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# Talking about Public Health: An Analysis of a Municipal Public Health Twitter Feed

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TALKING ABOUT PUBLIC HEALTH:
AN ANALYSIS OF A MUNICIPAL PUBLIC HEALTH TWITTER FEED

by

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MAJOR RESEARCH PAPER

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Abstract

Social media has become an increasingly popular tool used by experts and laypeople

alike to obtain, share, and create health information. Public health authorities have also

begun to use web 2.0 platforms to share information and foster engagement with the

public. Existing public health research about Twitter has explored its uses as a tool of

health promotion, however communication on the Twitter platform has not yet been

explored from a critical public health perspective. The purpose of this study is to analyze

how talk about public health occurs online via Twitter. Using both content and discourse

analysis of communication on Toronto Public Health's official Twitter feed, this study

explores emergent themes of biomedicalization; how biomedical power is affirmed; and

assesses whether Twitter can be a useful platform to facilitate a dialogue between citizen

and state. The immediacy and transparency, characteristic of the Twitter platform, do

support dialogues that question and responsibilize the health authority, however

biomedical power is most often affirmed rather than challenged. This study argues that

while Twitter may be an effective tool to facilitate engagement, it does little to reshape

the existing power dynamic between citizen and state.

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Talking About Public Health

## Table of Contents

List of Tables

Introduction

Technology shapes the way we think, talk, and share ideas about health. (Clarke, Shim, Mamo, Fosket, and Fishman, 2003; Nettleton, 2004; Nettleton, Burrows, and O'Malley, 2005). Governmental public health authorities have recognized the increasing use of online social media and web 2.0 for health information seeking, have begun to utilize social media to share health information with the public and have attempted to foster citizen engagement around health related issues. Health related content on Twitter has been studied from a health promotion perspective (Harris et al., 2014; Harris, Moreland-Russell, Tabak, Ruhr, & Maier, 2014; Sullivan et al., 2012), but has not yet been analyzed through a critical public health framework. Critical public health scholars argue that the creation of, and access to, health knowledge has historically reinforced a power differential between medical experts and lay people (Nettleton et al., 2005). The biomedicalization framework regards all aspects of life as increasingly impacted by biomedical science and that biomedical imperatives for healthy living reinforce individual responsibility inherent in neo-liberal citizenship (Clarke, Shim, Mamo, Fosket, & Fishman, 2003; Lupton, 1995). Web 2.0 technologies represent another platform where health information can be accessed, created and shared, and are therefore subject to biomedical power (Lupton, 2013; Nettleton, 2004b). Critical discourse analysis of health information online has focused largely on case studies of online forums and interviews with their users that have shown to both resist and reaffirm biomedical knowledge (Barker, 2008; Broom, 2005; Hardey, 1999; Song, West, Lundy, & Smith Dahmen, 2012; Zaslow, 2012). This study uses discourse analysis and content analysis from a critical public health perspective to examine interactions on a municipal public health Twitter

feed and extends upon existing research that has explored themes of biomedicalization emergent in other web 2.0 technologies. Situated as counterpoint to the health promotion oriented research the re: uses of web 2.0, this study critically examines the intersection of technology, health, communication and power, and offers insight into how such discourses may overlap, coincide and diverge

Health Information and Web 2.0

Social media has been identified as a growing source of health information (Barker, 2008; Burke-Garcia & Scally, 2014; Harris et al., 2014; Lupton, 2013; Nettleton, 2004a). Since 2004, the emergence of varied web 2.0 social media applications that support open sharing of user generated content have increased the proliferation of both lay and expert perspectives on health. Given the ease of use and relatively low cost, Twitter has become a popular platform for patients, health care providers and health researchers to share and gather information (Burke-Garcia & Scally, 2014; Dumbrell & Steele, 2013; Harris et al., 2014; Harris et al., 2014; Scanfeld, Scanfeld, & Larson, 2010a; Sullivan et al., 2012; Tsuya A, Sugawara Y, Tanaka A, Narimatsu H, 2014). Laypersons increasingly turn to web based sources to glean health information, and to a lesser extent to share information and ask questions online. According to Fox (2011), "of those who use social network sites, 15% have obtained health information on the site and 23% have monitored their friends health…34% of internet users read someone else's commentary or experiences about health or medical issues and 6% post comments, questions or information about health" (as cited in Ledford and Anderson, 2013). Patients have used Twitter as a "tool of psychological support" (Tsuya A, Sugawara Y, Tanaka A,

Narimatsu H, 2014) and have been shown to use Twitter more readily (than other social media) to gather health related information (Antheunis, Tates, & Nieboer, 2013).

