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Cancer and Social Media: A Comparison of Traffic about Breast Cancer, Prostate Cancer, and Other Reproductive Cancers on Twitter and Instagram

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Social media are often heralded as offering cancer campaigns new opportunities to reach the public. However, these campaigns may not be equally successful, depending on the nature of the campaign itself, the type of cancer being addressed, and the social media platform being examined. This study is the first to compare social media activity on Twitter and Instagram across three time periods: #WorldCancerDay in February, the annual month-long campaigns of National Breast Cancer Awareness Month (NBCAM) in October and Movember in November, and during the full year outside of these campaigns. Our results suggest that women's reproductive cancers – especially breast cancer – tend to outperform men's reproductive cancer – especially prostate cancer – across campaigns and social media platforms. Twitter overall generates substantially more activity than Instagram for both cancer campaigns, suggesting Instagram may be an untapped resource. However, the messaging for both campaigns tends to focus on awareness and support rather than on concrete actions and behaviors. We suggest health communication efforts need to focus on effective messaging and building engaged communities for cancer communication across social media platforms.

Since their emergence nearly 15 years back, social media sites have presented the public with a boundless platform to access and disseminate information, to exchange views and opinions, and to network and form online communities. Facebook, Instagram, and Twitter are among the top 10 most accessed sites in the United States, whereas their regional counterparts (such as QQ in China and VKontakte in Russia) join them among the most accessed sites worldwide (Alexa, 2017). With billions of active users, social media platforms provide valuable opportunities to raise public engagement with a variety of health, science, and other social issues (Pew, 2017). However, the relative newness of these communication tools means that there is still little clarity about the best practices for harnessing the potential of social media for outreach during health awareness campaigns (Heldman, Schindelar, & Weaver, 2017; Shi, Poorisat, & Salmon, 2016).

In this paper, we present a comparative study of differences in messaging for women's and men's cancer campaigns on social media through three discrete approaches. First, we directly

compare the incident rates of women's and men's cancers in the United States to the corresponding levels of traffic that these cancers elicited during World Cancer Day (February 4) across two social media platforms, Twitter and Instagram, to explore whether certain types of cancer are overrepresented in these online discussions based on their affected populations, in terms of both gender and age. Second, we examine social media activity for breast cancer versus prostate cancer and Movember, a men's health movement emphasizing prostate cancer, testicular cancer, and mental health and suicide prevention (Movember.org), on both Twitter and Instagram during the dedicated month-long campaigns (October and November, respectively).¹ Third, we compare the top terms associated with each campaign on these two social media platforms to discover whether there are differences in the terms associated with these online discussions.

This study makes two main contributions to the literature. First, we explicitly compare social media activity for the two most commonly studied types of men's cancer (prostate) and women's cancer (breast) (Koskan et al., 2014; Leveridge, 2016) for two separate health campaigns – #WorldCancerDay versus

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¹Although September is technically prostate cancer month, it receives less traffic on social media during this month, as we describe below. We focus on Movember in November, where traffic regarding prostate cancer increases.

the annual month-long campaigns of NBCAM and Movember – as well as throughout the year. Second, although Instagram is the second most popular social media platform in the United States after Facebook (Pew, 2017), we are the first study to examine cancer campaigns on this platform, which may be an untapped resource for campaign outreach. By comparing prostate and breast cancers across several campaigns on two social media platforms, we gain valuable insight regarding the nature and differences between patterns of communication and engagement. Our results demonstrate that Twitter traffic dwarfs Instagram posts for both campaigns overall, but the Movember campaign is relatively more successful than NBCAM on Instagram. In addition, social media posts during both campaigns focus primarily on awareness and support rather than on concrete behaviors, creating opportunities to expand the effectiveness of these campaigns online.

Literature Review

Public Health on Social Media

Public health officials who have attempted to harness the power of social media to promote public engagement with health outcomes have met with mixed success. The past decade has seen a large growth in the use of social media among hospitals and public health departments. For example, by 2012, 41 out of 51 state public health departments (including Washington DC) were using Twitter to communicate health information to their constituencies (Harris, Snider, & Mueller, 2013; see also Griffiths et al., 2014). Despite the growth in use by government health agencies and health charities, public engagement in health campaigns often remains low (Abramsom, Keefe, & Chou, 2015; Neiger, Thackeray, Burton, Giraud-Carrier, & Fagen, 2013; Theiss, Burke, Cory, & Fairley, 2016). For example, limited public engagement with state and Centers for Disease Control and Prevention (CDC)-sponsored tobacco cessation programs has been attributed to state programs failing to use social media formats like pictures and links that promote user engagement (Chung, 2016; Duke, Hansen, Kim, Curry, & Allen, 2014; Theiss et al., 2016).

