On the Link between Media Coverage of Anorexia and Pro-anorexic Practices on the Web

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ABSTRACT

Objective: Links between media portrayals of celebrities and participation in activities related to anorexia are of interest to both researchers and practitioners but are difficult to study over long time periods and in large populations. Here we aim to determine the links between media portrayals of celebrities and online practices related to anorexia.

Method: We examined the Internet searching activities of 9.2 million people, focusing on searches related to known celebrities, especially those perceived by the public as suffering from anorexia, and on searches indicative of anorexic practices. Additionally, we tracked media attention of individual celebrities by monitoring all messages from Twitter related to those celebrities.

Results: We found that a subset of users focus their browsing activities on celebrities perceived as anorexic. There was an increase of 14% in the hazard of performing anorexia-related searches after searching for information on the celebrities most perceived as anorexic. Media attention of a celebrity was a trigger for search activity, and when focused on a celebrity perceived as anorexic, resulted in a 33% increase in hazard for carrying out anorexic searches. Strikingly, when media attention included a reference to anorexia, the hazard decreased by 22%.

Discussion: Our findings suggest that it would be beneficial for media, when reporting on those celebrities who are known to suffer from anorexia, to include this information in their reporting. © 2013 Wiley Periodicals, Inc.

Keywords: anorexia; Internet

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Introduction

Anorexia nervosa is an eating disorder recognizable by both physical and psychological traits. Classified as a mental health disorder (DSM-IV), anorexia nervosa is characterized by food restrictions in the form of self-starvation and a fear of gaining weight. Colloquially, anorexia nervosa is often referred to as simply "anorexia," even though the medical literature distinguishes between the two. For the purposes of this article, we will use the term "anorexia" to refer both to the clinical category of disordered eating known as anorexia nervosa as well as the cultural practices encompassed by emic use of the term.

Anorexia affects an estimated 0.3% of young females[1,2] and has a lifetime prevalence ranging between 1.2% and 4.2% for females in different countries.[3] The causes of anorexia are not well understood, but self-control, perfectionism, anxiety, and depression all play a significant role.[4–8] Researchers have also posited that there may be a link between disordered eating and the exposure of at-risk populations to extremely underweight celebrities through mainstream media.[9,10] This suspected link was the basis for recent legislation in Israel,[11] barring the portrayal of models with a body mass index of under 18.5 kg/m^2 in advertisements and fashion shows.[1]

Anorexic individuals frequently identify photographs of certain celebrities as inspiring for maintaining their disordered eating practices.[12] Consuming celebrity images builds on a broader practice known as "thinspiration" where people use images that circulate in media as inspiration for their dieting and exercise regimens. Media images of thin celebrities and models often circulate via websites dedicated to inspiring fitness, weight loss, and thinness. These sites range from providing healthy exercise regimens to serving as "pro-ana" spaces that are dedicated to supporting

[1]The limit of 18.5 kg/m^2 applies to models aged 18 or over. For younger models, the law provides a table of BMI limits by age and gender, ranging from 16 kg/m^2 for 13-year-old females to 18 kg/m^2 for 17-year-old males.

individuals in maintaining the "anorexic lifestyle."[13,14]

People who frequent pro-ana sites appear to have higher levels of body dissatisfaction and eating disorders.[15] Moreover, viewing these sites appears to increase one's perception of being overweight[16] and negative body perception may be linked to the development of eating disorders.[17]

Links between media portrayals of unhealthy practices and behavioral changes in individuals are of interest to both researchers and practitioners, but they are by no means deterministic. For example, while reporting on suicide cases has been shown to cause "copycat" suicides,[18] and news of celebrity suicides is correlated with an increase in the number of suicides in the population,[19] the effect of reporting on mass shootings is more ambiguous.[20]

Previous studies have suggested that viewing images of underweight celebrities is associated with a less favorable body image[21] and an aspiration to lose weight,[22] and that these factors may lead to the development of eating disorders.[17] While researchers have found a correlational link between anorexia nervosa and viewing photographs of underweight models and celebrities, these studies do not demonstrate a causal link between everyday exposure of people to such photographs through mainstream media and the commencement of anorexic practices. These studies have focused on the short-term perception of body image and of anorexia, mostly due to the difficulty in long-term measurements of exposure to the media. Thus, they do not establish a temporal ordering of the exposure to underweight models and the development of anorexic practices.

