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Use of Twitter to Assess Viewer Reactions to the Medical Drama, *Code Black*

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Fictional medical television programs are popular with viewers and have been shown to influence health-related outcomes. We sought to systematically analyze real-time viewer discourse on Twitter related to the new medical drama, *Code Black*. We retrieved all Twitter posts (tweets) and metadata around the time of the airing of *Code Black* for four consecutive weeks. We developed a codebook using both content assessment of Twitter messages (tweets) and theory-based variables used in entertainment education analyses. We coded all tweets that occurred during the Eastern Standard Time (EST) airing of the program. Tweets that fell into at least one coding category were further analyzed by two independent researchers. We collected a total of 19,369 tweets, with 54% of total tweets originating during the EST airing of the program. There were 1,888 tweets that fit into one or more of six broad coding categories. Qualitative analysis revealed several key themes including real-life motivation to pursue health sciences careers based on the program, engagement regarding medical accuracy, and respect for the nursing profession. Examination of tweets related to *Code Black* provides insight into viewer discourse and suggests that Twitter may provide a vehicle for leveraging program engagement into real-life discussion and inquiry.

Fictional medical programs have long been a staple of television. In the 1960s and 1970s, television doctor heroes such as Dr Kildare and Marcus Welby populated the airwaves, and the 1994 premieres of *ER* and *Chicago Hope* ushered in a new era in which programs prided themselves on using medical jargon, making storylines as accurate as possible without sacrificing entertainment value, and hiring medical professionals to serve on the writing staff (Baer, 1996). At its peak in 1998, *ER* attracted over 47 million viewers per week, and its success has been followed by several other popular programs such as *Grey's Anatomy* (2005–present), *Nurse Jackie* (2009–2015), and *House M.D.* (2004–2012; Carter, 2009).

Based on the 2009 documentary of the same name, *Code Black* follows health professionals in an under-resourced emergency room at a fictional Los Angeles hospital. As described in the on-screen text at the beginning of each episode, the title refers to "an influx of patients so great, there aren't enough resources to treat them. The average ER is in code black five times per year. Angels Memorial Hospital in LA is in code black 300 times per year." The fall 2015 pilot episode had 8.6 million viewers—the most in its timeslot both overall, and the program was renewed for a second and third season (Andreeva, 2017).

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Previous studies on the content of fictional medical television programming have investigated both the depiction of illness and the patient-provider relationship. As compared to real-life statistics, patients on these programs are more likely to suffer from injuries as opposed to chronic diseases, and are more likely to be younger in age (Primack et al., 2012; Ye & Ward, 2010). Other studies examining the treatment of specific illnesses found seizure management to be suboptimal and cardiopulmonary resuscitation rates to be higher than real-life (Diem, Lantos, & Tulsky, 1996; Moeller, Moeller, Rahey, & Sadler, 2011). Furthermore, although television doctors engage in some patient-centered communication behaviors, they rarely engage in behaviors such as patient education (Jain & Slater, 2013). These depictions have the potential to influence viewers' perception of healthcare and the healthcare workforce.

Narrative Influence

Entertainment narratives, such as those on medical television shows, are powerful vehicles for communicating health messages. Even in the rapidly changing context of niche cable channels and streaming services, popular prime-time broadcast series continue to attract large audiences. Unlike overtly persuasive communication formats, entertainment narratives are less likely to be viewed with suspicion (Brown & Walsh-Childers, 2002). Theories regarding the persuasive power of narratives traditionally focus on two psychological mechanisms:

identification with a key character and transportation into the narrative (Moyer-Gusé, 2008). Research has shown that viewers who have a high level of involvement with characters, or who are transported into the narrative, tend to experience more knowledge gains and greater shifts in attitudes and behavior (Murphy, Frank, Moran, & Patnoe-Woodley, 2011).

Social cognitive theory suggests that media depictions featuring characters with whom the viewer identifies are most likely to be influential (Bandura, 2002). Whereas identification pertains to a relationship with a particular character, transportation describes the viewer's experience with the narrative as a whole. The extended elaboration likelihood model (E-ELM) posits that when one is engrossed in an entertainment narrative, attention and cognitive resources are devoted to following the story and characters (Slater & Rouner, 2002). E-ELM incorporates both mechanisms of identification and transportation, and is reliant upon the message not being perceived as an obvious attempt at persuasion. Furthermore, repeated exposure is associated with greater attitude change, and engagement is highest with plotlines involving main characters (Brodie et al., 2001; Hether, Huang, Beck, Murphy, & Valente, 2008).

