previous research suggested that Chinese people have different health beliefs and evaluate credibility in a different way. First we tested if their health belief correlated with content browsing frequency, as it has been showed in Western cultures. The two variables were significantly correlated, \(r(135) = .183, p = .034\), indicating that there is no difference between Chinese participants and participants from Western cultures. Then we compared their perceived medium credibility of social media with television, books and newspapers with regard to health information. 3 t-test were conducted and no significant difference was obtained, suggesting that social media is not an unfavorable health information medium.

**Hypotheses Testing**

Before we proceed to the analysis on hypothesis testing, it is worthwhile to note that all analyses conducted are contrasting two groups although we have 3 treatment conditions. Analyses on H 1.1 and H 1.2 were performed between control group and group A, while analyses on H 2.1 to H 2.4 were performed between control group and group B.
H1.1 participants who are engaged with more connectedness-oriented communication will perceive a stronger social connectedness than those who have less connectedness-oriented communication.

An ANCOVA [between-subjects factor: connectedness-oriented communication dummy (low level, high level); covariate: social connectedness (baseline)] analysis was conducted to test the effects of connectedness-oriented communication on social connectedness (figure 5). Results revealed no main effects of connectedness-oriented communication, $F(1, 81) = 1.185$, $p = .280$. Baseline social connectedness had significant effects on the post measure, $F(1, 81) = 4.993$, $p = .028$.

**Figure 5. Means of Social Connectedness (pre and post)**

As we manipulated the number of “Likes”, later on, a multiple regression was performed by using it as independent variables to see if it could predicted the post level of social connectedness [independent variables: amount of received “Likes”, control variables: social connectedness (pre level), education level, income, time spend on WeChat]. Results show
that a significant amount of variance in the post level of social connectedness was explained, $F (5, 79) = 5.391, p = .001$, adjusted $R^2 = .232$. Both the pre level of social connectedness ($\beta = .265, t (84) = 2.153, p = .034$) and amount of received “Likes” ($\beta = .196, t (84) = 3.108, p = .003$) predict the post level of social connectedness significantly. The effect of education was significant ($\beta = .208, t (84) = 2.263, p = .026$) and income and time spent on WeChat were not. Thus, **H1.1 was supported**.

H1.2 participants who are engaged with more connectedness-oriented communication will perceive stronger emotional social support than those who have less connectedness-oriented communication.

**Figure 6. Means of Emotional Social Support**

The main effect of connectedness-oriented communication on post level of emotional social support (figure 6) was examined with an ANCOVA analysis [between-subjects factor: connectedness-oriented communication dummy (high level, low level); covariate: emotional social support (baseline), network size]. No significant main effects for...
connectedness-oriented communication were found, $F(1, 81) = .636, p = .428$. Effects of network size were also not significant, $F(1, 81) = .330, p = .567$. Again, post measures were found moderated by baseline measures, $F(1, 81) = 10.118, p = .002$.

We also performed a multiple regression to see if level connectedness-oriented communication or the amount of received “Likes”, education, time spend on WeChat, gender and pre level of emotional social support predicted the post level of emotional social support. Results show that a significant amount of variance in the post level of social connectedness was explained, $F(3, 81) = 8.834, p = .000$, adjusted $R^2 = .219$. Both the pre level of emotional social support ($\beta = .364, t(84) = 3.295, p = .001$) and amount of received “Likes” ($\beta = .161, t(84) = 3.790, p = .000$) predicted the post level of social connectedness significantly, while income, time spent on WeChat and education did not. **H1.2** was supported.

H2.1 health information attributed to professional source will be perceived as more credible than topical-style source

To compare the difference in credibility across two groups (figure 7), we performed an independent t-test. No significant difference was found in credibility between professional source ($M = 8.81, SD = 1.43$) and topical-style source ($M = 7.96, SD = 1.29$), $t(92) = -2.947, p = .004$, although the results is nearly significant. **H2.1** was supported.

