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Anonymity in Questions and Answers about Health

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Social Question & Answer (Q&A) sites are a unique source of health information that draw from personal, rather than professional experience. When people ask or answer questions about health using these sites, they may do so using their real name, or another type of identity such as pseudonymity (e.g., a username or nickname) or anonymity. People's behavior may differ when they have a choice about which type of identity they choose, especially the context of different levels of sensitivity of content (e.g., health vs. non-health). In this work, we explore the relationship between different types of identity (e.g., anonymity and pseudonymity) and several Q&A metrics of user behavior on Yahoo Answers in the context of health and non-health content using path analysis. We find that health-related questions are more likely to be asked and answered anonymously. We also find that anonymous answers have more upvotes and downvotes than pseudonymous answers indicating more engagement. We conclude by suggesting that health Q&A sites and other online health communities may improve the quality of discussion by providing anonymity features and implementing moderation mechanisms.

INTRODUCTION

People are increasingly seeking answers to questions about health via non-traditional channels (Ventola, 2014). Whereas many people used to rely primarily on their healthcare-provider for answers to health questions, people now regularly seek information online. One in three U.S. adults have looked for answers to health questions online (Fox & Duggan, 2013). Using the Internet, people consult health information posted to websites, blogs, online reviews, social network sites, and social Q&A sites (Fox & Jones, 2009).

Social Q&A sites provide a platform for people from around the world to exchange personal knowledge and information. Compared to asking questions via a search engine, Q&A sites provide unique benefits for users such as social fulfillment (Kim, Oh, & Oh, 2007), expert opinions (Shah, Kitzie, & Choi, 2014), and an increase in perceived speed and answer quality (Morris, Teevan, & Panovich, 2010). However, similar to other ways people may learn about health information online, the quality of information on Q&A sites varies from excellent to poor (Agichtein, Castillo, Donato, Gionis, & Mishne, 2008). Q&A metrics, such as upvotes and downvotes, are related to quality (Agichtein et al., 2008; Harper, Raban, Rafaeli, & Konstan, 2008; Ponzanelli, Mocci, Bacchelli, Lanza, & Fullerton, n.d.; Wang, Gill, Mohanlal, Zheng, & Zhao, 2013).

One factor that may be related to Q&A metrics on Q&A sites is the identity policy of the site. Q&A sites have different identity policies ranging from real name, where a contributor's name (and subsequently the contributor's identity) is associated with the contributor's question or answer, to anonymity, where no identifying information such as name is given and therefore no identity is associated with specific questions or answers. For example, Zhihu (Zhihu, 2020), a Chinese Q&A site, encourages users to register using their real names, but this is not mandatory. As a result, some users register using real names while others register using pseudonyms. On the other hand, Quora (Quora, 2020a), has a strict "real name" policy (Quora, 2020b) that forces all users to register using their real name.

The Q&A site we focus on in this work - Yahoo Answers (Yahoo, 2020) - has a pseudonym policy that is even less strict than Zhihu. Yahoo Answers asks users to provide their Yahoo ID or any nickname of their preference. The choice of which identity policy to choose has implications for sites seeking to develop community and engage users. One of the most important implications is privacy. Zhihu, Quora, and Yahoo Answers all provide a privacy feature for users to ask or answer questions anonymously. As a result, on Yahoo Answers, there are two different levels of identity: pseudonymity and anonymity. Since pseudonyms are not real names, normally this means that a person's real identity is not easily ascertained when they use a pseudonym (though it may be possible to determine a real identity based on a pseudonym). In some cases, pseudonyms can be considered as a variant of anonymity. However, in a social Q&A site like Yahoo Answers, pseudonymity is likely distinct from anonymity primarily because social Q&A sites are community-driven. On Yahoo Answers, each user has a profile page that displays basic user information and a history of all the questions and answers the user has posted. Even if the user makes their profile page private, other users may still be able to retrieve questions and answers if they know the user's pseudonym. Thus, we argue that pseudonymity is different than anonymity in social Q&A sites such as Yahoo Answers.

In this paper, we seek to deepen our understanding of the relationship between anonymity and Q&A metrics in the context of health. We perform an analysis of the use of the anonymity feature on Yahoo Answers for both health and non-health topics.