Top-down approaches (such as governmental agencies attempting to influence the general public) are only one example of health communication efforts online. Grassroots community hubs also discuss health issues, including conversations about breast and prostate cancers (Himmelboim & Han, 2014). These hubs are core communities (presumably comprising patients and their relatives) that exchange information and experiences but rarely engage with visitors who stumble upon them while browsing for general health information.

Many health campaigns occupy a unique space between a top-down approach driven by health agencies and bottom-up discussion generated by members of affected communities. The social media campaigns surrounding cancer awareness and prevention are particularly noteworthy examples. Although there is a wide literature regarding cancer campaigns on social media (e.g., Bravo & Hoffman-Goetz, 2015, 2016; Diddi & Lundy, 2017; Glynn, Kelly, Coffey, Sweeney, & Kerin, 2011; Jacobson

& Mascaro, 2016; Thackeray, Burton, Giraud-Carrier, Rollins, & Draper, 2013; Xu et al., 2016), existing research is limited in several ways, as outlined below.

Cancer Campaigns

Social media can be a valuable vehicle for expanding the reach of public health campaigns beyond friends, family, and participants in events like cancer walks (e.g., Freeman, Potente, Rock, & McIver, 2015; Glynn et al., 2011; Himmelboim & Han, 2014; Klawiter, 1999). Public health campaigns that use social media generate more online activity as viewing information on one platform often leads to additional searches for further information (e.g., Glynn et al., 2011; Ling & Lee, 2016). For example, the role of social media has been examined for bladder cancer (e.g., Leveridge, 2016), breast cancer (e.g., Nastasi et al., 2017), cervical cancer (e.g., Yoo, Kim, & Lee, 2016), and lung cancer (e.g., Sedrak, Cohen, Merchant, & Schapira, 2016).

Social media campaigns offer two advantages over traditional campaigns. First, they connect people to motivated and ongoing cancer communities (Himmelboim & Han, 2014), which may also facilitate recognition of the effects of cancer on friends and family. Second, they offer lower-cost opportunities to participate in cancer activities that are easier to perform, combined with explicit calls to action important to motivate participation, reducing barriers to engagement, and potentially facilitating higher-cost behaviors in the future (Bode, 2017; Freeman et al., 2015; Neiger et al., 2013; Verba, Schlozman, & Brady, 1995).

However, the types of cancer that are the most frequent focus of health communication research do not match the distribution of cancer diagnoses and deaths by cancer type. Studies of social media campaigns focus overwhelmingly on women's cancers (especially breast cancer) rather than on men's cancers, at more than a 5:1 ratio (Koskan et al., 2014), even though males have a greater risk of developing and dying from cancer than females in the United States (American Cancer Society, 2016). Within studies of social media, breast cancer (32%) and prostate cancer (6%) remain the two most commonly studied types of cancer (Koskan et al., 2014), and they also dominate Twitter hashtag traffic (Leveridge, 2016). Therefore, it is worth examining whether this overrepresentation of women's cancers compared with men's cancers is also reflected in online social media traffic and the keywords associated with these campaigns on each platform.

Of course, differences in engagement with men's versus women's cancers may result from the composition of social media audiences. Instagram reaches a slightly larger audience (32% of online adults, or 28% of all Americans) than Twitter (24% and 21%, respectively). Like most social media sites, both Instagram and Twitter tend to overrepresent young adults. But while Twitter has a relatively even distribution of gender and racial backgrounds, women and minorities are overrepresented on Instagram (Pew, 2015, 2017). These age, gender, and racial differences on social media could contribute to differences in attention to cancer campaigns – for example, in generating attention to cancers that affect younger populations.

Annual Campaigns

Many of the studies of social media content about breast cancer and prostate cancer have focused on their corresponding annual campaigns: National Breast Cancer Awareness Month (NBCAM) in October (Diddi & Lundy, 2017; Thackeray et al., 2013; Xu et al., 2016), and Movember, which promotes men's health, in November (Bravo & Hoffman-Goetz, 2015, 2016; Jacobson & Mascaro, 2016). There is mixed evidence about the success of these campaigns. Previous research on NBCAM has indicated that Twitter traffic peaks at the start of the month-long campaign and tapers off (Thackeray et al., 2013; Xu et al., 2016). While organizations and celebrities emphasize fundraising, early detection, and diagnosis in their communications, the public (which accounts for more than 93% of tweets about NBCAM) tends to tweet about clothing (such as wearing pink) and rarely promotes specific preventative behaviors (Diddi & Lundy, 2017; Thackeray et al., 2013). A recent study suggests that engagement with the CDC's breast cancer Facebook page declined from 2014 to 2016 (Theiss et al., 2016), raising questions about the continued effectiveness of this campaign on social media.