The availability of data on web browsing behavior by Internet users may provide valuable insight for better understanding the connection between media exposure and anorexic-related activities. In this article, we use longitudinal search query data to draw a link between exposure to celebrities who are perceived as anorexic and Internet practices that are commonly associated with anorexia.

Method

In this work, we analyze three datasets: Two are composed of browsing information collected by Microsoft, and the third of the messages sent on the micro-blogging site Twitter. The first two datasets are proprietary, for reasons of privacy. The third was collected through a public interface.

Dataset 1

To produce Dataset 1, we extracted queries submitted to major search engines (Bing, Google, and Yahoo) by a population of approximately 9.2 million users who agreed to share their browsing behavior. The data included all searches conducted during 5 months, starting January 2012. Note that we do not have data from users who choose not to share their data; this is notable since anorexia is often stigmatized and those who are engaged in disordered eating may be more consciously trying to hide their practices.

High Perceived Anorexia Score Celebrities. Each query was labeled using string matching to determine if the object of the query was one of 3,640 celebrities (mostly from the US) as labeled by the Bing search engine. We counted the number of times each celebrity was searched for in the data and separately the number of times each was searched for in conjunction with the term "anorexia" or "anorexic" (e.g., "angelina jolie anorexia"). In the list of 3,640 known celebrities, 291 were mentioned in conjunction with the term anorexia.

We define the perceived anorexia score (PAS) of a celebrity as the ratio of the number of searches for a celebrity in conjunction with anorexia-related terms, divided by the total number of searches for that celebrity. We identify high perceived anorexia score (HPAS) celebrities as those celebrities whose ratio is in the top 2.5% of all celebrities (a total of 91 celebrities). The top 20 HPAS celebrities are listed in Appendix A.

We manually analyzed the list of HPAS celebrities. Two independent researchers labeled these celebrities as to whether they admitted publically to be suffering from anorexia, rumored to be suffering from it (but did not publically admit to it), or neither. The agreement between the two labelers was very high ($\kappa = 0.74$, $p < 10^{-5}$). Of the HPAS celebrities, 49% were rumored in news articles to be anorexic (but did not admit to it publically) and 32% admitted publicly to struggling with anorexia. This list represents a high precision list of people perceived to be suffering from anorexia, with 81% of its members being either known or publicly rumored to suffer from anorexia.

Anorexic Activities Searches. To identify a set of terms that would be indicative of anorexic activity searches (AASs), we began with a small set of terms that are likely to be used in AASs. These were: thinspiration, thinspo, anorexia, ed-nos (eating disorder, not specified), and pro-ana. We then identified the 10 most common websites that users read after posting queries containing these terms (see Appendix B).

As a final step, we found the most common queries in the dataset that led users to click on pages from these websites. By manually analyzing these queries, we identified a small set of common AASs, which we define as those queries that match the following patterns:

1. Tips for proana or anorexia, for example, "Tips for proana"
2. "How to ..." and proana or anorexia. Such queries include, for example, the query "how to become anorexic?"
3. Proana buddy, for example, "Looking for a proana buddy"

The 20 most common AASs are listed in Appendix C. The list of AASs represents a high precision set of terms that are likely to be queried by people suffering from eating disorders, but we also manually analyzed the most common queries to identify those that may not be indicative of pro-anorexia practices. In the 100 most popular "how to" queries (which account for 77% of these queries in the data volume), only seven could be interpreted as being pro-recovery (e.g., "how to recover from anorexia"). These queries account for 1% of the volume of queries in the 100 most popular queries and are therefore not excluded so as to keep the process automated.

The selected terms, while indicative of common anorexic searching activities, do not discover every kind of AAS. Our results should be considered an underestimation of total anorexic searching activity.

Dataset 2

Dataset 2 is a subset of Dataset 1. It consists of the searches made by all those users who searched for at least one HPAS celebrity. This dataset is comprised of 5,800,270 users, of which 3,615 also made AASs.

Dataset 3

Dataset 3 consists of Twitter messages (tweets) that mention any of the HPAS celebrities during the study period, extracted from the entire set of tweets made during the study period. This dataset was gathered so as to discover when the media is covering a particular celebrity. The volume of content (e.g., tweets) about people and events on Twitter is highly correlated with the volume of mainstream media content.[23]

We further identified the tweets that mentioned "anorexia" or "anorexic" in conjunction with the celebrities' name from all other tweets that only mentioned a name. If a tweet contained a link to a web page, we also included the text of the page in our test for the mention of anorexia. A total of 7,554,357 celebrity-related tweets were found, of which 15,912 mentioned anorexia in their text or in the text of pages linked to in those tweets.