RELATED WORK

Anonymity in Questions and Answers

Eighty-six percent of Internet users have taken actions to remove or mask their online activities, 59% of Internet users

say that people should be able to use the Internet anonymously and 18% of the Internet users use the Internet anonymously or in a way that their identities are hidden (Rainie et al., 2013). When people use their real names to ask questions on social networks to their friends, family, and colleagues, they ask less sensitive questions, for example about technology or entertainment (Morris et al., 2010). When people ask questions to strangers on anonymous platforms like Facebook confession boards, the topics of questions tend to be more sensitive including questions about health, illegal substances, and sex (Birnholtz, Merola, & Paul, 2015). Similarly, in real name enforced Q&A sites like Quora, people use the anonymity feature more frequently to answer highly sensitive questions than less sensitive questions (Peddinti, Korolova, Bursztein, & Sampemane, 2014). As a Q&A site that is similar to Quora, Yahoo Answers also contains sensitive questions and answers (Pelleg, Yom-Tov, & Maarek, 2012).

People tend to make different choices about revealing their identity when they ask questions about different topics. Therefore, we wondered how questions and answers from a Q&A site like Yahoo Answers with an identity policy that includes pseudonymity and anonymity would differ in terms of asker and answerer's identity given different topics. Since prior work suggests that privacy of health information is a concern (Bansal, Gefen, et al., 2010; Masys, Baker, Butros, & Cowles, 2002) and health is a sensitive topic, we are interested in how people choose an identity level when they are asking and answering health-related and non-health questions on Yahoo Answers. Therefore, we asked: **RQ1:** *What is the relationship between the identity of asker (anonymity vs. pseudonymity) and the topics of the questions (health vs. non-health) on Yahoo Answers?* **RQ2:** *What is the relationship between the identity of answerer (anonymity vs. pseudonymity) and the topics of the questions (health vs. non-health) on Yahoo Answers?*

Metrics in Questions and Answers

Besides asking and answering questions, upvoting, downvoting, and commenting on answers are core features of many Q&A sites. According to Yahoo Answers's community guidelines (Yahoo, 2020), upvoting an answer signals great content and is synonymous with a thumbs-up. Metrics such as upvotes and downvotes are widely used to evaluate and predict answer quality on Q&A sites (Agichtein et al., 2008; Harper et al., 2008; Ponzanelli et al., n.d.; Wang et al., 2013). However, very few studies look at the relationship between identity and these metrics. Anonymity has both advantages and disadvantages. On one hand, anonymity helps people feel free to express views and provides a sense of control over personal information disclosure (Kang, Brown, & Kiesler, 2013). On the other hand, anonymity may undermine perceptions of one's contributions (Rains, 2007). As anonymity may be more frequent in highly sensitive contexts (e.g., health), we wondered whether these metrics varied across contexts. We asked: **RQ3:** *What is the relationship between the identity of answerer (anonymity vs. pseudonymity), the topics of the questions (health vs. non-health), and the number of answers, answer downvotes, answer upvotes, and answer comments on Yahoo Answers?*

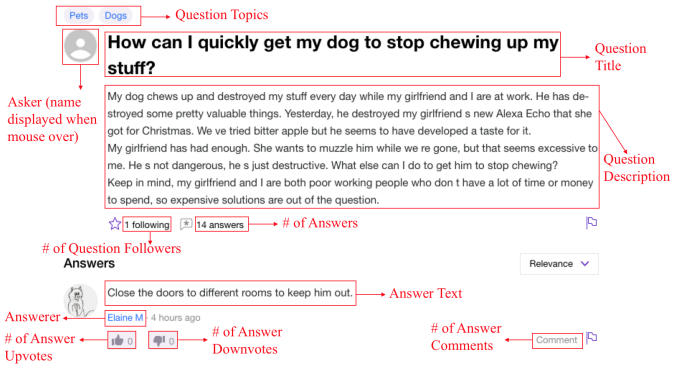

Figure 1. An Example Web Interface from Yahoo Answers with Pointers to Each Metric

Table 1. *Metrics collected from Yahoo Answers at the question and answer levels*

Question	Answer
Question Title	Answer Text
Asker's Name	Answerer's Name
# of Question Followers	# of Answer Comments
# of Answers	# of Answer Upvotes
	# of Answer Downvotes

METHOD

We picked Yahoo Answers, a popular community-driven Q&A site to study. Yahoo Answers provides a platform for users to ask questions about a large variety of topics and post them to the whole community. Other users can view and interact with these questions. The available interactions are: follow questions, answer questions, comment on answers, and downvote/upvote answers. An example of the Yahoo Answers interface is shown in Figure 1 along with these interactions.