Similar concerns have plagued research on the Movember campaign held each November. While the focus of Movember is supposed to be on prostate cancer and other men's health issues, Movember has been described as more of a "branded movement" than a health promotion campaign (Theiss et al., 2016), focused on the growth and cutting of facial hair as a sign of support for prostate cancer awareness. Much like the breast cancer campaigns, there is typically a large peak in Movember-related tweets at the beginning of the month and then a small peak at the end, primarily created by men sharing photos of their Movember moustaches as they prepare to shave them (Jacobson & Mascaro, 2016). Across multiple years and countries, researchers have consistently found that few tweets provide actionable health information or even mention prostate or testicular cancer (Bravo & Hoffman-Goetz, 2015, 2016; Jacobson & Mascaro, 2016), suggesting that there is little alignment between social media discourse and campaign objectives. The notion that social media act as a trigger for people to seek further information (Sedrak et al., 2016) is questionable for Movember.

Existing research has focused on the annual cancer campaigns, given that social media attention peaks during the campaign months (e.g., Xu et al., 2016; Jacobson & Mascaro, 2016). However, there is a need to study the effectiveness of cancer campaigns throughout the year (Attai et al., 2015; Xu et al., 2016), since cancer is not a seasonal disease. Different patterns of attention to specific cancers may emerge when considering other types of online campaigns. Additionally, many studies focus on a single type of cancer. This limits the ability to analyze the differences in strategies and success for women's and men's cancer campaigns. By examining cancer awareness activities both during special days and months and more generally across the calendar year, we can quantify differences in public activity about sex-specific cancers.

Testing Platform Differences

Additionally, previous research studies of cancer campaigns on social media have tended to study each platform in isolation. Studies most commonly focus on either Facebook (e.g., Abramsom et al., 2015; Patel, Chang, Greysen, & Chopra, 2015; Strelakova & Krieger, 2016; Theiss et al., 2016) or Twitter (e.g., Bravo & Hoffman-Goetz, 2015, 2016; Himelboim & Han, 2014; Kim, Hou, Han, & Himelboim, 2016; Park, Reber, & Chon, 2016; Park, Rodgers, & Stemmler, 2013). Although Instagram is the second most popular social media site in the United States, behind Facebook and ahead of Twitter (Pew, 2017), no studies to our knowledge have examined the dissemination of cancer information through this image-heavy medium.

In this study, we expand on existing literature by comparing cancer communications about women and men's cancers on Twitter and Instagram. Both Twitter and Instagram are public sites, which makes it easy for health agencies and organizations to maintain a public profile and interact with the public. Moreover, both Twitter and Instagram use conventions like the hashtag (#) to organize conversations around a topic. This allows strangers with similar interests to find each other online and create inclusive, heterogeneous communities organized around those shared interests (Bruns & Moe, 2014; Grudz, Wellman, & Takhteyev, 2011; Himelboim & Han, 2014).

Despite these similarities, health communication campaigns may not be equally effective across social media platforms. In addition to differences in the audiences on each platform noted above, Twitter and Instagram differ in the structural capabilities available to users (e.g., Evans et al., 2017; Treem & Leonardi, 2012). Twitter bills itself as a micro-blogging site, featuring short textual exchanges and links to external content such as news organizations. For Twitter, including photographs or pictures in a post is a secondary (although increasingly valued) consideration (Twitter, 2013). In contrast, Instagram is primarily a visual medium, featuring photographs with only short textual descriptions and hashtags. These distinct features mean that users likely take different approaches to encouraging engagement with a topic and prompting behavior changes like the adoption of specific health promoting activities (e.g., Evans et al., 2017; Majchrzak, Faraj, Kane, & Azad, 2013; Treem & Leonardi, 2012).