Twitter Analytics

Emerging technologies such as Twitter represent a novel platform for research in this area. The Twitter platform provides an opportunity to observe public behavior and sentiment through the analysis of units of content—known as "tweets"— that are a maximum of 140 characters. Moreover, Twitter is generally a "public-facing" platform, with an estimated 88% of users allowing their content to be viewed publicly (Beevolve, Inc., 2014). This distinguishes it from sites such as Facebook, for which most content can only be viewed by a select group of friends. In addition, Twitter and individual developers maintain dedicated tools that facilitate automatic downloading and processing of relevant content (Denecke et al., 2013; Hanson, Cannon, Burton, & Giraud-Carrier, 2013), facilitating analysis of data from this platform. Twitter data are well-suited for a qualitative approach because the textual content itself can be highly unstructured, and qualitative approaches are useful to uncover the depth of the "lived experience" underlying sentiment (Colditz, Welling, Smith, James, & Primack, 2017).

With regard to television, examining tweets that occur during the live-airing of a program may be particularly valuable because it allows researchers to evaluate viewer reactions in a real-time, organic environment (Harrington, 2014). Research suggests that viewers use social media to engage with television programs; particularly, when there are prompts such as designated hashtags (TvTechnology., 2012). In 2015, over 24 million unique users tweeted more than 800 million tweets related to television, resulting in 80 billion tweets about television (Casey, 2016). Moreover, a 2015 study that found that 58% of tweets related to television dramas occur during the live-airing of the program (Nielson, 2015). However, it is unknown if this holds true for all television dramas, and in particular fictional medical television programs. Information about when viewers of *Code Black* are most active on Twitter would be valuable for medical and public health practitioners seeking to share information related to medical issues portrayed on the program. Due to the limited research in this area thus far, we proposed the following research question:

RQ1: How do the quantity of relevant tweets relate to the live-airing of the program *Code Black*?

Furthermore, because *Code Black* claims a high degree of perceived realism ("Code Black actors experience 'real shift,'" n.d.), it may be more likely to generate factual discussion versus pure character/narrative comments and to that extent, could be useful in assessing the reaction to medical information. Two systematic reviews recently examined the influence of fictional medical television programs on the health-related knowledge, perceptions, and behavior of both regular viewers and health professional students (Hoffman, Hoffman, et al., 2017; Hoffman, Shensa, Wessel, Hoffman, & Primack, 2017), and found that these programs impact both populations' knowledge about specific health topics, perceptions of healthcare and healthcare workers, and health behaviors. However, these reviews found that most prior research in this area has been limited by focusing on quantitative postexposure reactions to health-related television (Hoffman, Shensa, et al., 2017; Hoffman, Hoffman, et al., 2017). This fails to leverage the rich real-time qualitative information that is now available because of modern technology. Examining tweets, in particular, may provide a novel way to examine viewer discourse around and engagement with the programs. This may help determine with which characters viewers most identify, which may lead to opportunities for intervention (Bandura, 2002). This leads directly to our second research question:

RQ2: What is the qualitative content of tweets related to *Code Black* that occur during the live-airing of the program? Specifically, do tweets show viewer engagement with the medical content of the program, identification with characters, and/or the formation of parasocial relationships with the health professional characters on the program as might be suggested from theories of narrative influence?

Method

Data Collection

We utilized the *Python(x,y)* software (2014) to write a custom data collection script built on the *Twython* package (McGrath, 2014). This allowed for reliable access to Twitter's *Public Streams* API (Twitter, Inc., 2017) to retrieve a live feed of public Twitter content. *Code Black* airs on CBS on Wednesday at 10 p.m. EST and again at 10 p.m. Pacific Standard Time (PST). Thus, we collected data from 7 p.m. EST to 3 a.m. EST for four consecutive episodes in 2015: November 18, November 25, December 2, and December 9. We chose this time frame because November is a "sweeps" period, during which networks air new episodes to get the highest ratings (Rocha, 2004). By the November sweeps, period networks will have replaced programs that do not perform well, and decided on a consistent time slot for new programs (Mogel, 2000).

Collecting data at the end of sweeps month and the beginning of the following month allowed us to capture viewers that not only might have been pulled in by the dramatic programming aired during sweeps month, but also those who continued to watch the program after sweeps month, allowing us to capture a representative fan base. Three search keywords were used to filter the Twitter stream: *codeblack, @CodeBlackCBS*, and *@CodeBlackWriter* (the latter two are the show's official Twitter accounts). Content was limited to English language tweets. Data were decoded from Twitter's native format and recorded in a structured text file. Recorded data included the timestamp, time zone of the Twitter account (if provided by the user), textual content of the tweet (images were omitted), and the user's Twitter handle (i.e., screen name). Although images were omitted, emojis were decoded. In this manuscript, emojis are indicated in square brackets. For example "[scream]" indicates an emoji with a screaming face, and "[heart]" indicates a heart-shaped emoji. Retweets were included as part of the dataset, but not analyzed separately as that was not the focus of our research questions. The data collection and use of textual content were approved by the University of Pittsburgh Institutional Review Board (PRO14070505).

