Microblogging platforms are increasingly adopted by people to acquire and share online health advice. However, the unique nature of such platforms (e.g., user-generated content, restriction of length) may invalidate previous guidelines in assisting health credibility assessment and propagate health information with low quality. In view of this, drawing on ELM and its derivates, this study, as one of the early attempts in the field, explores how two prominent design features (i.e., author credential and microblog reply) can facilitate microblogging users' assessing of health advice credibility on different health topics (i.e., health promotion and disease management). The research model will be tested through an experiment. By synergizing the cumulative literature in areas of online health information, microblogging and credibility assessment, this study can potentially advance our understanding of credibility assessment of health information on microblogging platforms. Potential practical implications are offered for microblogging designers and health practitioners.
Introduction

Online health information seeking has grown at a phenomenal rate. A report from Pew Internet and American Life Project indicates that 80% of American Internet users have sought health information online. On a typical day, around eight million Americans look for at least one health topic online and 58% of users utilize the online health information to decide how to treat an illness or a condition (Fox 2006). Among various online platforms, microblogging, an online blogging platform allowing users to read, post (i.e., tweet) and forward (i.e. retweet) short information, is increasingly becoming a prominent and favorite source for people to acquire and share information (Chamberlain 2009; Java et al. 2007; Siegler 2011; Zhao and Rosson 2009). By mid-2011, Twitter, a popular microblogging platform, has reached serving up to 18 thousand queries per second, i.e. 1.6 billion queries per day on average (Siegler 2011).

Despite the increased prevalence of microblogging, this platform has its inherent limitations to disseminate healthcare information. First, the length restriction of a microblog imposes challenges for an even qualified provider to accurately or completely describe the whole health message in a single microblog. Second, microblogging platform could be a favorable environment for disinformation (Chamberlain 2009). Different from traditional media such as newspapers and magazines, health information posted online often lack professional gatekeepers such as editors to evaluate the credibility (Metzger 2007). For instance, in Twitter, a user can tweet and retweet any short information he/she likes, with extremely limited responsibility for the information credibility. Hence, a microblogging user could frequently be exposed to incomplete, spurious or fraudulent health information (Berland et al. 2001; Crocco et al. 2002).

To the extent that most users could lack sufficient medical expertise to judge the information (Baker et al. 2003; PSRA 2002; UCLA 2003), it is challenging for them to assess the credibility of health information, which encompasses health information quality as well as the provider’s trustworthiness and expertise (Freeman and Spyridakis 2004). As a result, it is possible for them to adopt health information with low degree of quality and potentially harm personal health and life. More seriously, one’s misjudgment of the health advice as credible can lead to his/her retweeting of the microblog, which consequently propagates the negative impact over networks. With the challenges and potential negative consequences for microblogging users, the public’s trust in online health information has decreased over time in spite of the increasing availability of health information on the Internet (Hesse et al. 2005). Hence, it is pertinent for microblogging designers or operators to provide appropriate features to aid users in assessing the health information credibility.

While the concern of online health information quality has been corroborated by many scholars (Metzger 2007; Seidman 2006; Suggs 2006), to our best knowledge, few studies have explored the specific design features that could be utilized in assessing credibility on microblogging platforms. Furthermore, although the specific topic of the health information seems to have an influence on people’s credibility perception, most of prior studies handle this factor by simply controlling rather than carefully investigating its potential effect (e.g. Freeman and Spyridakis 2004). In this study, we propose and evaluate technological artifacts that can be deployed on microblogging platforms to help users assess the credibility of the health advice - a type of health information that communicates an opinion about what could or should be done about a health related problem or issue (Siegal and Sussman 2003). Drawing on elaboration likelihood model (Petty and Cacioppo 1986) and dual processing model of credibility assessment (Metzger 2007), we propose that when confronted with different types of health advice (i.e., health promotion and disease management) on a microblogging platform, the influences of author credential and microblog reply on one’s credibility assessment are likely to differ. The outcomes of this study would add a much needed perspective for health practitioners and microblogging designers to understand online users’ assessment processes and to develop more attractive features.