H2.2 participants who receive health education content via professional source will browse it more often than who receive the content via topical-style source
Figure 7. Means of Source Credibility

![Chart showing perceived source credibility](chart1.png)

Figure 8. Means of Content Browsing Frequency

![Chart showing content browsing frequency](chart2.png)
We performed an ANCOVA [between-subjects factor: information source dummy (topical-style source, professional source); covariate: health belief] to investigate the effect of information source on content browsing. The main effect of information source was found significant, \( F(1, 89) = 9.756, p = .002, \) adjusted \( R^2 = .180. \) Professional source had a higher content browsing \( (M = 17.21, SD = 4.06) \) (see figure 8 for a reference) than topical-style source \( (M = 18.88, SD = 3.26). \) **H2.2 was supported.**

As a follow-up analysis, we performed a multiple regression by including content browsing as dependent variable and group dummy as independent variable, and we controlled for credibility and age. The results indicated that a significant amount of variance in the content browsing was explained, \( F(4, 87) = 6.837, p = .000, \) adjusted \( R^2 = .239. \) Both the health belief \( (\beta = 2.117, t(91) = 3.500, p = .001), \) age \( (\beta = -1.052, t(91) = -2.412, p = .018) \) and the group dummy \( (\beta = .161, t(91) = 3.790, p = .000) \) predicted the post level of content browsing significantly, but not for credibility \( (\beta = .288, t(91) = 1.123, p = .265). \) An interaction between credibility and the dummy was then created and included to the model, it was not significant \( (t(91) = .106, p = .916). \)

**H2.3** participants who receive health education content from professional source will have higher post knowledge level than those who receive the content from topical-style source.

An ANCOVA [between-subjects factor: information source dummy (topical-style source, professional source); covariate: pre knowledge level] was conducted to test the hypothesis. The main effect of information source was found significant, \( F(1, 89) = 4.257, p = .042, \) \( R^2 = .252. \) Planned contrasts revealed that participants receive information via professional source had higher post knowledge level (figure 9), \( p = .042, 95\% \ CI [0.034, 1.793]. \) **H2.3 was supported.**
A multiple regression model was performed to control credibility and content browsing [dependent variables: post knowledge level, predictors: group dummy, control variables: credibility, content browsing, age], the results suggested a significant results $F(4, 87) = 13.206, p = .000$, adjusted $R^2 = .378$. Group membership did predict the post knowledge level significantly ($beta = .870, t(91) = 3.500, p = .041$), so as to age ($beta = .587, t(91) = 2.462, p = .016$), pre knowledge level ($beta = .870, t(91) = 2.857, p = .005$) and perceived credibility ($beta = .870, t(91) = 3.693, p = .000$). But content browsing is no more a significant predictor ($beta = -.045, t(91) = -.861, p = .392$).

Aside to the knowledge quiz another measurement on knowledge level is the self-report scale on knowledge increase from van Uden-Kraan (2009). We used an ANCOVA analysis to test the effects of information source on this measure. No significant variance was explained, $F(2, 89) = .249, p = .780$, adjusted $R^2 = .180$. 
H2.4 participants who receive health education content from a professional source will have higher behavioral intentions than those who receive the content from a topical-style source.

We conducted a t-test to examine this hypothesis. Professional source induced a higher behavioral intention ($M = 8.44, SD = 1.54$) than topical-style source ($M = 6.56, SD = 2.29$), $t(90) = -4.666, p = .000$. **H2.4 was supported.**

Then we controlled credibility in a multiple regression, the results was significant $F(4, 87) = 29.964, p = .000$, adjusted $R^2 = .402$, and both group membership ($beta = 1.275, t(91) = 3.494, p = .001$) and perceived credibility ($beta = .712, t(91) = 5.560, p = .000$) significantly predicted behavioral intentions (figure 7).