Data Analysis

We analyzed the relationship between tweet volume and the time of the live-airing of the program. We did not account for time zone of Twitter users (tweeters) because (a) not all tweets contain a time zone stamp, and (b) the time zone is self-reported, and thus not necessarily indicative of the location of the tweeter.

Based on our interest in analyzing data pertaining to theories of narrative influence and engagement with medical aspects of *Code Black*, we developed a codebook to code tweets that occurred during the EST airing of the program using a hybrid approach that involved (1) direct content assessment of the tweets themselves and (2) the addition of codes that are particularly relevant to theories of narrative influence and entertainment education. We framed three broad a-priori coding categories based on our research questions and theoretically established mediators of narrative influence: medically related, parasocial interaction, and identification with characters. We then refined the codebook through a structured process of independent coding, collaborative discussion, and code clarification. Two independently working researchers each assessed 400 randomly selected tweets (100 per episode), noting areas where codes might be split into subcodes or clarified. An additional 400 tweets were coded, interrater agreement was examined using Cohen's kappa statistic (Cohen, 1960), and coding disagreements were discussed and adjudicated. This process was repeated two more times, until Cohen's κ for each category had increased to at least 0.7 (good). Thus, 15% of the tweets that occurred during the EST airing of the program were used to develop the codebook. After the fourth round of double coding, Cohen's κ for each category were as follows: medical terms = 0.70, medical profession = 0.81, accuracy = 0.82, behavioral intention = 0.85, parasocial interaction = 0.92, and identification = 0.80. The final codebook consisted of six broad but purposeful coding categories: (1) medical terminology (i.e., did a tweet contain medical terminology relevant to the use of medical procedure seen on the show), (2) medical profession (i.e., did a tweet mention the profession of medicine or a type of healthcare worker), (3) accuracy (i.e., did a tweet mention if the portrayal of the medicine or medical profession was realistic), (4) reaction/behavioral intention (i.e., did a tweet reference the tweeter's reaction to the program and/or an action the tweeter would take in response to the program), (5) parasocial interaction (i.e., did the tweet mention something that suggested the character represented a part of the tweeter's social milieu, and/or sought guidance from the character; Moyer-Gusé, 2008), and (6) identification (i.e., did a tweet mention empathy for the character, taking on the role of the character, and/or identification with a character; Moyer-Gusé, 2008). The codebook included clear definitions, specific criteria, and exemplar tweets meeting these criteria (Table 1). Coding categories were designed to be non-exclusive (i.e., a tweet could be coded as belonging to multiple categories), and all codes were dichotomous. This process was similar to the process reported in more detail in Colditz et al. (2017).

After the codebook was finalized, the two coders then independently sorted through all 8,899 remaining tweets collected during the EST airing of the program to assess whether or not they fit into one of the six specific codebook categories mentioned above. Tweets belonging to at least one of the six categories were gathered and grouped in a new spreadsheet according to category. Tweets that belonged to more than one category were listed under all relevant categories. This was done to maximize the ability of coders to identify themes that might cut across the different coding categories. These tweets were then further analyzed to identify additional themes and synthesize these themes within the context of current theory on narrative influence and education entertainment. Coders reassessed these tweets, developed notes on emergent themes, and then discussed their findings with a supervising researcher to create a comprehensive qualitative analysis.

Results

Over the course of the four consecutive Wednesdays, from 7 p.m. EST to 3 a.m. EST, there were a total of 19,369 tweets using the keywords above. Each week saw a consecutive rise in the number of total tweets collected, with 4,197 collected on Nov. 18, 4,261 collected on Nov. 25, 5284 collected on Dec. 2, and 5,627 collected on Dec. 9. The hour from 10 p.m. to 11 p.m. EST, when *Code Black* airs live on the east coast, drew by far the most tweets (Figure 1).

Of the 10,499 tweets that occurred during the EST airing of the program, 99% (n = 10,470) were deemed relevant. Of these, 94% (n = 9,842) were from individuals not affiliated with the program or the official program accounts. However, 52% (n = 5,252) of these tweets mentioned one of the official program handles or a cast member. A total of 1,888 tweets fit into one or more of the six broad coding categories and were subjected to deeper analysis. The coding categories with exemplar tweets are shown in Table 1. These 1,888 tweets were then reanalyzed as described above in order to identify emergent themes.