One criticism leveled at social media campaigns like NBCAM and Movember is the emphasis of actions that are not directly related to health, like wearing pink clothes during NBCAM (Thackeray et al., 2013) or growing moustaches for Movember (Bravo & Hoffman-Goetz, 2015, 2016). However, these visual elements may be valuable for gaining traction on a visual medium like Instagram that is designed around sharing photographs (Theiss et al., 2016). In contrast, Twitter is a more established social media platform that is popular among news agencies and health organizations because it is a popular mechanism for disseminating written news items and observing other news agencies (Harris et al., 2013; Molyneux & Holton, 2015; Parmelee, 2013; Van Leuven & Deprez, 2017). The ways in which cancer campaigns occur on Instagram and Twitter merit further exploration.

Research Questions

Based on the review of the literature above, we would argue that the existing body of research on cancer campaigns on social media is limited in three ways: the emphasis on studies of single cancers rather than comparing types of cancers, the focus on awareness months rather than year-long efforts, and the examination of single social media platforms in isolation rather than comparing multiple platforms. We propose the following research questions to address these gaps in the literature:

Research Question 1: How does Twitter and Instagram activity about women's and men's cancers on World Cancer Day compare to actual diagnosis rates for these cancers?

Research Question 2: How does Twitter and Instagram activity about breast cancer during National Breast Cancer Awareness Month (NBCAM) in October compare to the corresponding activity about prostate cancer during Movember in November?

Research Question 3: How does Twitter and Instagram activity about breast cancer compare to the corresponding activity about prostate cancer throughout the entire year?

Research Question 4: How do the key terms on Twitter and Instagram differ during NBCAM in October compared to Movember during November?

Method

World Cancer Day Data sets

We collected posts tagged with #WorldCancerDay on World Cancer Day and the day prior and after (February 3–5, 2016) from the Twitter and Instagram Application Program Interfaces (APIs).² We then identified which of the #WorldCancerDay posts featured one or more specific cancer sites by including site-specific nouns (such as cervix, endometrium, ovary, or uterus) or adjectives (such cervical, endometrial, ovarian, or uterine). The list of cancer sites used to generate the subset of location-specific cancer references included all the more than 20 different types of solid tumor cancers listed in the American Cancer Society's annual *Cancer Facts & Figures* report (excluding nonmelanoma skin cancers) (ACS, 2016). This process identified 14,846 references to site-specific cancers in Twitter among a total of 310,625 tweets that included the hashtag #WorldCancerDay (4.8% of the tweets), and 1,509 references in Instagram among a total of 25,811 posts that referenced #WorldCancerDay (5.8% of the posts). These site-specific Twitter and Instagram posts form our data set for Research Question 1. *Cancer Facts & Figures 2016* was used as the source of the estimated number of cancer diagnoses in the United States in 2016 (ACS, 2016).

Monthly Cancer Campaigns

For Research Questions 2 and 4, we compared social media data associated with NBCAM and Movember in 2015. For this analysis, we collected posts mentioning *breast cancer* (and #breastcancer), *prostate cancer* (and #prostatecancer), and

Movember (and #Movember) from the Twitter API, while collecting the three hashtags only (#breastcancer, #prostatecancer, #Movember) from Instagram.

Annual Cancer Activity

For Research Question 3, we examined social media data regarding breast cancer, prostate cancer, and Movember for an entire year. The Twitter data analyzed run from 1 October 2015 to 30 September 2016, and Instagram data run from 1 January 2015 to 31 December 2015.

Results

RQ1: Comparison of World Cancer Day 2016 in Twitter and Instagram

Figure 1 shows the proportion of cancer diagnoses in the United States alongside the proportion of site-specific social media posts on Twitter and Instagram that were focused on the four most common cancers of the female reproductive system, and the two most common cancers of the male reproductive system.

The first key observation is that mentions of women's cancers dwarfs mentions of men's cancers. In total, there were 14,846 mentions of #WorldCancerDay on Twitter, of which 5,905 dealt with women's reproductive cancers (nearly 40% of the mentions compared with 25% of new solid tumor cancer cases) and 1,634 dealt with men's reproductive cancers (11% of the mentions compared with 14% of the cases) (ACS, 2016). Comparatively, on Instagram there were 1,509 total mentions, with 662 (44% of the mentions) referencing women's reproductive cancers and 120 (8%) referencing men's reproductive cancers. This underscores a second key point: that Twitter is a much more active community than Instagram for #WorldCancerDay, by a factor of nearly 100.