**Figure 7. Means of Behavioral Intentions**

![Figure 7. Means of Behavioral Intentions](chart.png)
Discussion

Social media is becoming a novel setting of health promotion (Loss et al., 2014). With social media, individuals could not only search, create and share health information, but also networking with connections to create and maintain stable interpersonal relationship, which is one of the most important human motivations (Baumeister & Leary, 1995). Although the use of health-related social media has demonstrated initial benefits in both social and knowledge aspects, very little is known about the underlying mechanism of how such benefits are generated and impacted. For instance, with respect to social benefits, as Thackeray et al. (2013) noted, the real “social” value of health-related social media has not been fully understood and captured. Our goal was to investigate two factors (connectedness-oriented communication and information source) that are likely to influence the benefits created by health-related social media.

First of all, following the strong links between connectedness-oriented communication and awareness of relationship (e.g., Kuwabara et al., 2002), we expected individuals who use health-related social media more for connectedness-oriented communication would perceive a stronger social connectedness and emotional social support (Hypothesis 1.1 & Hypothesis 1.2), which are important social benefits of health and well-being. To manipulate connectedness-oriented communication, we incentivized participants to share the content and collect “likes” for the posts. Manipulation checks further confirmed that our experimental manipulation was successful.

Second, information source could influence credibility perception, therefore influence selective information exposure, which may greatly impact knowledge benefits. We distinguished two typical health information sources: professional sources and topical-style sources. We expected professional sources to be preferable over topical-style sources, as they
are seen as more credible (Hypothesis 2.1), which would lead to more content browsing (Hypothesis 2.2) and result in higher knowledge levels for the participants (Hypothesis 2.3). In addition, considering the strong persuasive power of professional sources, we expected it would induce stronger behavioral intentions (Hypothesis 2.4).

**Information Source and Knowledge Benefits.** One important research question of this study is “will health education content attributed to professional sources yield better knowledge benefits than knowledge gained through topical-style sources in social media?” Besides, we also proposed the question on the effectiveness of information source on engagement. To this end, the current research found that compared with topical-style source, professional source has positive influence on not only knowledge benefits, but also on other important variables in health promotion including engagement and behavioral intentions. Participants who received health education content from professional source achieve a higher post knowledge level than those who received the same content from topical-style source after accounting for their pre-knowledge level. Professional sources were perceived as more credible than topical-style source respect to health information. Respondents also reported significantly greater behavioral intentions of taking action toward health education content attributed to a professional source than topical-style source. Besides, the content engages users more when it attributed to professional source than to topical-style source.

We obtained the results with a successful manipulation of source credibility, which at first glance does not appear to be consistent with Hu & Sundar’s results (2010). However, this inconsistency may be explained by potentially different perceptions of credibility between topical-style sources and layperson sources. In Hu & Sundar’s study, professional sources were compared with layperson sources while we compared professional sources with topical-style sources, which are less credible than layperson sources since they have lower
homophily. Our findings on knowledge benefits are in line with the conclusion of Groenendyk & Valentino (2002), and at variance with Hovland’s results (1951). It implies that information source does impact health information retention, and means people have the tendency to memorize more health information attributed to professional sources than topical-style sources. However, according to our analyses the effect is caused by source credibility rather than our prediction (by selectively exposure). The results supported the reputation heuristic Metzger et al. (2013) identified in online information credibility evaluations, indicating that aside to examining the content sent via sources individuals also rely on reputation heuristics to evaluate its credibility.

In Hovland’s study participants were exposed to information source under experimental conditions, and we identified the effects of information source on information retention under a relatively naturalistic condition where respondents can control their exposure to information. Respondents in our study were observed to selectively expose themselves to professional source more, and tended to dismiss topical-style source therefore less likely to retain health information from it. It suggests that information source may not influence information acquisition and retention under the experimental condition as Hovland (1951) illustrated, it does make communication more effective under the condition where individuals have the control over their own information exposure.