Table 1. Definitions for categorical codes and example tweets.

Code *Sub-code*	Definition	Example content
Medical terminology	Contains medical terminology related to procedures, medication, and/or diseases relevant to the episode.	• *"OMG HE JUST STUCK HIMSELF [scream] [scream] [scream] follow the protocol!!! Go get prophylactic drugs!! @CodeBlackCBS @IAmHarryFord"* • *RE: Hypothermia - You're not dead until you're WARM and dead - really is the quipu phrase often used. @CodeBlackWriter*
Medical profession	Mentions the profession of medicine or a type of health-care worker.	
Show professionals	Mentions the health professional characters on the program.	• *What a great team of doctors! #CodeBlack* • *All hospitals need doctors & nurses in their #ER as amazing as the staff at #AngelsMemorial. That's a fact. #CodeBlack*
Is a health professional	Tweeter identifies as a health professional or someone studying to be in the healthcare field.	• *As an anesthesia provider I am experiencing physical and mental anguish watching #codeblack* • *He is not dead until he is warm and dead" like my EMT teach said! Man #CodeBlack is really helping me study.*
Nursing	Mentions nurses or the profession of nursing.	• *Thank you @CodeBlackCBS @IamLuisGuzman "...Apologize...no one talks to my nurses like that" #CodeBlack #nurses #nursingcounts #nursesunite* • *Annnnnnd I believe we have our Moma back #CodeBlack @IamLuisGuzman Once a nurse #AlwaysANurse*
Accuracy	Discusses whether or not the portrayal of medicine on the show is realistic.	• *Ok, I almost liked #CodeBlack until they were doing surgery without masks on! Where are the medical advisors?* • *@michaelseitzman @0bFuSc8 @CodeBlackWriter I have doctors in family y'all know what you r doing [thumbsup]*
Reaction/behavioral intention	Mentions the tweeters reaction to the program and/or an action the tweeter would take in response to the program.	
Reaction/other action	References the tweeters reaction to an episode or other action that the tweeter will take.	• *#CodeBlack gets me crying every damn episode* • *I would freak tf' out if I accidentally stuck myself with a needle.. especially if that needle was used! #Nursing101 #CodeBlack*
Medical profession	Mentions wanting or not wanting to work in the medical field.	• *I am so obsessed with Code Black.. Makes me want to work in ER [heart_eyes] #CodeBlack* • *Could never [COMMA] ever be a doctor but I have #CodeBlack to give me hope for one day.*
Parasocial interaction	Engages with the show, plotline, or officials in a way that blurs the line between fiction and reality.	
Asking	Asks for medical advice, or expresses a wish for one of the characters to be his/her provider.	• *@William_A_Young @CodeBlackCBS I need to ask you something I have 3 arachnoid cyst in my brain would I survive the surgery sence I'm 15 y o* • *@IAmHarryFord: @IamLuisGuzman You are my MAMA for life!! #CodeBlack Rip those cables out.*
Identification	Identifies with the character, which can involve sharing of the character's perspective or goals.	
Identification with main character	Identifies with a main character.	• *I'd throw a computer too... #CodeBlack* • *RT if Rorish and Jesse are your #FriendshipGoals #CodeBlack*
Identification with non-main character	Identifies with a non-main character (i.e., patient).	• *My leg's hurting in some sympathy thing for that crunchy leg girl. Thanks, #CodeBlack* • *#CodeBlack is too real tonight. #HIV #AidsAwareness*