Statistical Analysis

We analyzed our data using nonparametric tests (Kurskal-Wallis and ranksum), owing to the non-Gaussian distributions of these data. Grouped variables were analyzed using ANOVA. A Cox proportional hazard model was used to estimate the effects of independent attributes on the development of AASs. p values less than .05 were considered statistically significant.

Results

Clustering Celebrities by Users who Browsed Them

To ascertain if certain users prefer to view specific groups of celebrities, we represented each celebrity by the users who searched for them. This resulted in a matrix of 9,188,983 users by 3,640 celebrities. The matrix was clustered using the k-means algorithm, with a cosine similarity measure, into 10 clusters.

We tested whether celebrities can be clustered according to their PAS and found that, indeed, the resulting clustering partitioned users into statistically significant clusters according to PAS (Kruskal-Wallis, $\eta^2 = 0.11$, $p < .0001$). In an ANOVA model, which included PAS, the occupation of the celebrity, and age, only PAS and age were found to be statistically significantly related to the partitioning induced by the clustering. Therefore, this clustering suggests that at least some users appear to browse celebrities according to their PAS.

People who Performed Anorexic Activity Searches

To understand the relationship between searching for HPAS celebrities and making AAS queries, we examined the correlation between these different practices and developed hazard models to understand the likelihood of impact.

Drawing from Dataset 2 (users who searched for a HPAS celebrity), for computational feasibility we randomly sampled 57,781 users (approximately 1%) who did not make AASs, as well as all those users who did (3,615 users).

On average, users who made AASs viewed 1.6 HPAS celebrities, compared to 1.2 among users who did not (statistically significant, ranksum, $p < 10^{-10}$). This implies that searching for HPAS celebrities is strongly associated with AASs.

In 57% of users who made AASs, searching for HPAS celebrities preceded AASs. On average, the HPAS celebrity query preceded the AAS by 41 days. For comparison, 38% of users searched for AASs before searching for HPAS celebrities, on average 34 day before (statistically significant, ranksum, $p < 10^{-10}$).

To quantify the risk for making AASs associated with web activity, and especially viewing HPAS celebrities, we constructed a Cox proportional

TABLE 1. Basic hazard model coefficients

Attributes	Model 1		Model 2	
	Weight (s.e.)	Exp(weight)	Weight (s.e.)	Exp(weight)
Number of all searches	1.4×10^{-3} (5×10^{-5})	1.00	1.4×10^{-3} (5×10^{-5})	1.00
Number of celebrity searches	1.5×10^{-4} (0.011)	1.00	-5.9×10^{-3} (0.011)[N.S.]	0.99
Number of searches for top PAS celebrities	0.131 (0.008)	1.14	6.8×10^{-2} (0.012)	1.07
Number of (unique) top PAS celebrities searched			0.498 (0.061)	1.65

All attributes are statistically significant at $p < .01$, unless denoted by N.S. Weight denotes the hazard model coefficient, while s.e. denotes its standard error. An exponential weight greater than 1 denotes an increase in hazard.

hazard model. In the first model, we used as input the number of queries of HPAS celebrities made by a user, as well as the number of queries for other celebrities, and the total number of queries the user made. The two latter attributes were included as a control. All attributes were computed on a daily basis and smoothed over the past 10 days. A second model used the attributes of the first model, as well as the number of unique HPAS celebrities for which the user searched.

The model coefficients are shown in **Table 1**. The results of the first hazard model show that the control variables (total number of queries and the number of queries which mention a celebrity) have a negligible hazard associated with them. However, each query for an HPAS celebrity is associated with a 14% increase in the risk of later making an AAS query. Model 2 shows this even more strikingly, as each unique HPAS celebrity viewed is associated with a 65% increase in the risk of making an AAS query in the population of users in Dataset 2.

The Role of Media in Anorexic Activities

We examined the role of public media on the future practice of engaging in AASs by studying the correlation between the appearance of AASs and surges in media activity around specific, HPAS celebrities. Media activity was judged according to surges in Twitter activity that mentioned a specific celebrity.