Next, the specific types of reproductive cancers were examined. Our results demonstrate that on #WorldCancerDay, more than 26% of the mentions on Twitter and 32% of the mentions on Instagram posts referenced breast cancer, even though only 18% of all new solid-tumor cancers diagnosed each year are breast cancers (ACS, 2016). By contrast, only about 8% of Twitter mentions and 6% of site-specific Instagram mentions on #WorldCancerDay referenced prostate cancer, the most commonly diagnosed male cancer, accounting for 13% of new cancer diagnoses. This indicates that there is an "attention surplus" in social media for breast cancer and an "attention deficit" for prostate cancer.

There is also an attention surplus for ovarian cancer and cervical cancer, whereas uterine cancer (a category that includes endometrial cancer) shows an attention deficit. In contrast to the attention deficit for prostate cancer, testicular cancer, which accounts for only .6% of all cancers diagnosed in males, had an attention surplus. The lower median age at diagnosis for cervical (49 years) and testicular (33 years) cancers (SEER report, 2013) may draw special attention from social media audiences, who themselves tend to be younger (Pew, 2017). Overall, the data show that women's cancers are overrepresented on both platforms on World Cancer Day and men's cancers are underrepresented, answering Research Question 1, although this relationship is complicated by the average age of the affected population.

²Specifically, data was collected from Instagram: [Feb 02 23:49:36 UTC, Feb 06 00:57:56 UTC] and Twitter: [Feb 02 23:50:38 UTC, Feb 06 00:59:44 UTC].

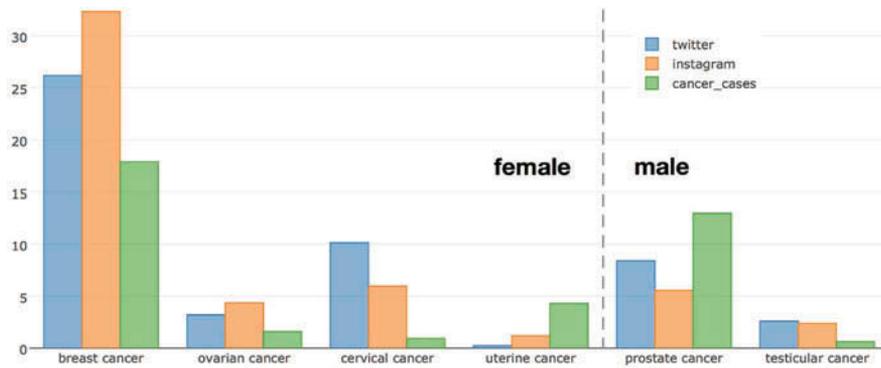


Figure 1: A comparison of percentages of cancer cases (green bars) and references to corresponding cancers in Twitter (blue bar) and Instagram (orange bar) during World Cancer Day 2016.

RQ2: Comparison of NBCAM and Movember on Twitter and Instagram

Next, we examine social media activity for breast cancer and prostate cancer during the annual awareness campaigns in October (NBCAM) and November (Movember). On Twitter (Figure 2, top), the data suggest that both campaigns start strong in their respective months but taper off over time. During the two-month period included in this data set, there were 2,075,168 mentions of breast cancer during October, compared with 400,680 tweets about Movember and 65,820 tweets mentioning prostate cancer during November. Notably, breast cancer received more mentions on Twitter in November (284,015 posts) than prostate cancer. Traffic for NBCAM peaked on Friday, October 9, which was a special “Pink Out Friday” day featured as part of the campaign that was accompanied by public activities such as the outside of the White House being lit with pink lights. As a result, breast cancer was mentioned 21 times more often than prostate cancer during the months of October and November of 2015, even though there are only 1.4 times more diagnoses of breast cancer than prostate cancer each year.

A different pattern emerges for Instagram. On Instagram, Movember traffic in November (179,254 posts) exceeded breast cancer mentions during October (83,376 posts). Posts about prostate cancer remained minimal, receiving only 3,336 mentions during November, again producing fewer posts than breast cancer (11,976). Furthermore, while both campaigns started strong at the beginning of the corresponding month and tapered off, Movember had a strong finish at the end of the month. The selection of moustaches and other facial hair as the visual representation of support for Movember makes the campaign suitable for Instagram in a way that is not possible for visuals that directly show breasts and reproductive organs. While Movember was mentioned two times more often than breast cancer on Instagram, breast cancer was mentioned over 21 times more often than prostate cancer during this two-month period on Instagram, much like its overrepresentation on Twitter. The limited number of posts that specifically mention prostate cancer raises questions about whether the Movember campaign is fulfilling its purpose of raising awareness about men’s health issues, or whether the

campaign itself – the growing of facial hair– has become divorced from men’s health education.