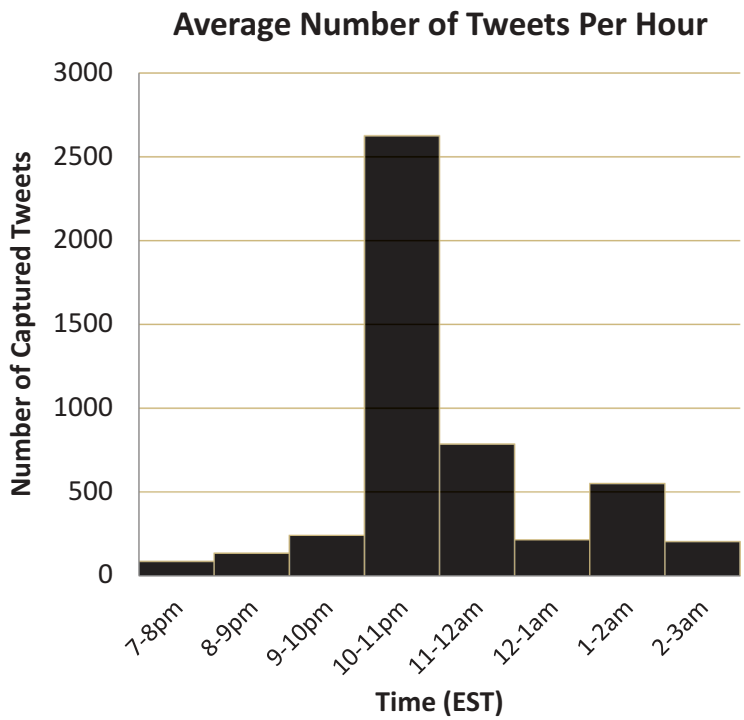

Figure 1. Average number of tweets with relevant keywords per hour over the course of four weeks.

Medical Terminology

There were 270 tweets in our dataset that contained medical terminology. Tweets typically pertained to plotlines involving recreational drugs or health issues affecting the program's main characters (e.g., Nurse Jesse's myocardial infarction; Table 2). Furthermore, the official show accounts and cast members actively tweeted well-received messages related to health content. For example, Marcia Gay Harden, one of the show's lead actresses, tweeted in reference to a patient who appeared high in the emergency department, "DONT [sic] DO DRUGS! No SPICE obviously! @CodeBlackCBS #codeblack," and this tweet appeared in our dataset 20 times.

Medical Profession

The profession of medicine was mentioned in 491 tweets, usually with regard to a specific health professional character and/or the character's actions on the program (e.g., "Uh-oh. jesse's in trouble. And that doctor better learn to trust Leanne. #CodeBlack"). However, there were also several tweets that related more broadly to the profession of medicine, often praising the program's depiction of the emergency department and personnel. Tweets revealed admiration for the work of the characters on the program (e.g., "#CodeBlack thank you from someone who works in the ED for your beautiful rendition of what it's like to be a part of an amazing family"). For others, the program led them to respect the profession despite acknowledging that they would not prefer to actually perform that job (e.g., "I could never work in the ER. Just watching @CodeBlackCBS stresses me out [joy]"; Table 2).

Communication-related behavior of the main characters was addressed in 47 tweets, mostly as direct quotes from these characters (e.g., "'If you can't be useful to me, get out.' OW. #CodeBlack"). These tweets often noted a particular character being funny (e.g., "@IAmHarryFord I totally love your character on the show. You're so funny in the midst of some really scary situations"), or support of the actions of a main character. Specifically, for the episode that aired on Dec. 2, a tweet regarding a power differential between one of the physicians and a patient's family member appeared 13 times ("How bout that mom; someone needs put her in her place! Please don't talk to Malaya like that. #CodeBlack").

Furthermore, a theme emerged around respect for nurses and/or praise for the program for its depiction of the nursing profession (e.g., "@IamLuisGuzman @CodeBlackCBS [heart] momma bear! Your character is one of the reasons i love your show! I love how you stand up for your nurses!"). For tweets that contained the word "nurse" or the theme of nursing, the word "respect" or the general attitude of respect often appeared as well. In addition, for the episode that aired on Dec. 9, a quote from Nurse Jesse appeared 47 times in our dataset (e.g., "I'm a nurse bro. Always a nurse. @IamLuisGuzman YES! #CodeBlack"; Table 2). In relation to this, #alwaysanurse appeared in 36 tweets for this episode, and across the four episodes #nurses appeared in 76 tweets.

Accuracy

There were 34 tweets praising the program for accuracy. Three emergency medical technician students noted that the topics on the program coincided with what they were learning in class

Table 2. Emergent themes within selected tweets with examples.