According to Yahoo's privacy policy (Yahoo, 2020), activities like viewing and voting do not require users to login. All other activities such as asking, answering, and commenting require login. Users can register with their Yahoo User ID or any nickname, making all usernames on Yahoo Answers pseudonyms. When asking or answering questions, Yahoo Answers provides users the option to participate anonymously. Using this feature, each user can conceal their identity. When this feature is enabled, the username is displayed as "Anonymous" and the user's avatar is shown as a uniformed anonymity avatar to any viewers.

Data Collection

We manually selected three sub-topics under the health category (men's health, women's health, and mental health) and three general topics (sports, music, and food & drink). We selected these topics based on previous work on topic sensitivity using Yahoo Answers (Pelleg et al., 2012), other Q&A communities such as Quora (Peddinti et al., 2014), and Facebook confession boards (Birnholtz et al., 2015) that suggested that these topics are popular topics on Q&A sites and are highly sensitive and less sensitive respectively.

Under each topic, we then went to the Yahoo Answers topic feed page and manually collected the top 50 questions as of February 2017, resulting in a total of 300 questions. Fol-

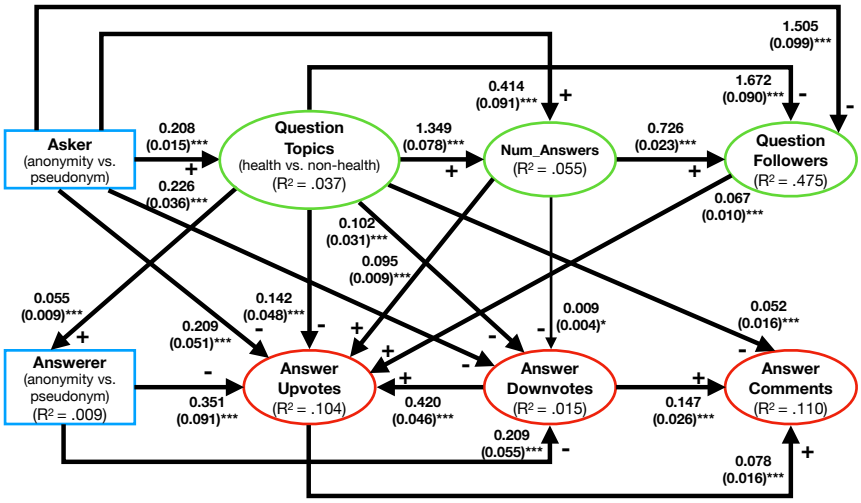

Figure 2. The trimmed path model for the data from Yahoo Answers. Significance levels: ***p< .001, **p< .01, *p< .05. R^2 is the portion of the variance explained by the model. Numbers beside each arrow (and their thickness) represent the coefficient (and standard error). Factors are scaled to have an SD of 1. Identities are shown in blue. Question-level metrics are shown in green. Answer-level metrics are shown in red.

lowing recommendations by Paskuda and Lewkowicz (2015), we skipped questions without any answers to avoid low-quality questions and make sure we had enough answers to analyze at the answer-level. Some questions have a question description while others only have a title (as highlighted in Figure 1). To be consistent and avoid the impact of the uneven quality of these descriptions, we only collected questions that have a title but no description. We then manually collected all the answers under these 300 questions, resulting in 5,160 answers in total. For each question and answer, we collected a set of metrics from Yahoo Answers' web interface. Similarly, for each question, we collected a set of metrics (question title, name of the asker, # of question followers, # of answers) from Yahoo Answers' web interface. We also collected a set of metrics (name of the answerer, # of comments, # of upvotes, # of downvotes) from Yahoo Answers' web interface for each answer. Table 1 contains the full list of all the metrics we collected.