Background: Evaluating Health Advice on Microblogging

To help people judge the credibility of online health information, many healthcare organizations and scholars have spent great effort in developing criteria and guidelines (see Kim et al. (1999) for a review). In the field of health informatics, a wide range of criteria or indicators of credibility for online health information has been recommended (e.g. Winker et al. 2000; Wyatt 1997). A recent review by Eysenbach and his colleagues (2002) compiled a list of quality criteria and provided a comprehensive overview of
quality criteria and their evaluation results based on extant empirical studies. The list of credibility criteria could be classified into seven themes (O'Grady 2006), including content, authorship, advertising, currency, scope, contact information, and legal issues.

While these guidelines or criteria vary, they are similar in their focus on setting and assessing credibility standards of the institutional providers (i.e., health web portals). For instance, four most frequently used quality criteria, as revealed by the review conducted by Eysenbach et al. (2002), include the overall health website’s accuracy, completeness, readability, design. In the review by Kim et al. (1999), two most frequently mentioned areas are “content of the site” (e.g., authors of health advice need to provide a detailed statement of his/her medical qualifications and clear references to source data with date of modification) and “design and aesthetics of the site” (e.g., designing website layout and navigation in the clearest possible manner to provide information).

These guidelines and criteria may provide invaluable help for users to evaluate the credibility of online health information in traditional setting but they are less applicable to the microblogging platforms. Unlike online health web portals where the content is mainly provided by health professionals or researchers and reviewed by editors, content on microblogging platforms are primarily generated by ordinary users (Metzger et al. 2010). In other words, there is a shift of information providers from professional institutions to the anonymous crowds (Madden and Fox 2006). Such a change may invalidate the importance of those website-level credibility indicators such as the layout design and interface aesthetics of the site since microblogging platforms do not allow users to customize the layout of microblogs. Some other generally accepted ways such as verifying institutional identity and certification through reputation or stated qualifications may no longer be applicable (Fritch and Cromwell 2001; Sundar 2008). Additionally, this change puts the actual quality of health advice disseminated on microblogging platforms at more risk considering the fact that while average users do not have necessary medical expertise, they can tweet or retweet the health information with limited liability. There is also a call for education and research on online information credibility assessment to shift beyond the “checklist” approach which have been criticized for unrealistically assuming Internet users will spend great efforts in assessing each website they visit (Meola 2004), towards a more “contextual” and realistic approach with emphasis on understanding the context within which online information is located (Meola 2004; Metzger 2007).

The microblogging platform has its own characteristic that challenges the credibility assessment of health information, namely the length restriction of the messages being tweeted (e.g., a limit of 140 characters for Twitter). Since its birth, microblogging, designed to facilitate a “faster mode of communication” (Java et al. 2007), often restricts the length of the message. For authors, this length restriction is likely to cause them to tweet short declarative statements without necessary supporting arguments such as references, evidence and analyses (Chamberlain 2009), which can lower the actual quality of health information disseminated on this platform. For recipients, it can increase the difficulties of judging the credibility of the health information since they can no longer directly refer to the details of the health message such as the evidence, analyses, etc. Therefore, such a unique characteristic further creates the challenge for users to justify the credibility of health advice. With these challenges and the need for more in-depth understanding toward a specific context, it is imperative to explore how particular features can actually aid a user’s credibility assessment of health advice. In the following section, we draw on elaboration likelihood model and its derivate to have a theoretical understanding of how microblogging users process health advice. This serves as a basis for proposing the website features examined in this study.