Thematic Group	Examples
Medical terms — drugs	• DONT DO DRUGS! No SPICE obviously! @CodeBlackCBS #codeblack
	• Differential diagnosis: what presents as a hangover but can lead to seizures? #CodeBlack
	• @IAmHarryFord always check the fingers. #CodeBlack Synthetic pot who knew?!? #NoThanks
Medical terms — main character plotline	• Mama is down. Get that man some help quick! @CodeBlackCBS @IamLuisGuzman #cardiacsupport
	• WAIT,Jesse is having heart surgery & he's alive WHILE they operate? WHOA #CodeBlack
	• Mario just pricked himself??!! #Yikes #CodeBlack
Perception of emergency department	• There's a lot of shit hitting the fan right now. I'm overwhelmed and I'm never even there. [speak_no_evil] [see_no_evil] [hear_no_evil] #CodeBlack
	• #codeblack every ER has a ["] mama ["] nurses that help keep us docs going as residents and attendings.. So important for Med students to know
	• I'm very stressed. But, it's really something to see what the ER team has to endure everyday. #CodeBlack
Respect for profession	• No medical drama has ever made me truly appreciate the work of trauma doctors like this one. So gritty. #CodeBlack
	• #CodeBlack never fails to make me realize the seriousness of the medical world. Thank god for the doctors and nurses arpynd the world [pray]
	• @CodeBlackCBS makes me even more thankful for ER doctors and EMTs.
Respect for nursing	• Respect for the nurses! Love Mama……..@IamLuisGuzman #CodeBlack
	• @CodeBlackWriter my sister is an RN and I am studying to be one… We absolutely love this show. Thx for showing so much respect for nurses!
	• Mama almost loses his life one week [COMMA] then saves someone else's the next. #RespectForNurses @IamLuisGuzman #CodeBlack
Accuracy	• Lovin how realistic @CodeBlackCBS is! Best medical show by far! ["] Their not dead until there warm and dead ["]
	• I love @CodeBlackCBS. It could be excellent but as an RN some of these senarios are so inaccurate it's painful to watch. #wouldneverhappen
	• #CodeBlack nitpick. Does this hospital not have any specialists? Peritonsillar abscess on a stable patient needs ENT and an OR. [unamused]
Emotional reaction	• Only a few minutes in and I'm already almost crying. #CodeBlack
	• @hollingsworthb is making me cry. #CodeBlack #TeamMangus
	• The end of @CodeBlackCBS brought tears to my eyes
Confirm decision to be healthcare worker	• #CodeBlack is life espically cause im going into the medical field just makes me exicted #futureRN
	• God I love #CodeBlack ! Just makes me want to be a trauma nurse even more
	• #CodeBlack makes me so happy about my goals in life. I know that I'll be doing good for people. [ambulance]
Share personal medical information	• And the incredibly ironic thing on #CodeBlack is that my throat specialist had someone inexperienced work on my throat lol
	• T-2 minutes!! @CodeBlackCBS @IAmHarryFord @hollingsworthb @BonSomerville @MGH_8 surgery didn't go right. 13 biopsy samples taken. #CB2rescue
	• @IamLuisGuzman on #CodeBlack reminds me of the nurse I had when I had my appendix took out.
Motivate to join workforce	• #CodeBlack is making me want to get into the medical field lol. Must be an amazing feeling to be able to help and save lives everyday
	• #CodeBlack is making want to recertify as a LA County EMT.
	• I want to work in a hospital like #CodeBlack
Wish character was real	• ok if @hollingsworthb was my doctor id wanna be sick all the time lol [heart_eyes] #DrDimples
	• YOU'RE SERIOUSLY THE BEST DOCTOR EVER. NO JOKE. #CodeBlack @MGH_8
	• Hey there, handsome doctor @RazaJaffrey! If I will be your patient,] I'd probably faint when I see you. #CodeBlack
Identification with characters	• That's the worst thing to happen in the medical profession even if you double glove. Needle pricks from contagious patients! [fearful] [mask] #CodeBlack
	• I was in the room when my grandma signed a DNR order so I feel for Jeremy. Breaks my heart. #CodeBlack
	• #codeblack was tough to watch tonight. I have PSVT and have been given the drug that stops your heart. Scary business

(e.g., "It is too weird that #CodeBlack goes exactly parallel with what we are learning in class"). There were 32 tweets criticizing the program, mostly from individuals who identified as health professionals. For example, there was a critique of the lack of depiction of other specialties (e.g., cardiology), and the lack of sterility or use of body substance isolation techniques (e.g., "@CodeBlackCBS please get more accurate or I'm gonna have to quit watching. Masks go along with sterile procedures. Come on"; Table 2).

Reaction/Behavioral Intention

An emotional response to the program was mentioned in 607 tweets (e.g., "The end of @CodeBlackCBS brought tears to my eyes"). Individuals had a particularly strong reaction to the plotline from the episode on Dec. 2 in which Nurse Jesse (i.e., "Mama") had a heart attack. During this episode, 206 tweets stated that individuals were holding their breath or crying, and others declared that they would stop watching the show if the character died (e.g., "if jesse dies im out. #CodeBlack"). There were also tweets stating that the program motivated individuals to think more seriously about joining the healthcare workforce or confirmed their decision to enter that profession (n = 34; e.g., "This show goes to prove exactly why I want to be an ER nurse. So much to learn and so many lives to help save [heart] [heart] #CodeBlack @CodeBlackCBS"). Moreover, one tweeter was motivated to come out as a lesbian because one of the doctors on the program identified as a lesbian ("@melaniechandra I'm not sure if you're actually gay in real life but I recently came out and your character inspired me to do so"; Table 2).