RQ3: Comparison of Breast Cancer and Prostate Cancer on Twitter and Instagram Throughout the Year

Figures 3 and 4 highlight the relative importance of cancer awareness months in year-round traffic related to breast cancer, prostate cancer, and Movember. Over a 12-month period (1 October 2015–30 September 2016), there were 4,305,797 mentions of breast cancer on Twitter, with 2,075,168 (48.2%) occurring in October. Of the 526,437 mentions of Movember, 400,680 (76.1%) were made in November. Of the 612,236 mentions of prostate cancer, only 65,820 (10.8%) were made in November and 50,490 (8.2%) were made in September. Notably, prostate cancer garners more traffic throughout the year on Twitter than Movember, but both are dwarfed by traffic addressing breast cancer.

Turning to Instagram, over a 12-month period (1 January 2015–31 December 2015), there were 193,248 mentions of breast cancer on Instagram, with 83,376 (43.1%) of them posted during October. There were 237,192 mentions of Movember, with 179,254 (75.6%) made during November. There were only 10,417 mentions of prostate cancer on Instagram throughout the year, with 3,336 (32.0%) mentions in November and 2,037 (19.6%) in September.

Overall, these results speak to our Second and Third Research Questions. Both platforms demonstrate the importance of NBCAM for overall annual communication, the high level of engagement with Movember during November, and the insignificant contributions of Movember activities in promoting communication about prostate cancer. Moreover, the results demonstrate that traffic for breast cancer dwarfs Movember or prostate cancer traffic on social media, largely due to the greater attention to these cancer campaigns on Twitter versus Instagram.

RQ4: Comparing Key Terms during NBCAM and Movember on Twitter versus Instagram

Our fourth and final research question asked whether the key terms differ for NBCAM versus Movember on Twitter and Instagram.

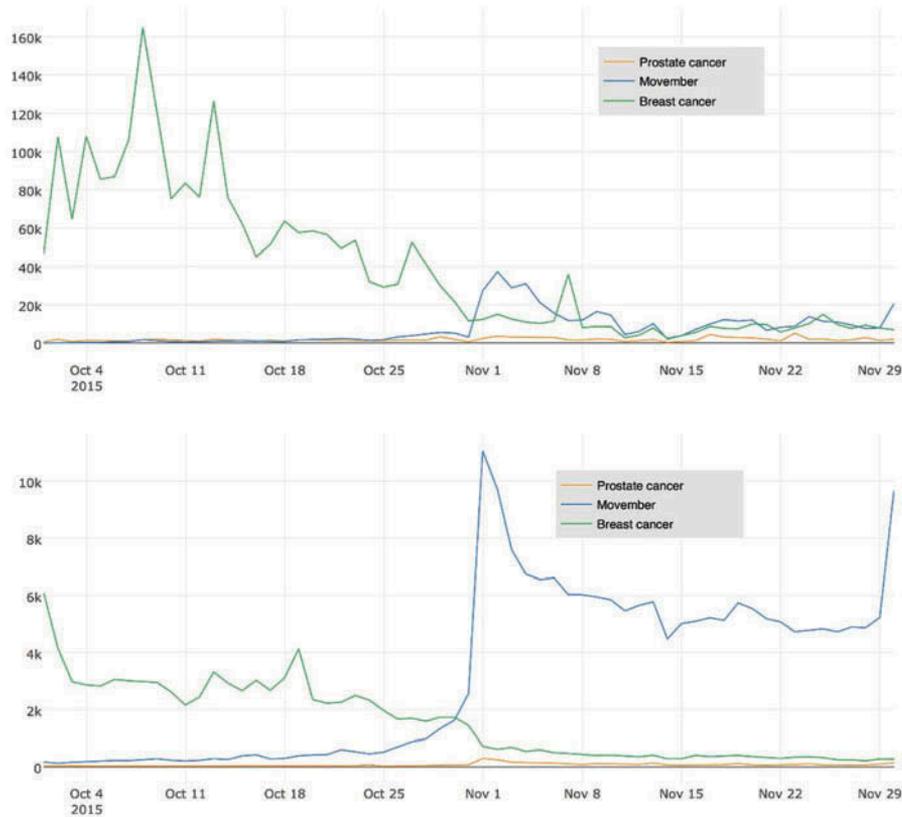


Figure 2: Mentions of breast cancer (green line), prostate cancer (orange line), and Movember (blue line) in Twitter (top) and Instagram (bottom) over the two-month period of October and November 2015. In both charts the horizontal axis shows time and the vertical shows number of relevant posts.