**Literature Review**

**Assessing Health Advice through Elaboration Likelihood Model**

Elaboration Likelihood Model (ELM), initially developed in the discipline of psychology, postulates that external information may influence one’s attitude and/or behavior change through two routes: 1) effortful processing of information that are relevant to the judgment situation; and 2) less effortful processing of heuristic cues (Petty and Cacioppo 1986). These two routes of persuasion are clearly distinct from each others. The central route generally requires a greater amount of cognitive effort compared to the peripheral route but results in more stable attitudinal changes that can more accurately predict long-term behavior (Petty and Cacioppo 1986; Petty et al. 1981). Based on ELM, Metzger proposed a dual processing
model to understand online information credibility assessment (Metzger 2007). Accordingly, when confronted with relevant online information such as health advice, when a microblogging user is motivated, he/she will be more likely to use “central” or “systematic” processing to assess the information credibility when he/she is able to do so. In contrast, users will likely rely on more “peripheral” or “heuristic” credibility cues when the ability to judge the credibility of the information is low. This view has gained support from some recent credibility studies (Hilligoss and Rieh 2008) and theories from information processing and cognitive science (Sundar 2008; Taraborelli 2008).

Type of information has been recognized as an important factor in influencing one’s assessment of online information (Petch 2004). The processes of credibility assessment can vary with information type (Flanagin and Metzger 2000). In relation to our context, based on the extent of specialty required to interpret the information, health advice can be generally categorized into two types: health promotion and disease management. Derived from O’Donnell’s definition, health promotion in this study is defined as health advice that help people strive for optimal health and support them in changing their lifestyle to move toward a state of optimal health (O’Donnell 2009). Some examples of health promotion topics include nutrition, sexuality, and substance use (Petch 2004). In contrast, disease management in this study is defined as health advices that facilitate patients’ self-care for their illness besides the medical treatment. It is part of a system of coordinated health care interventions and communications. These two types of health advice exhibit different nature. Health promotion is generally accepted within an individual’s control and responsibility (Breslow 1999), i.e. people could change their habits or lifestyle to following these advices for optimal health. Whereas, disease management often requires the participation of professional healthcare practitioners since most ordinary persons actually lack necessary expertise thus are not able to, for instance, diagnose symptoms or prescribe medicine.

According to ELM and its derivate, different health topics could potentially influence the way individuals assess credibility. Specifically, it may affect one’s belief in his/her ability to evaluate the health advice delivered in a microblog. For health promotion that is generally believed to be within individuals’ personal control and responsibility, they may reasonably feel more autonomy thus have more confidence to judge the credibility based on their own experience and knowledge through “central route”. While for those that seems partially out of their personal control and responsibility (i.e. might need to consult medical professionals like physicians), they might expect other means, e.g. through peripheral routes, to assess their quality rather than process and evaluate on their own. In this case, people believe more in the role of powerful others thus be more receptive to health messages with cues endorsed by medical authorities (Norman et al. 1998). Figure 1a depicts a typical users’ dual processing of credibility assessment for health advice on microblogging platforms. In this study, we aim to explore appropriate microblogging features that can aid the assessment of these two types of health topics.
Figure 1a. A Dual Processing of Credibility Assessment for Health Advice on Microblogging Platforms (Adapted from Metzger 2007)

Research Model

Figure 1b depicts the research model. The central thesis is that when confronted with different topics of health advice (i.e., health promotion and disease management), the effects of different settings of author credential and microblog reply on a user’s assessment on health advice credibility are likely to differ. In this study, we focus on health advice that is relevant to a microblogging user. In other words, the user is motivated to assess the health advice on the microblogging platform, perhaps for the reasons that they want to follow the advice themselves or to retweet to their friends.

In this study, we choose to focus on two most prominent features commonly offered on microblogging platforms for credibility assessment – account verification and microblog reply. Many microblogging platforms provide account verification to help users discover high-quality sources of information from a legitimate source. This feature is served as a means to deliver information of the author credential, which is vital in this context where content is contributed by the crowds (Morris et al. 2012). Besides author credential, some microblogging platforms also allow users to reply to a microblog and display replies right under the original piece. Functioning similarly as product reviews (e.g. Ghose and Ipeirotis 2011), this feature can facilitate individuals to harness collective intelligence to help them assess and evaluate information online (O’Reilly 2005). However, it should be noted that product reviews are not equivalent
to microblogging replies. While the former is created by customers with product experience, the latter can be generated by any user and may contain irrelevant content. The precise way of how microblog reply works for microblogging users to assess health advice is still unclear thus worth our focal investigation.