In addition, the obtained results on behavioral intention were in line with Hu & Sundar (2010), indicating professional sources have a stronger persuasive power than topical-style sources since participants showed stronger behavioral intentions to share, forward and follow advices in health education content when the content was attributed to a professional source.

With respect to the effects of information source on knowledge benefits, we have recognized alternative explanations. Participants under the condition that health education
content was sent via professional source have significantly higher pre-knowledge level than the participants in the control group (via topical-style source). Although we have accounted for the pre-knowledge level in the analysis, it may indicate that participants in the former group probably are more motivated and enthusiastic to health promotion or/and have higher health awareness than the control group. Such difference may also explain the difference of content browsing and behavioral intention. According to selective exposure theory, individuals have the tendency to favor information that reinforces pre-existing knowledge and views while avoiding contradictory information (see Knobloch-Westerwick, 2014). As we measured pre-knowledge with a quiz based on the content, participants who obtained a higher score in the quiz may favor and browse the content more than those with a lower score, since it confirms with more pre-existing knowledge.

Our study results have significant implications within the context of health communication. From the theoretical perspective, our research extends Hovland’s study on source credibility and communication effectiveness by finding differences between different information sources (professional source vs. topical-style source) with respect to source credibility and information retention (knowledge increase in our study). This completes Hovland’s conclusion by following his research suggestions of conducting research under naturalistic conditions and giving participant control on information exposure. At this moment, we know that information does influence information acquisition and retention when individuals have the control over their information exposure. In addition, the present study also extends the study of Hu and Sundar (2010) by bridging the gap between knowledge benefits and information source through source credibility. Previous research has provided associations between information source and source credibility and between source credibility and information retention, our study links all of them together and provides a clear image on how a preferable information source yields to more information retention through source credibility.
The present study results also have significant practical implications to health-related social media development. By suggesting that professional sources are a more effective source than topical-style sources in promoting knowledge benefits, our study shows the way of health-related social media to amplify health benefits and enlarge effect size. This finding is useful to health-related social media product owner who want to know how information source can modify engagement and health outcomes, especially when considering the low engagement of health-related social media. An obvious design proposition emerging from this is that source characteristics could be made more apparent during user reception of health education content if a professional source is available. Besides, the fact that individuals were more likely to take action towards the health information delivered from professional sources provides a good direction for health-related social media product owners who have ambitions relating to health behavior change of their customers. Health advice is more likely to be memorized and accepted when provided by professional source than topical-style source, or other less credible source.

**Connectedness-oriented Communication & Health Benefits.** The present study also aims at exploring the real “social” value of health-related social media by studying the effect of connectedness-oriented communication on two underlying health benefits: social support and social connectedness. The study results supported the notion that higher level of connectedness-oriented communication could leads to enhanced social connectedness and emotional social support in social media. The results are in line with previous research conducted in Twitter (Riedl, et al., 2013), which suggested that frequency and amount of communication play an important role in maintaining social relationships and social connectedness is enhanced by active information sharing among members. Therefore, more frequent usage would result in users experiencing higher levels of social connectedness. Further, the more people interact with each other, the more it is likely that they will experience
psychological and emotional connection with other members of the network. Riedl et al. (2013) also pointed out that social connectedness within social media is a qualitative source of social capital therefore our findings support the general conclusion of research on social networking site usage and social capital (e.g. Ellison et al., 2007), which is usage of social networking site may yields to higher emotional social support and reducing loneliness, which is highly correlated with social connectedness. Our study, again, implies that social media’s potential of influencing social well-being through social connectedness and social support. More importantly, the positive results not only enhance our understanding of what benefits were created, but also extend our knowledge of how they were created by studying the effectiveness of connectedness-oriented communication. This knowledge nicely responds to research suggestions of examining the inherent “social” value of social media proposed by Thackeray et al. (2013). We believe more “social” value of social media in health promotion will be identified and understand in furture research by adopting the construct of connectedness-oriented communication. A direct practical implication for health-related social media design is encouraging and eliciting more of social interactions within intimate relationships which does not necessarily conveys concrete information but focus more on networking. To put it simply, keeping users connected with their intimate ones will yields to more health benefits.