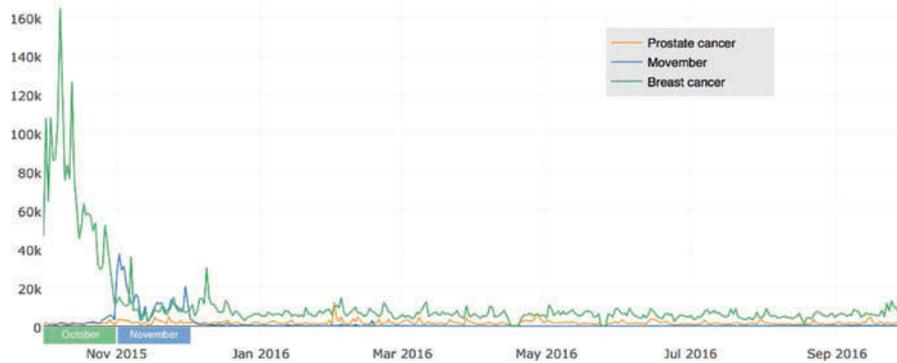


Figure 3: References to breast cancer (green line), prostate cancer (orange line), and Movember (blue line) over the full year 2015 in Twitter.

For breast cancer, we see remarkable similarity in the top terms on Twitter and Instagram, but none of these terms are explicitly associated with cancer or prevention. Two of the terms – “aware/awareness” and “support” – relate to campaign goals, whereas others match existing criticisms by focusing on the campaign itself (“month”) and its visual elements (“pink”) (Diddi & Lundy, 2017; Thackery et al., 2013). Prostate cancer fares better; while the “Movember” campaign is the top term for both Twitter and

Instagram, the other top terms on both social media platforms focus on “men,” “support,” and “health.” However, the top terms associated with the more popular Movember campaign on Twitter versus Instagram differ. On Twitter, Movember is associated with men’s health and prostate cancer awareness as the top four terms, with “donate” as the final. In contrast, the Movember campaign on Instagram has only one term (“men”) related to the health campaign, and the rest focus on facial hair.

Table 1. The five most frequently encountered terms associated with breast cancer, prostate cancer, and Movember in Instagram and Twitter during October and November 2015

Breast Cancer		Prostate Cancer		Movember	
Twitter	Instagram	Twitter	Instagram	Twitter	Instagram
aware	pink	Movember	Movember	cancer	beard
pink	awareness	men	men	prostate	moustache
support	October	health	awareness	men	November
month	support	help	health	health	noshaveNovember
help	month	support	support	donate	men

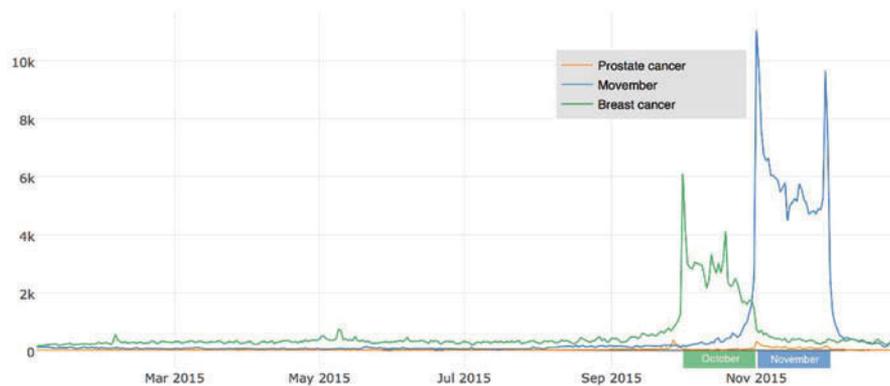


Figure 4: References to breast cancer (green line), prostate cancer (orange line), and Movember (blue line) over the full year 2015 in Instagram.

To answer Research Question 4, we find that the terms associated with breast and prostate cancers in both platforms comprised references associated with the campaigns (pink, month, Movember) along with general sentiments about the disease (awareness, support, health). However, the Movember campaign appears to more successfully align with campaign objectives on Twitter as compared to Instagram, where the visual element of the campaign was emphasized.

Discussion and Outlook

This study examined traffic about women’s and men’s cancer campaigns on Twitter and Instagram. Our analysis showed that women’s cancers tend to be overrepresented compared with men’s cancers across specific campaigns like #WorldCancerDay, the annual awareness campaigns of NBCAM versus Movember, and throughout the year. Our results also highlight the importance of comparing health campaigns across social media platforms, as we uncovered substantial differences in how the campaigns performed on Twitter versus Instagram. Both cancer campaigns tended to overall generate substantially more social media activity on Twitter compared with that on Instagram, but within Instagram itself, Movember tended to outperform NBCAM in terms of social media mentions.