**Author Credential**

Author credential has been recognized as an important antecedent of one’s assessment on credibility of online information (Walther and Burkell 2002). Although on microblogging platforms, the anonymous nature of content makes the concept of “author” difficult to authenticate (Fritch and Cromwell 2001; Sundar 2008), many microblogging platforms have provided account verification service for users to identify authenticity and qualifications of the authors (i.e. users who tweet or retweet a microblog). For instance, on Twitter, there are two major types of user account, i.e. regular user account and verified user account. After a user account is being verified, a verified badge will appear in the user’s profile page and also be placed beside the username of a posted microblog. A verified user account typically represents a professional, public figure or business. In other words, it represents basic credential which is earned by one’s reliable identity, positive communications and interactions over time in a microblogging platform. In addition to the verified badge, microblogging platforms also allow users to briefly describe their credentials or qualifications for some professions (e.g., “I am a medical doctor”). This will be displayed in the form of a short bio on the users’ profile page that can be easily accessed. If a user account has both the verified badge and medical related bio presented, it is likely that the actual user has a medical credential to qualify him/her to give medical advices.

With verified badge and relevant bio displayed, this author credential can serve as cognitive heuristics (Metzger et al. 2010) that exempt people from a close inspection of the microblog content to assess the quality of the health advice. It greatly alleviates users’ uncertainty about the authenticity and authority of the author, functioning similarly to certifications or seals from trusted third parties in traditional health websites. In short, the presence of author credential, in the form of a badge and bio, helps microblog users identify the high-quality health advice provided by legitimate authors. We reasonably believe that the presence of preliminary author’s credential (i.e. with verified badge) will positively affect microblogging users’ perceived credibility of health advice and that, such an effect will be heightened when the displayed bio is indicated as medical-related.

**H1**: Microblogs with author credential (both with verified badge and with verified badge plus medical-related bio) lead to higher credibility than those without credential indicator.

**H2**: Microblogs with verified badge plus medical-related bio lead to higher credibility than those with verified badge.

While users are motivated, the extent to which they are knowledgeable about a given health topic actually vary across a spectrum. As discussed previously, their beliefs are influenced by their perceived specialty of the health topic. For health advices on disease management, which are likely to be out of their control or responsibility, microblogging users might deem it as too professional to assess and look for other means to evaluate, such as utilizing cues such as author credential through peripheral routes to justify the credibility of the information. In this sense, when the author is found to have medical credential, the advice, although cannot be fully understood, will be considered more convincing and believable. On the contrary, health promotion is generally accepted as within one’s daily responsibility, hence people have more faith in themselves and process the advice based on their own knowledge or experience, instead of looking for some peripheral means. In addition, to the extent that the bio information is usually one-click away from the original microblog, users who evaluate health promotion may not bother to take effort in assessing the bio.

**H3a**: The superiority of author credential (both with verified badge and with verified badge plus medical-related bio) over no author credential in terms of credibility will be less prominent when health advice is related to health promotion.

**H3b**: The superiority of verified badge and medical-related bio over verified badge in terms of credibility will be less prominent when health advice is related to health promotion.
**Microblog Reply**