Parasocial Interaction

Six individuals seemed to think that the medical professional characters were professionals in real-life that could answer their healthcare questions (e.g., "@CodeBlackCBS What's my diagnosis? I have had a headache and chills since Saturday. Not sleeping well. #CodeBlack"). Tweets also expressed a wish for the characters on the program to be their real-life health care providers (n = 84; e.g., "As a patient, I would definitely want Dr. Leighton in my court. And he gets advice from Mama, our Yoda of the E.R. #CodeBlack @IAmHarryFord"; Table 2).

Identification

Individuals expressed empathy for the main characters or patients (e.g., "Did anyone else esp other healthcare providers heart sink when u saw mario get stuck!!! That's all to [sic] real of a threat [scream] #codeblack"; Table 2). Related to this, 63 tweets involved sharing personal medical information related to the plotlines (e.g., "I had the same situation as the singer. Fortunately it didn't spread like in this case. #CodeBlack"). It was more common for tweeters to express identification with a main character than a one-time patient. For example, Nurse Jesse's heart attack aired in the same episode as an emotionally charged story in which a child's mother was surreptitiously giving the child exogenous thyroid medication to draw attention. However, people tweeted about Nurse Jesse's heart attack three times more frequently than they did about the child.

Discussion

In this study, we focused on the content of Twitter conversations related to the fictional medical drama *Code Black* by monitoring relevant Twitter content around the time of the live-airing of the program for four consecutive weeks. This approach allowed us to contextualize the extent to which viewers were engaged with the medical aspect of the programming and to discover new insights that may inform public health research and practice. Our qualitative analysis suggests that viewers actively tweet during the airing of the program, are engaged with the medical plotlines and the depiction of the healthcare workforce, are motivated by the program to consider joining (or remaining a part of) the healthcare workforce, and sometimes blur the line between fiction and reality with regard to the characters depicted in the program. These findings can be understood in the context of theories of narrative influence and entertainment education, which postulate that entertainment narratives facilitate education and behavior change by fostering identification with characters, parasocial interaction, and transportation into the narrative (Moyer-Gusé, 2008).

The majority of captured tweets occurred during 10 p.m.–11 p.m. EST, when the program airs live for viewers in Eastern and Central time (Figure 1). This was not necessarily expected, because recent years have shown a trend toward delayed viewing, such as watching the program online or on a recording device (Nanji, 2016). There was also a spike in the number of tweets during the PST airing (Figure 1), but it was not as large as the EST one.

The analysis of tweets related to medical aspects of the program suggests that viewers are emotionally invested in the show, with many individuals tweeting that they were crying or almost in tears due to the program. This is important to note because theories of narrative influence suggest that more emotionally invested viewers will be more likely to be transported into the plotline and develop parasocial relationships with characters, promoting cultivation effects and increasing influence by the messages delivered (Bilandzic & Busselle, 2008; Green & Brock, 2000; Moyer-Gusé, 2008; Moyer-Gusé, Jain, & Chung, 2012). Our analysis also found that many tweeters expressed being regular viewers of the program, and certain tweeters were likely to tweet multiple times an episode and tweet across all four episodes. This is in keeping with Slater's theory of reinforcing spiral models, which posits that there is a positive feedback loop wherein media use influences corresponding beliefs and behaviors, and those beliefs and behaviors in turn result in increased use of that type of media (Slater, 2007).

Furthermore, we found that over half of all tweets mentioned the program's official Twitter accounts or those of actors/actresses on the program. Thus, although as a fictional program *Code Black* is under no obligation to tweet about the issues on the program, messages from these accounts may help reinforce the health content presented in the program. Although these messages may be perceived as overtly persuasive and thus induce reactance or counterarguing (Moyer-Gusé, 2008; Quick, Kam, Morgan, Montero Liberona, & Smith, 2015; Quick, Shen, & Dillard, 2013), a recent study using *Law & Order: SVU* found that exposure to an explicit persuasive appeal about drinking and

driving by a main character following an episode about this topic did not result in perceived greater persuasive intent, perhaps due to a parasocial relationship with the character. Another study found that viewers who watched an epilogue following an episode of a television drama depicting the illness had increased recognition of the episode subtext. An increase in reactance was observed only for viewers that were less involved with the episode's plotline. This suggests that one way to avoid viewer reactance to epilogues is to create highly involved narratives (Cohen, Alward, Zajicek, Edwards, & Hutson, 2017). With regard to *Code Black* specifically, our findings that most medically relevant tweets were related to main characters, that tweeters formed parascocial relationships with characters, and that tweeters showed high involvement with the narrative suggests that tweets from cast members of this program containing relevant information might be well received.