Several reasons may exist for why women’s reproductive cancers drive more traffic on social media compared with men’s reproductive cancers. Most importantly, public engagement with

breast cancer awareness activities has been growing since the 1970s (Jacobsen & Jacobsen, 2011). Since the founding of NBCAM in the early 1990s, the campaign has built numerous partnerships and cosponsors, leading to a more rigorous and extensive campaign that reaches more communities (Glynn et al., 2011; Thackeray et al., 2013). Alternatively, it may be that women are overrepresented on most social media platforms (Pew, 2017) and in participating in online support groups (Nikoloudakis et al., 2016). However, the relative success of breast cancer awareness on Twitter in October (even though Twitter users are about evenly divided by gender) versus Movember on Instagram (which has more female users) undermines this explanation.

Instead, we think the nature of the campaigns themselves may explain the greater success of breast cancer (in particular) compared with prostate cancer or Movember. The breast cancer campaign has explicitly engaged men and women in its “pink” support activities, for example, in its partnership with the National Football League (NFL). In contrast, women are mostly excluded from the primary Movember activity – facial hair growing and grooming – which may cap the ability of Movember to invite more people to participate in the campaign.

This emphasis on the visual components of the Movember campaign also explains the exception to the trend of greater traffic devoted to breast cancer. Movember outperformed breast cancer on Instagram during the annual campaigns in November and October, respectively. Movember is a more visual campaign, associated with the “no shave November” slogan (Bravo &

Hoffman-Goetz, 2015, 2016). This practice of growing out a mustache and shaving it at the end of the month is well-suited for a visual medium like Instagram. The pattern of results, with posts peaking at the beginning and end of the month, validates the effectiveness of this strategy for *generating* Instagram posts. Likewise, the top terms on Instagram focused on the visual component of growing and shaving facial hair, rather than raising awareness or support for prostate cancer and men's health issues.

As a result, this relative success of Movember in terms of Instagram posts may not be translating into greater awareness of health issues. While the Movember campaign generates traffic in November, Movember is not encouraging communication about prostate cancer. Mentions of prostate cancer are minimal on every platform during November (and throughout the year). Even "successful" online cancer campaigns may be ineffective at promoting health behavior changes related to the issues they are purporting to represent (Bravo & Hoffman-Goetz, 2015, 2016; Thackeray et al., 2013; Theiss et al., 2016), although low-cost online activities may create a gateway to more involvement in the future (e.g., Bode, 2017; Freeman et al., 2015), which cancer campaigns should leverage.

We acknowledge several limitations of our study. First, our analyses would be strengthened if we could examine the same 12-month period for Instagram and Twitter. Second, while our study was the first to examine how cancer campaigns occur on Instagram in comparison to that on Twitter, we did not include Facebook or a broader array of social media platforms where cancer communication is occurring. Third, many other characteristics of the social media platforms – such as age and gender distributions – and the cancer campaigns themselves – including the age at diagnosis, the mortality rate, and even the timing of the campaign in relationship to other holidays and current events (e.g., Vraga et al., 2017) – may contribute to differences in attention. Finally, we did not measure the characteristics of the people engaged in these campaigns, so we cannot make assumptions about who is participating or their motivations for doing so. We see this as a fruitful avenue for future research.

Our study has important implications for health communication. First, women's reproductive cancers are outperforming men's reproductive cancers in the social media landscape. While this represents a victory in generating attention to women's cancers online – especially breast cancer – it suggests more effort needs to be dedicated to creating the same participatory environment surrounding men's cancers. Yet, attention is not the only – or even necessarily the most important – outcome. The messaging surrounding these campaigns also needs improvement, as posts during NBCAM and Movember typically focus on support or awareness, rather than on concrete behaviors associated with prevention or treatment. Third, we underscore the value of examining cancer communication across different campaigns and social media platforms. Many more people are posting to Twitter about cancer than sharing on Instagram. Instagram may represent an untapped resource for creating more sustained engagement with cancer communication, especially during Movember, where attention elevated, albeit emphasizing grooming over prostate cancer. Ultimately, although cancer campaigns on social media have made great strides in encouraging public

engagement, many opportunities still exist for improvement to their messaging and their inclusiveness.

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