Replying mechanism in microblogging platforms is often provided along with its retweeting function. Take Twitter for example, a user can give comments as a reply to a microblog message when retweeting. These replies can be directly accessed by all users simply through a click on the same page of the microblog. As a form of electronic word-of-mouth, online review has become a favorable information source for consumers and its great impact on people purchase decision has been well demonstrated (e.g. Chevalier and Mayzlin 2003; Dellarocas et al. 2004; Ghose and Ipeirotis 2011). In the context of microblogging replies, users can express comments, attitudes and emotions, which can potentially serve as an informal “review” of the original microblog. Such a system feature provides great potential for peer-to-peer credibility. Therefore, replies of a health advice can facilitate other users’ credibility assessment and influence their judgment. Prior research on product reviews show that negative reviews can elicit a conformity effect that a great portion of negative reviews are likely to induce users to conform to the perspective of reviewers repliers (Lee et al. 2008). In the context of this study, when majority of replies are negative, a microblogging user’s perception on the health advice credibility is likely to reduce. We further conjecture that such an effect can be moderated by the health topic. Considering the fact that most of microblogging users lack the necessary expertise to assess health topic of high specialty, for health advice which involves medical expertise of disease management, the replies that contain opinions and comments from other microblogging users may not help much for one to better understand and further evaluate the original piece of advice. Even though some replies could come from real medical expert users, they are not likely to help much. From the perspective of these experts, given the length limit for the replies, they won’t be able to elaborate their opinions in-depth within a few replies. Furthermore, these expert users may not be that motivated as average users to search or browse health advices that seems unprofessional to them. From the perspective of average users, it is still difficult for them to judge the actual quality of these short relies per se by their own. Moreover, due to the lack of the ability, they are not likely to go through a systematic route to examine all those replies and credentials of repliers behind.

When it comes to health promotion which puts more emphasis on daily habits and life styles, users can interpret the advices more easily and have more confidence in their ability of evaluating them based on their own life experience. The reply, hence, is more likely to be relevant to the original advice, comprehensible and add value to the original content. Therefore, for health promotion topic, average users assessing credibility of the microblog can benefit from incorporating more firsthand experiences and other information in addition to the original tweets.

**H4**: Microblogs with the presence of negative replies lead to lower credibility than those without replies.

**H5**: The superiority of absence of replies over the presence of negative replies in terms of credibility will be less prominent when health advice is related to disease management.

**Research Method**

The current study is still in progress. As the next step, we plan to conduct a lab experiment to evaluate our hypotheses. The experimental approach was chosen for the following reasons. Previous empirical studies on consumers’ credibility judgment of online health information primarily collected data through large-scale surveys. Results of these surveys sometimes differ from the studies that assess participants’ actual evaluation behaviors with specific web pages (e.g. Eysenbach and Kohler 2002; Fogg et al. 2002). For example, Fogg et al. (2002) who conducted both types of studies admitted that there is “a mismatch, as in other areas of life, between what people say is important and what they actually do” (page. 6). This discrepancy impels us to conduct a lab experiment, in which participants will be required to judge the credibility of tangible microblogs that deliver health advice in real microblogging platform environment.

**Experimental Design**

The proposed hypotheses will be tested through a laboratory experiment study (yet utilizing a real microblogging platform) with a 3 x 2 x 2 (i.e. three levels of author credential presence (between-subject) x 2 forms of microblog replies (between-subject) x 2 types of health topic (within-subject). The author credential will be manipulated as three real microblogging accounts and is characterized respectively by
(1) absence of verified badge (2) presence of verified badge but without bio information, (3) presence of verified badge with medicine-related bio information. The forms of microblog replies will be manipulated by presenting microblogs characterized by (1) absence of any comments, (2) presence of negative comments right under. The topic of health information will be manipulated by carefully crafting the microblog content adapted from advices of (1) life styles aspect for health promotion, (2) chronic conditions for disease management. The perceived credibility of users, measured with a widely cited scale adapted from (West 1994), will be surveyed at the end of experiment. In addition to our focal variable, in order to account for the potential covariates in the analysis, pre- and post- intervention surveys of the participants will be included into the experiment. The pre-intervention survey is used to assess their attitudes towards overall online health information, its credibility as well as receiving health advice on microblogging platforms. And the post-intervention survey is used to evaluate their ability to distinguish between health promotion versus disease management type of advice.

At least 180 users from a microblogging website will be invited to participate in the experiment. Power analysis for the current design indicates that 30 (179/6) participants for each between-subject factor group are required for statistical power of 0.8 for medium effect size (f = .25) (Cohen 1988) , i.e. 180 for each within-subject factor group. To be representative of the average users for microblogging websites, participants will be recruited based on the criteria that (1) they have no education or working experience in medical setting and (2) they have at least one year of experience using the website and at least one login per month in the past year.