ANALYSIS AND RESULTS

We considered multiple univariate and multivariate approaches for data analysis to deal with the complicated relationships between all the metrics we collected. We settled on using path analysis (Wright, 1921) with a robust estimator. A path model is a special case of Structural Equation Model (SEM) without latent variables, which lets us determine the structural relations between all variables in a single model. It can be seen as an extension of the regression model. We started with a saturated path model (with all possible paths) and trimmed it until the model had a good fit and the effect of each path was statistically significant ($p < .05$). Each path of the model is shown using an arrow. Regression weight is predicted by the model. Numbers on the arrows (and their thickness) represent the coefficient (and standard error). The trimmed path model is in Figure 2. The model has a good (Hu & Bentler, 1999) model fit: $\chi^2(8) = 11.588$, $p = .171$; $RMSEA = 0.010$, 90% CI: [0.000, 0.021], $CFI = 0.999$, $TLI = 0.997$. The *marginal* (unmediated) effects of identity (anonymity vs. pseudonymity) and question topic (health vs. non-health) on the number of answers, question followers, answer upvotes, answer downvotes, and answer comments, are shown in Table 2.

Topics	Health	Non-health
(M) answers of (A) questions	13.2 (*2.98*)	16.4 (*2.03*)
(M) answers of (P) questions	12.27 (*1.17*)	23.49 (*2.64*)
(M) followers of (A) questions	0.25 (*0.07*)	0.41 (*0.09*)
(M) followers of (P) questions	0.33 (*0.05*)	0.42 (*0.33*)
(M) upvotes of (A) answers	1.12 (*0.11*)	1.41 (*0.15*)
(M) upvotes of (P) answers	0.82 (*0.04*)	0.83 (*0.02*)
(M) downvotes of (A) answers	0.46 (*0.07*)	0.70 (*0.08*)
(M) downvotes of (P) answers	0.36 (*0.02*)	0.39 (*0.02*)
(M) comments of (A) answers	0.18 (*0.04*)	0.18 (*0.04*)
(M) comments of (P) answers	0.49 (*0.01*)	0.70 (*0.01*)

Table 2. *The marginal (unmediated) effects of identity and question topic on the number of answers, question followers, answer upvotes, answer downvotes, and answer comments. (M) = mean, standard errors are in parentheses. (A) = anonymous, (P) = pseudonymous*

Using the path model (see Figure 2) and the marginal effects (see Table 2), we find that health questions are more likely to be asked anonymously than non-health questions (54 anonymous questions in health vs. 40 anonymous questions in non-health). Health questions are also more likely to be answered anonymously than non-health questions. Pseudonymous questions have more answers than anonymous questions, and non-health questions have more answers than health questions. By contrast, pseudonymous questions have fewer question followers than anonymous questions, and non-health questions have fewer question followers than health questions. Under both health topics and non-health topics, anonymous answers have more upvotes and downvotes than pseudonymous answers. The identity of the answerer, however, does not have a direct effect on answer comments. The weak, indirect effect between the identity of the answerer and answer comments is mediated by answer upvotes and downvotes.

DISCUSSION AND IMPLICATIONS FOR THE FUTURE

In this section, we summarize our key findings, discuss them in the context of previous research and provide implications for Q&A sites and online healthcare practitioners.

Health-related questions are more likely to be asked and answered anonymously

We find that people are more likely to ask and answer health-related questions anonymously than non-health questions. Prior work on Quora suggests that sensitive questions (e.g., health-related questions) have a high anonymous answer ratio (Peddinti et al., 2014). Although both Quora and Yahoo Answers provide a similar anonymity feature, Quora and Yahoo Answers have different identity policy (real name versus pseudonymity). Unlike the enforced real name policy on Quora, Yahoo Answers only asks for a username or nickname, which does not necessarily link to someone's real identity. Still, people are more likely to answer health-related questions anonymously. Our work fills a gap left by prior literature by showing that the same behavior (i.e., being anonymous for highly sensitive topics such as health) also applies to question asking.

Question answering and question asking may have different motivations. Question answering is motivated by both intrinsic and extrinsic factors (Raban & Harper, 2008). For example, Constant et al. (1994) use the social exchange theory to explain information sharing motivated by self-interest and mutual benefit. Other intrinsic factors include altruism, learning, and competency (Nam, Ackerman, & Adamic, 2009). Extrinsic factors include gaining status and monetary rewards (Hsieh & Counts, 2009; Nam et al., 2009). To motivate user participation, some sites use social comparison to show users how they compare to others on the site (Harper, Li, Chen, & Konstan, 2007). Yahoo Answers uses several extrinsic factors to motivate answering. For example, users can upvote each other's answers. Users can also earn points by answering questions or being awarded a "best answer". And top answerers under each category are listed on the category homepage, which may help users to build a reputation that rewards activity (Masys et al., 2002). However, very few extrinsic motivators, aside from the motivation to learn the answers to a question, are offered to askers. But asking the right question is often the most difficult part of eliciting good information (Tofade, Elsner, & Haines, 2013). Online health peer-support groups and online health forums should consider adding anonymity features to motivate – or enable – askers to ask health-related questions anonymously.

