An Empirical Analysis of Social Interaction on Tobacco-Oriented Social Networks

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Abstract. Social media is widely utilized in the tobacco control campaigns. It is a great challenge to evaluate the efficiency of tobacco control policies on social network sites and find gaps among tobacco-oriented social networks. In this paper, we construct three tobacco-oriented social networks according to user interaction on Facebook tobacco-related fan pages. We further investigate the interaction patterns including temporal distribution and interaction patterns to reveal the differences of tobacco-oriented social networks. Our empirical analysis demonstrates that: 1) the user interaction on the pro-tobacco fan pages is more active. Fan pages for tobacco promotion are more successful in obtaining more user attention. 2) The gap between tobacco promotion and tobacco control is widening. These empirical results can provide us significant insights into understanding the evolutionary patterns of social interaction in tobacco-oriented social networks and further help the government departments of tobacco control to make reasonable decisions.

Keywords: Tobacco, User Interaction, Social Network, Facebook, Fan Page.

1 Introduction

Social Media such as Facebook, YouTube, and Twitter is becoming the battlefield of tobacco. Tobacco companies stand to benefit greatly from the marketing potential of social media, without themselves being at significant risk of being implicated in violating any laws [1], such as cigarette promotion on Facebook [2], pro-tobacco video clips on YouTube [1] and mobile applications ('ishisha' and 'Cigar Boss') for tobacco promotion. By contrast, as a primary source of health information for the general public, news coverage has been widely utilized in anti-tobacco campaigns to

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raise public anti-tobacco awareness with horrible facts such as lung cancers and toxic chemicals derived from tobacco. In addition, for smokers, social media is adopted to kick the bad habit by tracking cigarette consumption and offering tobacco cessation assistance with social support such as QuitNet and EX [3, 4].

However, with the progression of new technology, it is a great challenge to quantify gaps among tobacco promotion, tobacco control and tobacco cessation forces on social media [5].There is a growing need for an active research to ensure that advocacy efforts have the desired effect to improve future campaigns and maximize impact [6]. The comparison of three forces on social media may help to find the gaps and loopholes, evaluate the efficiency of tobacco control policies in the new media environment. Furthermore, it provides solid and impressive proofs for the decision makers.

To address the above problem, in this paper, we investigate the social interaction on tobacco-oriented social networks. According to user interactions on Facebook tobacco-related fan pages, we extracted three tobacco-oriented social networks, named pro-tobacco, anti-tobacco and quitting-tobacco social network individually. Based on those three tobacco-oriented social networks, we conduct a comparative study of interaction patterns on tobacco-oriented social networks. The main contributions of the paper are two-folders: (1) To the best of our knowledge, it is the first time to provide large-scale tobacco-oriented social networks based on user interaction on social network; (2) We aim to find the gaps among different forces with the analysis of interaction of tobacco-oriented social networks.

The remainder of this paper is organized as follows. The data collection is presented in Section 2. In Section 3, we conduct a comparative analysis of user interaction including temporal distribution and interaction patterns. Section 4 concludes this paper and presents our future work as well.

2 Data Collection on Facebook Fan Pages

Facebook fan page is a public profile that enables users to share their business and products with Facebook users [2]. In this paper, we mainly focus on the interaction (post likes and comments) on Facebook tobacco-related fan pages. The data collection on Facebook consists of two steps: offline data preparation and online data collection.

Table 1. Keywords for Facebook searches

Keywords	tobacco, smoking, cigarette, anti-tobacco, anti-smoking, anti-cigarette, tobacco free, smoking free, cigarette free, quit smoking, stop smoking, smokeless, beedi, cigars, cigar, snuffs, hookah, pipe smoking, snuff, snus, quit cigarette, stop cigarette, quit tobacco, stop tobacco, tobacco addiction, smoking addiction, cigarette addiction, smoking cessation, tobacco cessation, cigarette cessation, nicotine, nicotine addiction, nicotine prevention, nicotine cessation

In the offline data preparation, we first conduct keyword searches for tobacco-related fan pages using the keywords shown in Table 1. Then, according to the profiles of fan pages, all retrieved fan pages are classified into 4 types by two coders manually: (0: unrelated to tobacco; 1: tobacco promotion; 2: tobacco control; 3: tobacco cessation). A third coder coded the fan pages for which there was no agreement between the first two coders. If the third coder disagreed with each of the first two coders, that fan pages are excluded.