Two microblogs containing health advices will be edited to reflect the two topic conditions: (1) health promotion (e.g. advice on upper limb build-up), and (2) disease management (e.g. advice on relieving headaches). Importantly, difference in actual quality between two microblogs will be minimized by maintaining similar length, argument frame, as well as excluding references, source information (e.g. publishing institution, URL linked to another web page), photos, videos, and other possible cues. Expert review and pilot test will be done to further ensure the quality of the microblogs.

**Overall Procedure**

To further ensure the difference of perceived credibility across groups are caused by our treatment stimuli, participants will be randomly assigned to each of these six groups. This ensures the sum of participants’ past experiences is homogenous across conditions (e.g. Jiang and Benbasat 2007).

Owners of three real microblogging accounts that satisfy our pre-requirements (i.e. conditions of author credential) will be invited in our experiment for research purpose. After finishing the pre-intervention survey, the participants of Group 1 – 3 will be firstly invited to the lab environment and required to login in their real website account during the experiment. They will be asked to “follow” (in this case, the microblogs tweeted by these accounts can be automatically broadcasted to their microblogs, simulating the common scenarios where users are always lingering around to browse the microblogs) the three accounts we selected as health advice sources. Instructions will be given to illustrate that these three are usual accounts as what they normally encounter in the website. Two simple scenarios will also be depicted by instructions to simulate one’s information needs for two health topics (e.g., “You are interesting in how to build up power of your upper arm” for health promotion; “One of your best friends suffer from periodic headaches recently, you want to offer a hand by giving some tips” for disease management). Then each group of participants will receive the two relevant health advice microblogs from the corresponding account. After examining the microblogs, participants will advance to questionnaire with Likert-scale, which is designed to assess participants’ credibility judgment of each of these microblogs. After that, post-intervention survey will be administered and demographic information (e.g., age, gender, internet use) will be collected for future data analysis. The same procedure will go for Group 4–6; the only difference is that the microblogs they will receive are present with negative comments that can be accessed right under. Each participant will be offered $10 as token of appreciation at the end of the experiment.

Lastly, analyses of covariance (ANCOVA) will be run to test our hypotheses after the data collection.
Potential Implications

This study can potentially provide several theoretical implications in the areas of online health information, microblogging and credibility literature. First, this study serves as one of the first attempts in exploring how microblogging system features can affect a user’s credibility assessment on different types of health advice, an area that has received scant attention in the online health information and the microblogging literature. Given the increasing popularity and unique nature of microblogging platforms, understand how such platforms can facilitate the assessment of health information is of great importance. In addition, we add to the health information literature by systematically delineating and distinguishing two types of health advice - health promotion and disease management, in terms of user’s ability of assessment as well as the facilitating designs. Second, this study may also advance the accumulative research in the credibility and dual processing literature. While the perspective of dual processing of credibility assessment (Metzger 2007) suggests that cues such as system designs are primarily important for periphery evaluation, we propose that when users evaluate short content such as microblogs, their central evaluation can also be influenced by certain system cues, albeit different from cues supporting periphery evaluation. Toward this end, this study could extend the conceptualization of credibility assessment by incorporating the new context.

This study also offers important practical implications for microblogging operators as well as health professionals/institutions. First, microblogging operators should be aware that system features could exhibit different effects on user’s credibility assessment based on the topics of microblogs. Hence, they may wish to implement stricter rules to verify and authenticate an account which frequently disseminate health information. They may also implicitly indicate the credential of verified users rather than allow them to modify their bio section without constraint. Effort could also be devoted on categorizing microblogs’ topics (e.g., requesting authors to indicate tags for their microblogs). Strategies can also be deployed accordingly (e.g., for microblogs on health promotions, using filtering function to identify more informative replies). Second, for health professionals/institutions who want to promote health advice on the microblogging platform, it is important for them to utilize the available system features to enhance the credibility of the microblogs. For instance, they should obtain the credential from the microblogging platform and carefully indicate the bio information, especially when disseminating advice related to disease management.

Acknowledgment

This project is supported by the "MOE AcRF grant No: T1 251RES1111" awarded to the third author.
Reference