Our analysis also suggests that while some viewers believe *Code Black* to be a realistic portrayal of the profession of medicine, others do not and are quick to point out inaccuracies on the program. One component that sets entertainment education apart from overtly persuasive messages is the notion of transportation, or being swept up in the plotline (Moyer-Gusé, 2008). However, if audience members are focused on the perceived realism and do not think the programming is accurate, they are probably less likely to be transported into the plotline. As noted above, fictional medical dramas are primarily a source of entertainment; however, taking steps to increase accuracy while not sacrificing the plotline may help reduce counterarguing regarding perceived realism.

Overall, our findings suggest that the program shapes viewers' perception of the emergency department and emergency department personnel. Medical dramas tend to positively influence patients' perceptions of doctors, which may lead to patient satisfaction in actual patient-physician interactions (Quick, 2009). Our findings were consistent with this. For example, individuals often tweeted that the show gave them respect for workers in the emergency department, particularly with regard to nursing. Prior research suggests that power differentials are prominent in fictional medical television (Stanek, Clarkin, Bould, Writer, & Doja, 2015), and we found that viewers often tweeted their support of the actions of the doctors and nurses, even when these actions were just overt displays of power differentials between provider and patient/family. Furthermore, individuals tweeted that the show inspired them to take action, such as entering the medical field, or confirmed their decision to enter the medical profession. In keeping with theories of narrative influence, these tweets can be seen as expressing wishful identification (Moyer-Gusé, 2008). These tweets suggest that clips from *Code Black* could be utilized as a tool to help fill existing shortages by encouraging young adults' interest in fields such as nursing.

Although the patients featured in the episodes that aired during our data collection time frame were racially, ethnically, and socioeconomically diverse, none of the episodes featured plotlines that addressed the topic of health inequities. Perhaps as a result of this, we did not find any tweets related to this topic. Future work could analyze tweet content during an episode that did address health inequities to see if viewers tweet about this important public health topic.

These findings have several important implications for health communication research and practice. Our findings suggests that in practice it might be beneficial for important public health messages to originate from the program's official account during the program. Moreover, the finding that individuals tweet about the actions of the medical professionals on the program and sometimes quote them directly suggests that future research could build upon this study and previous studies of patient-provider communication on television (Jain & Slater, 2013) to better understand the role these portrayals have on real-life patient-provider interactions.

To our knowledge, this is the first study to analyze real-time social media discourse related to a fictional medical television program. Our analysis identified the presence of variables of theoretical interest such as behavioral intention to join the healthcare workforce, parasocial interaction, and identification. Future work could include social network analysis of tweets to measure diffusion of messages, retweets, responses, and which individuals are exposed to such messages. Future research could also examine if retweets are made by accounts related to health organizations or specific interest groups, and measure whether medical television programming discourse on Twitter translates into real-life changes in the utilization of healthcare services.

Limitations

Our data only included a five-hour span of live tweets collected around the EST airing of the program *Code Black* for four consecutive weeks. We then focused our in-depth analysis on tweets that originated during the EST airing of the program. Thus, these results may not reflect the broader context of discussion about the program throughout the week. A second limitation is that we also only gathered tweets that contained one of three specific keywords (CodeBlack, @CodeBlackCBS, and @CodeBlackWriter). While these keywords resulted in 99% of tweets being relevant to the program, restricting our search to these three keywords may have caused us to miss potentially relevant tweets that did not contain one of our keywords. Finally, it should be noted that we focused our analysis on tweet content; therefore, it may be useful for future research to examine Twitter metadata such as user locations, social influence, and profile characteristics (e.g., personal versus health organization accounts). Moreover, in the present analysis framework we did not characterize the nature of retweet accounts. In addition, although our researchers viewed each episode prior to coding, we did not specifically analyze program content alongside tweet content. It may also be useful for researchers to examine program content alongside Twitter content, to see if Twitter content matches the content of the program and vice versa. Relatedly, because we focused on collecting data over a one-month

period, it may be useful for future work to examine frequency of themes over time.

Conclusion

Examining tweets during the live-airing of *Code Black* provided insight into viewer discourse. Viewers are active on Twitter during the show, and they are engaged with both the official show account as well as the accounts of actors/actresses affiliated with the show. Thus, Twitter may provide a vehicle for program engagement to be extended into real-life discussion and inquiry. Future research should explore whether Twitter can be used to leverage the impact of programs such as *Code Black* on public health as well as the perception of the medical field and the healthcare workforce.

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