Notably, we obtained the conclusion with observing a significant decrease of emotional social support of all participants. A more precise conclusion therefore should be connectedness-oriented communication slowed down the decrease of emotional social support. We are not capable to offer sound theoretical explanations on this phenomenon at this moment. It may be caused the respondent fatigue, which is tired and bored respondents may often give more perfunctory answers (Ben-Nun, 2008). Our study has relatively longer study duration and participants encountered several questionnaires twice, it is likely that they
lose their interest in the end, especially when considering items on emotional support were arranged in the end of the surveys.

We manipulated connectedness-oriented communication by incentivizing participants share more posts and asked for more “Likes”. With an observation on the effectiveness of incentives, we are also aware that it may also bring about a series of other effects. The acceptance of incentives, especially monetary incentives, could pose threat to experiment validity. For instance, previous research indicates that in online health community some members reported that incentive are “not accepted” and “regarded as ineffective” when compared with other non-monetary motivation mechanism (Matzat & Rooks, 2014). It also has been suggested to affect the participants’ mood, which might lead to mood congruent or mood-incongruent answering in survey (Goritz, 2004). Besides, offering financial incentives, which is a form of extrinsic motivation, can drive intrinsically motivated participants away from the experiment (Deci 1971). As illustrated in our manipulation check process, using incentives to encourage connectedness-oriented communication serves somehow undermines knowledge benefits, which may be correlated with the changes in participants’ motivations.

The difference between different analysis approaches probably implies that the manipulation is probably not strong enough, as the group difference in “Likes” did not predict the two health benefits significantly. Returning to the definition of social connectedness which encompass positive appraisal towards both quality and quantity of interaction, the non-significant results based on the default incentive-based manipulation implies that although it boosted the quantity of interactions as illustrated in manipulation check, it may negatively impact the quality of interaction. This has a practical implication for the designing on health-related social media. Given that fostering social interaction and connectedness-oriented communication could yields to series health benefits, the detailed design, for example online
community moderation mechanism, should not only take the quantity but also the quality of such motivated interactions/communications.

With regard to Chinese cultures, we did not find any evidence that shows China were under an unfavorable conditions when incorporating health promotion with social media. We know that Chinese are more tend to regard political news from television as more reliable than from newspaper and the Internet, but we did not obtain any significant difference in medium credibility when it comes to health information. Previous research suggest that Chinese have different health belief with Western people, it was not our study focus to compare the difference but the notion that health belief correlates with content browsing frequency developed under Western cultures has been proven holds to Chinese individuals as well. In general, the different health belief and credibility evaluation approach are not obstacles of developing health-related social media in China

**Limitations and Future Research**

It is important to note some limitations of the studies involved in this thesis. As previously discussed, an important limitation is randomization. A significant difference in pre knowledge level was found across groups, which provides alternative explanation to the effect of information source. Besides, we also observed significant difference across groups in income and health belief which is the extent to which individuals believe their health is within their own control. We have controlled health belief during our analysis therefore it is less problematic while the difference in income may impact the effectiveness of our incentive-based manipulation. For example, individuals with lower income may respondent more actively towards the incentives, although the reanalysis did not exhibit significant relationship between income and the amount of “Likes” individuals received.
It is also worthwhile to discuss the generalizability of the results, especially those relate to source credibility. In the present study, the health education content was in a decent quality as it was finely edited and reviewed by an editor and a professor and dietitian, which is not the case to most online health information. Previous research has found that health information credibility assessment is associated with the content in itself (Eastin, 2001; Flanagin & Metzger, 2000; Sundar & Nass, 2001), as the central processing routine in elaboration likelihood models (ELM) suggested. Considerable attempts have been made to explore the interactions between information source and content attributes (e.g. topic, tones, completeness and type) (Eastin, 2001; Hovland & Weiss, 1951; Hu & Sundar, 2010), although no consistent conclusions were made. At this moment we are not clear that if our conclusion still holds when the health education content was in a relative bad quality. A future research on the information source and content quality would be desirable. Besides, health information source credibility was suggested to be impacted by web-use orientation (e.g. searching or surfing) (Rains & Karmikel, 2009). Participants in our study received the content passively, which is similar with surfing in the Internet. Our conclusions may not be generalized to the situation where participants actively seeking for health information in social media.