Most of the online health peer-support groups and online health forums (e.g., PatientsLikeMe) do not currently offer privacy features such as anonymity. This may discourage or prevent users from seeking and discussing health information on these sites. Alternatively, users may find a way to work-around to be able to participate in online discussions while staying private. For example, on Reddit, a massive online discussion community that does not have an anonymity feature, users can use a one-time throwaway account to achieve temporary anonymity (Leavitt, 2015). Online health peer-support groups and online health forums should consider providing users such an anonymity feature as they seek health information and support online.

Anonymous answers and health-related answers have more upvotes and downvotes than pesudonymous and non-health answers

We find that anonymous answers receive more upvotes than pseudonymous answers in both health and non-health contexts. Upvoting is synonymous with a thumbs-up according to Yahoo Answers's community guidelines (Yahoo, 2020). People usually have high trust in online experiential information and also facts about health (Crawford, Guo, Schroeder, Arriaga, & Mankoff, 2014). The trust in online health information such as the answers generated by other users may lead to upvoting. Furthermore, being anonymous makes people feel free to express views (Kang et al., 2013). People may feel freer to answer health-related questions anonymously which may, in turn, increase the number of upvotes. Like we discussed previously, especially in the context of health, people may feel more comfortable sharing experiential personal information by being anonymous. People's trust in experiential health information increases with the experience of chronic disease, but stays constant with factual information (Crawford et al., 2014). This may also cause users to upvote more anonymous health answers than pseudonymous health answers as these anonymous answers usually contain rich experiential health information.

We also find that in both health and non-health contexts, anonymous answers receive more downvotes. Yahoo Answers's community guidelines (Yahoo, 2020) do not provide guidance on downvoting. Downvoting may indicate disagreement or misbehavior such as trolling, which includes any behavior that violates community guidelines (e.g., flaming, griefing, swearing, or personal attacks; Cheng, Bernstein, Danescu-Niculescu-Mizil, & Leskovec, 2017). Some users may intend to use the anonymity feature to perform irresponsibly such as trolling. Some Q&A sites such as Quora and Zhihu already take actions to deal with trolling answers by moderating and collapsing them. Future studies could carry out text analysis to classify the reasons why answers are downvoted by other people. Online health peer-support groups and online health forums may consider using some sort of moderation mechanisms to moderate content especially those are most downvoted. Bots that use artificial intelligence could help to reduce the costs of and to human moderators (Chandrasekharan, Gandhi, Mustelier, & Gilbert, 2019).

LIMITATIONS

One major limitation of our work is that health questions are overall inherently more sensitive than non-health questions (Tourangeau & Yan, 2007). Therefore, we do not know whether it is the sensitivity of the question or the topic (i.e., health) that is related to the use and benefits of anonymity. Future work could try to separate these variables by looking at less-sensitive health questions and more-sensitive non-health questions. Future work may also expand the context to other sensitive topics such as sex, legal issues, etc.

Another limitation of our work is that the dataset is relatively small. Future large-scale studies would be facilitated if Yahoo would open their API to allow researchers to collect data at the question level (Yahoo, 2014) rather than requiring re-

searchers to collect these data manually which limits the amount of data that can be collected efficiently. Future work may also investigate other social Q&A sites with different identity models such as PatientsLikeMe, Quora and Zhihu.

CONCLUSION

In conclusion, we find that people are more likely to ask and answer health-related questions anonymously. We also find that anonymous answers and health-related answers have more upvotes and downvotes than pseudonymous answers and non-health answers. Our paper provides insights for Q&A sites and other online healthcare communities (e.g., online health peer-support groups and online health forums) and suggests they should consider providing anonymity features for users to ask and answer health-related questions anonymously. Moderation mechanisms may be helpful to reduce negative behaviors that can be associated with anonymity.

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