The Spearman correlation between the number of queries for a celebrity and the number of tweets was .63 ($p < 10^{-10}$). When focusing on queries and tweets that mentioned anorexia (in their text or in pages to which they linked), this correlation is .68 ($p < 10^{-10}$). Thus, the correspondence in popularity across the two data sources is very high and is even higher when focused on anorexia (the difference is statistically significant, $p < 10^{-10}$).[24]

We defined a media peak in the interest of a celebrity as the appearance of tweets that are three standard deviations above the average number of tweets for that celebrity per day, and minimum of

at least 10 tweets per day that mentioned the celebrity.

Users who later displayed AASs were 1.9 times more likely to query for an HPAS celebrity in the days following a media peak compared to all other people and 2.4 times more likely when the peak was associated with anorexia. Thus, people who later made AASs were much more interested in HPAS celebrities, compared to the control population, and even more so when anorexia was mentioned.

We repeated the building of the Cox proportional hazard model, this time measuring, for each user who queried for a HPAS celebrity, whether there was a peak in media interest in a celebrity for which they queried no more than N days prior. In other words, we examined whether, when a user searched for a specific celebrity, this was N days or less since there was a peak of Twitter activity related to that specific celebrity.

The results of the model, for $N = 1$ (media interest peak one day before a search) and $N = 10$ (results for $N = 3$ and 7 are similar) are shown in **Table 2**. As the table shows, peaks in general media interest correspond to a 33% increase in the hazard of later making an AAS. Strikingly, media interests in a HPAS celebrity that mentions anorexia—including both tweets and news coverage—correspond to a 22% decrease in this hazard.

Discussion

Our data suggest that media coverage of celebrities who are perceived to be anorexic triggers search queries associated with anorexic practices. When HPAS celebrities receive media coverage, we see an increase in search engine queries about that celebrity as Internet users seek out information and photographs about that celebrity. Our data also show queries for these HPAS celebrities are followed by an increase in anorexic activity searches among a fraction of the population interested in HPAS celebrities. This suggests that media focus on an HPAS celebrity elevates the AAS hazard.

TABLE 2. Hazard model coefficients for query log and media activities

Attributes	$N = 1$		$N = 10$	
	Weight (s.e.)	Exp(weight)	Weight (s.e.)	Exp(weight)
Number of all searches	1.35×10^{-3} (5.31×10^{-5})	1.00	1.35×10^{-3} (5.31×10^{-5})	1.00
Number of celebrity searches	-2.06×10^{-3} $(1.10 \times 10^{-2})^{N.S.}$	1.00	-2.13×10^{-3} $(1.11 \times 10^{-2})^{N.S.}$	1.00
Number of searches for top PAS celebrities	3.24×10^{-3} (1.10×10^{-2})	1.03	3.30×10^{-3} (1.11×10^{-2})	1.03
Number of (unique) top PAS celebrities searched	0.61 (5.70×10^{-2})	1.84	0.60 (0.06)	1.83
Peak in all Twitter activity	0.29 (0.11)	1.33	0.29 (0.07)	1.33
Peak in Twitter activity related to anorexia	-0.25 $(0.13)^{N.S.}$	0.78	-0.27 (0.10)	0.77

All attributes are statistically significant at $p < .01$, unless denoted by N.S. An exponential weight greater than 1 denotes an increase in hazard. N denotes whether there was a peak in Twitter activity about an HPAS celebrity not more than N days before the user searched for that celebrity.

The correlations between the number of queries for a celebrity and the number of tweets reinforces previous work that found that queries and media activities are correlated,[23] and demonstrates that the specific interest in anorexia is even more inter-related in these sources. Moreover, the heightened interest in HPAS celebrities by people who later made AASs suggests that, even before making AASs, this population is more attracted to HPAS celebrities than the general population.

The hazard models provide two insights into the development of AASs. First, media interest in a celebrity, as observed via tweets, is associated with a significant increase in the hazard for later making an AAS. Second, the mentioning of anorexia in conjunction with these tweets significantly ameliorates the aforementioned hazard.

Our analysis of the text in media coverage allows us to potentially distinguish between the differing effects that such coverage has. When media coverage, including both tweets and news articles, use the language of anorexia in conjunction with the celebrity, there is very little increase in searches related to anorexia. This suggests that coverage that simply focuses on the activities of the celebrity has a much greater potential to do harm than coverage that includes reference to their illness or perceived illness.

In this article, we focused on those who made queries to HPAS celebrities before they made AASs. We note that a significant number of users (33%) searched for AASs prior to their search for HPAS celebrities. This can be because of data did not go back enough in time, when searches to HPAS celebrities may have preceded the first AAS, or, more likely, because people who make AASs are more interested in HPAS celebrities as a way of reinforcing their disordered eating practices (e.g., "thinspiration"). Future work is needed to better understand this population.