Another potential limitation is the reliance of the survey data. Participants reflected that the questionnaire is too long and a few items are obscure, and they also gradually lose interests on such longitudinal study, which may constitute a threat to the data quality. We did observed some intriguing inconsistencies in our data. First of all, similar with Rains et al. (2009), we also observed that participants had an overall tendency to rate all information as relatively credible. In the feedback sessions, however, most participants said that the content quality is not better than the average level of health education content they read in social media. Second, while most participants claimed that they read all of posts, the background data from WeChat shows that the two groups in which participants did not receive incentives each article was generally
read by half of the participants. Besides, as mentioned we adopted the self-report measurement from van Uden-Kraan (2009), and a quiz to measure knowledge benefits and found an interesting contrast. While most participants reported they were better informed, the quiz results indicate that post quiz score was not significantly different with the baseline level if all participants were considered. Finally, several participants in group A indicated that they were not aware of the incentive mechanism although it was made explicitly in the information consent. Since the information consent was send via mobile device, it would help if a better process was adopted.

In addition, due to the legal restrictions we had no full access to survey data of participants who drop out halfway. The analysis based on their screening data was underpowered, and we could not explore in depth of their drop out reasons. Investigations on the drop out population could generate meaningful outcomes in improving engagement.

Future research may look at the effect of information source under different web-use orientation, combining with the ELM and HSM. In our study the content was in a good quality, and provided clear and strong evidence based arguments, hence it is more likely that individuals resort to the heuristic-based peripheral routine to evaluate source credibility. It is possible that when the content contains inconsistent and ambiguous arguments, individuals tend to go through the central processing routine therefore weaken the effectiveness of heuristics.

We have correlated the knowledge benefits with information source, but how long-lasting is the source effects? How individuals utilize the new knowledge and will such knowledge leads to health behavior change? An important determinants in most behavior change theories is self-efficacy, which is the “conviction that one can successfully execute the behavior required to produce the outcomes” (Bandura, 1997), as individuals becomes more
knowledgeable when receive health content from professional source, will they also feel more empowered and have a stronger self-efficacy? Given the effects of information source on behavioral intentions, it is imperative that we understand its impact on behavior change. This will not only extend our understanding the effect of information source but have the potential to provide concrete health benefits.

In summary, the present study makes several noteworthy contributions to health-related social media research from perspectives of both interpersonal communication and mass communication. The knowledge on the inherent “social” value of social media in health promotion has been extended based on the construct of connectedness-oriented communication. The knowledge gap between information source, source credibility and knowledge benefits of health-related social media has been bridged, and several insights on engagement have been provided. However, we are still not clear about the optimal approach to elicit more connectedness-communication while avoid unwanted negative effects given its benefits in health promotion. Furthermore, professional source has been proved can yield more knowledge benefits and higher engagement, but some underlying mechanisms or reasons why it works in such way calls for future research. With our practice in China we hope more future research on this potential novel setting of health promotion could develop a more universal solution in the worldwide and create more profound health benefits.