For the online data collection, the basic information of fan pages is collected including the number of fan page likes, post volume and post content. More importantly, the user interaction records on Facebook fan pages are gathered as well. When a Facebook user A comments or likes a post launched by Facebook user B, it is regarded that user interaction occurs between A and B.

Totally, we got 2149 tobacco-related fan pages (708 for tobacco promotion, 684 for tobacco control and 757 for tobacco cessation). Specifically, 557 of the pro-tobacco fan pages are about tobacco brands (such as new port, camel and black devil), tobacco-related products such as smoking pipe, tobacco promotion information (such as free-duty cigarettes and cheap online tobacco shops) and protest for tobacco control. 151 of the pro-tobacco fan pages are concerned about electronic cigarettes. As shown in Table 2, the pro-tobacco group overwhelms other groups in terms of page likes, post like and comments.

Table 2. Overview of three tobacco-oriented fan pages

Group of Fan Pages	Page Volume	Page Like	Post Like	Comment
Tobacco Promotion	708	2909532	14660450	521091
Tobacco Control	684	1232153	489853	81236
Tobacco Cessation	757	1569490	837938	191004

3 Comparative Analysis of Interaction on Tobacco-Oriented Social Networks

To compare user interaction in the three groups, we analyze the temporal distribution of post volume, and interaction patterns including page likes, post volume and comments of the three tobacco-oriented social networks.

3.1 Temporal Distribution of Post Volume for Fan Pages

We analyze the temporal distribution of post volume on fan pages for different groups. As shown in Fig. 2, the post volumes of three groups have been increasing since 2008. The year of 2011 witnessed the breakthrough of the three groups with more than 1000 posts per month. The explosive growth happened at July, 2012 with rapid expansion of gap between pro-tobacco group and anti-tobacco group. Compared with the explosive growth for pro-tobacco and quitting tobacco groups, the anti-tobacco group experienced a steady growth. As time goes by, the gap between anti-tobacco and pro-tobacco has been widening. This indicates that we are facing with a tremendous challenge for tobacco control.

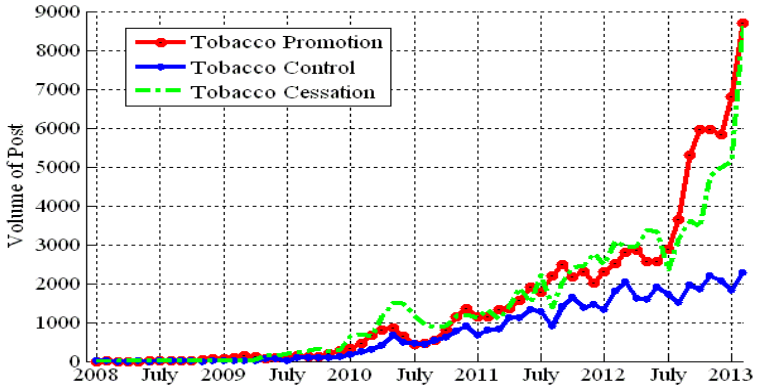

Fig. 1. Temporal distribution of the post volume on three tobacco-oriented groups

3.2 Interaction Patterns on Tobacco-Oriented Fan Pages

As shown in Fig. 2a, the number of page likes (measured by log_{10}) is presented on horizontal axis. While the value on vertical axis indicates the percentage of fan pages with the given page likes. According to Fig. 2a, the curves of anti-tobacco ecosystem and quitting-tobacco reach the peak at log_{10}(page likes) =1.5, which means most of fan pages in those two of groups have approximating $10^{1.5} \approx 32$ page likes. By contrast, for the pro-tobacco group, the curve peaks at log_{10} (page likes) = 3 with 21.6%. That means the 21.6% of pro-tobacco fan pages have approximating 10^3=1000 page likes.