Previous work[21] has found an association between short-term exposure to underweight models and the development of anorexia, but this work neither examined long-term exposure nor estab-lished temporal ordering of the two. In this article, we have been able to contribute to the literature by offering data that provides both. Future work is needed to establish more conclusive causal links between exposure and AASs by conducting randomized controlled intervention studies of exposure to media.

The anorexic activity search hazard we identified is not applicable to the entire population. We focused on a specific population, who showed interest in a specific group of celebrities that are perceived as likely to be anorexic. As our results show, this group of users was more likely to react to a media peak related to these HPAS celebrities than to interest in other celebrities.

While earlier scholars have found a link between anorexia and the consumption of pro-ana content online,[15] we are unable to verify to what degree anorexic activity searches are indicative of anorexia in the target population. Furthermore, our measure of HPAS celebrities is quite narrow; we are inevitably missing other celebrities who are anorexic as well as celebrities who engage in other disordered eating practices (e.g., bulimia).

Conclusions

Media frames matter.[25,26] Media coverage of celebrities increases their visibility in the public eye. In turn, as we see in our data, people turn to learn more about the celebrities that received media attention. When perceived anorexic celebrities are given attention that does not account for their disordered eating practices, their image may be viewed in a positive light, implicitly reinforcing a broadly embraced cultural notion that thinness is desirable. When these same celebrities are discussed in conjunction with anorexia, their image is framed in light of illness.

The elevated interest of the population which made AASs in HPAS celebrities, and the effect of mentions of their eating disorders in the media,

indicate that it is beneficial to include specific information as to whether the celebrity is suffering from anorexia when reporting on these celebrities. Such a finding highlights how reporting ethics vary across domains. For example, based on findings related to suicide prevention, the CDC recommends that news entities never mention suicide in the headline and highlight that a person "died by suicide" rather than using language like "committed suicide".[27] The purpose of this approach is to emphasize that death is the outcome and minimize potential copycat scenarios. Our findings suggest that, rather than encouraging disordered eating, highlighting that a celebrity is struggling with anorexia is more likely to undermine certain readers' interest in search queries associated with disordered eating.

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Appendix A: Top 20 HPAS celebrities

Celebrity Name	Confirmed as Anorexic	Rumored to be Anorexic
Mary-Kate Olsen	Yes	
Tracey Gold	Yes	
Karen Carpenter	Yes	
Ali Lohan		Yes
Vera Ellen	Yes	
Sally Hawkins		Yes
Evanna Lynch	Yes	
Mary Frann		Yes
Rza		Yes
Kate Bosworth		Yes
Angela Bettis		Yes
Nicky Hilton		Yes
Angelina Jolie		Yes
Demi Moore	Yes	
Kristian Alfonso		Yes
Chelsea Staub		Yes
Christina Ricci		Yes
Ellen Muth		Yes
Elisa Donovan	Yes	
Rose Byrne		

This table lists the top 20 HPAS celebrities in descending HPAS score, together with an indication of whether the celebrity was confirmed as being anorexic (usually through self-admission) or was rumored to suffering from it.

Appendix B: Top 10 visited sites in conjunction with AAS queries

1.	thinspiration-pictures.blogspot.com/
2.	pro-ana-angels.wetpaint.com/
3.	www.prettythin.com/
4.	www.pro-thinspo.com/
5.	www.prettythin.com/
6.	pro-thinspo.com/
7.	pro-thinspiration.com/
8.	thinspirationforme.blogspot.com/
9.	get-thinspiration.tumblr.com/
10.	thinspox.tumblr.com/

Appendix C: Top 20 AASs

1.	Anorexia tips
2.	Pro-ana tips
3.	How to be anorexic
4.	How to become anorexic
5.	Pro-anorexia tips
6.	Anorexic tips
7.	Pro-ana tips and tricks
8.	Loss weight fast anorexia tips
9.	How to become anorexic fast
10.	Tips pro ana
11.	Secret anorexia weight loss tips
12.	Tips para ser anorexica
13.	How to be anorexic fast
14.	Anorexia tips and tricks
15.	Anorexia tips for beginners
16.	Pro-anorexia tips
17.	How to get anorexic
18.	How to become an anorexic
19.	Pro-anorexia weight loss tips
20.	Anorexic diet tips