References


A WAY TO ENHANCE HEALTH BENEFITS OF SOCIAL MEDIA IN CHINA


Appendix

Health Education Content

Health Education Content.rar

Questionnaire

Social Connectedness (relationship salience battery), ABC-Questionnaire

1. Even when we are not in each other’s company, I often feel "together" with people in my social network somehow.
2. Aside from our contact, I often feel "together" with people in my social network somehow.
3. I feel that people in my social network often think of me.
4. I often think of people in my social network.
5. 微信连接你我，有时哪怕朋友不在身边，彼此之间也有心心相通的感觉。请你根据你的切实感受选择最恰当的一个答案。

1. 即使不在身边，我也经常有种和微信里的朋友们在一起的感觉。
2. 即使在不联系的时候，我也经常有种和微信里的朋友们在一起的感觉。
3. 我感觉我的微信里的朋友们时常想起我。
4. 我经常会想到我的微信里的朋友们。

完全不同意，不同意，不同意也不否认，同意，完全同意
**Self-efficacy**, Ralf Schwarzer & Britta Renner

“How certain are you that you could overcome the following barriers?”

I can manage to stick to healthful foods, ...

1. ...even if I need a long time to develop the necessary routines.
2. ...even if I have to try several times until it works.
3. ...even if I have to rethink my entire way of nutrition.
4. ...even if I do not receive a great deal of support from others when making my first attempts.
5. ...even if I have to make a detailed plan.

我能坚持健康合理的膳食结构，哪怕：

1. 需要长时间来养成必要的习惯
2. 需要尝试多次才看到效果
3. 需要重新考虑我摄入营养的方式
4. 第一次尝试得不到很多周围人的支持
5. 需要做一个详尽的计划
非常没把握 比较没把握 比较有把握 非常有把握

**Social Support (ISEL)** Cohen, 1983

Belonging Support Subscale, items 10, 25, and 27 are reverse scored.

5. When I feel lonely, there are several people I can talk to.
7. I often meet or talk with family or friends.
10. I feel like I’m not always included by my circle of friends.
12. There are several different people I enjoy spending time with.
25. Most people I know do not enjoy the same things that I do.
27. I don’t often get invited to do things with others
31. If I wanted to have lunch with someone, I could easily find someone to join me.

在微信上：

1. 当我觉得有点孤单，微信里有我可以聊天的人
2. 我经常跟家人或朋友在微信上聊天
3. 在微信上，我感觉我并不总是在朋友们的圈子里
4. 在微信上，有些朋友让我很享受跟他们在一起消磨时光
5. 在微信上，大多数好友对我喜欢的东西并不感兴趣
6. 不经常有人通过微信邀请我一起做些事情
7. 如果我想找人一起吃个饭，我可以很容易地从微信上找到

完全不同意， 同意， 完全同意

**Better Informed, van Uden-Kraan, 2009 (adapted version)**

After I following the Wechat public account:

1. … I feel better informed in nutrition and physical activity.
2. … I understand my eating habits and physical activity better.
3. … I have a clearer picture about my health status.
4. … I feel like I have more (correct) knowledge at my disposal to deal better with my unhealthy habits.

自从关注了这个微信公共帐号，我感觉：
1. 我觉得在营养和身体活动方面有更好的了解。
2. 我更好地理解了自身的饮食习惯和身体活动状况。
3. 我对自身的健康状况有了更清晰的认识。
4. 我觉得我掌握了更多正确的知识，以更好地处理不健康的生活习惯。

完全不同意， 同意， 完全同意

**Behavioral Intention, Hu&Sundar, 2010**

How likely you will:

1. Act on the advice that is offered in the message and
2. Recommend the advice he or she read in the passage to another person.
3. Forward the message to his or her acquaintances online.
回忆过去十天里我们推送的文章，你有多大可能会：
1. 转发文章到微信群或朋友圈
2. 按文章里提供的建议照做。比如食用低GI，高膳食纤维食物。
3. 把文章里的建议推荐给家人朋友。

Scale: 1 to 10

**WeChat Background Content Browsing Statistics**

![Content Browsing Times Graph](image1)

![Content Forward Times Graph](image2)