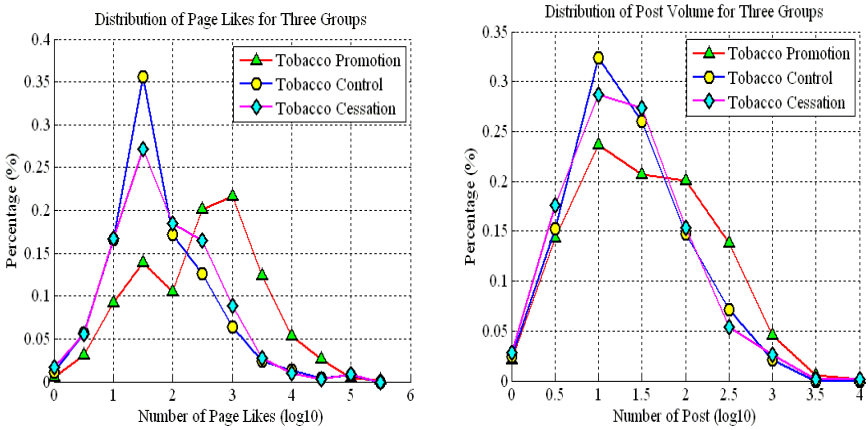

Fig. 2. (a) Distribution of page likes on three tobacco-oriented groups; (b) Distribution of post volume

For both the anti-tobacco and quit-tobacco group, the proportions decrease rapidly when the log_{10} (page likes) goes beyond 1.5. It is obvious that pro-tobacco group out weights the other two groups when log_{10} (page likes) goes beyond 3. The slow decay demonstrates that fan pages in pro-tobacco group are prone to having over 1000 fan likes. This illustrates that fan pages in tobacco promotion group are more successful in gaining more user attention.

Similarly, we analyzed the distribution of post volume for each group. As shown in Fig. 2b, the three curves reach their peaks at log_{10} (post volume) =1, which means many fan pages have only around 10 posts. However, when log_{10} (post volume) goes beyond 2, the pro-tobacco group outperforms the others. Therefore we conclude that fan pages in pro-tobacco group are more active. They usually have more posts on each fan pages.

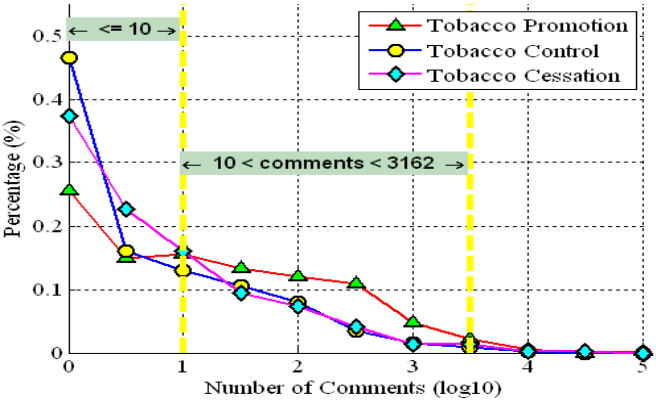

Fig. 3. Distribution of post comments on tobacco-oriented social networks

The distribution of post comments in three groups are illustrated in Fig. 3. It is observed that over 70% fan pages in anti-tobacco and quitting tobacco groups have less than 10 comments (The sum of values when log_{10} (comment)=0,0.5,1). On the contrary, it is about 56% for the pro-tobacco group. That indicates that more fan pages in anti-tobacco and quitting tobacco groups seem not successful in attracting human interaction with fewer people commenting on those fan pages. Especially, when log_{10} (comment) = 0, that is 46.5% for anti-tobacco, 37.4% for quitting tobacco and 25.6% for pro-tobacco. This phenomenon demonstrates that many of those anti-tobacco fan pages and quitting tobacco fan pages do not benefit the tobacco control campaigns, and fail to help smokers to stop smoking with social support. Ironically, that value of pro-tobacco group, when log_{10} (comment) = 0, is the smallest of the three results. Meanwhile, when log_{10} (comment) goes beyond 1, the pro-tobacco group out weights the other two groups. That means the comment interactions on pro-tobacco fan pages are more prosperous.

4 Conclusions

Social media is becoming the battlefield of tobacco-oriented war. However, how to quantify and evaluate the war forces is still a big challenge. In this paper, we first extract three large-scale tobacco-oriented social networks based user interaction on tobacco-related Facebook fan pages. Then a comparative study is conducted and reveals the differences of interaction patterns in the three social networks.

Based on the analysis of user interaction on tobacco-oriented social networks, we could draw the following conclusions: (1) compared with the pro-tobacco fan pages, lots of fan pages in anti-tobacco and quitting-tobacco groups are less effective with fewer posts, fewer comments and lower page likes; while pro-tobacco fan pages have succeed in attracting more potential users to involve or interact with the fan pages in pro-tobacco group; (2) There is a significant gap between pro-tobacco fan pages and anti-tobacco pages in term of post volume. And the gap is widening with the embracing of social media. We are now facing with a tremendous challenge for tobacco control.

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