Public Health Online

Health authorities have also embraced Twitter as a tool of communication (Dumbrell & Steele, 2013; Harris et al., 2014) to share information with the public, engage in surveillance of population health trends and to facilitate emergency responses. Dumbrell and Steele (2013) note that Twitter has been a valid indicator of health events; citing that during the swine flu epidemic of 2009 in the US researchers found that public concern expressed on Twitter in real time matched the spread of the actual illness documented in epidemiological data. Public health agencies also use Twitter to convey routine health messages about topics such as health promotion encouraging healthy lifestyle choices and advice aimed at mitigating risks to health (Dumbrell & Steele, 2013; Harris et al., 2014; Xu, Chiu, Chen, & Mukherjee, 2014)

The use of Twitter to facilitate the exchange of health related information appeals to both experts and lay people for pragmatic reasons: it is a tool that allows one-to-many real-time interactive communication with a relatively low cost in terms of money, time and required expertise (Burke-Garcia & Scally, 2014; Dumbrell & Steele, 2013; Harris et al., 2014; Harris et al., 2014; Scanfeld, Scanfeld, & Larson, 2010b; Sullivan et al., 2012; Tsuya A, Sugawara Y, Tanaka A, Narimatsu H, 2014; Xu et al., 2014). The interactive capabilities of Twitter can facilitate a dialogue with potentially thousands of participants situated throughout space and time.  When viewed as a data set, Twitter is a temporal and

geospatial log of varied and multi-directional perspectives, voices, messages and directives about a growing expanse of health information.

What is Twitter?

Twitter allows its 230+ million monthly active users to share information in real-time via short (140 character) postings (Twitter, 2013). Postings or *tweets*, as they are called, are displayed upon the user's *Twitter feed* and are shared in real-time as updates sent to the user's *Twitter followers*. A follower refers to any user that subscribes to another Twitter feed (Dumbrell and Steele, 2013). Twitter users can share tweets with their followers while receiving updates from those whom they follow. Twitter users can also *reply* to other user's tweets, creating *strings* of comments that are publicly displayed. Users also have the option to *retweet* or forward another user's tweet to share it with their own followers. Passive users can also access information posted on publicly accessible feeds without being registered followers or having registered Twitter accounts. Correspondence between twitter users is deemed (by Twitter) as a *conversation*.

Twitter's capacity for real-time exchanges makes it a particularly unique platform where state and citizen dialogue occur. State and citizen dialogues have long existed in varied mediums: through letters written to members of parliament; town hall-style meetings; and through interactions with public administrative bodies, to name just a few; but online dialogues differ from other mediums in both their transparency and immediacy. Twitter offers a platform where citizens can inform, challenge, question and gain information from governmental bodies as they enter into dialogues that are both publicly visible and occur in real-time. For example, on the Toronto public health feed

citizens have questioned why they were turned away from the flu clinic, and publicly critiqued the city's lenient smoking by-laws. The notions of both immediacy and transparency have the possibility to either transform or reproduce both existing relationships between citizen and state and the expressions of power inherent within them.

Aim of Research

This study uses a critical public health perspective to examine how talk about public health occurs online and explores the dialogues that emerge online between citizen and state. The applications of web 2.0 have been widely examined from the public health perspective as potential tools for health promotion. This study offers an alternative perspective, the sociological, examining a public health Twitter feed through a biomedicalization framework. Various web 2.0 microblog platforms have been examined from the critical public health perspective (Fox, Ward, & O'Rourke, 2005; Schaffer, Kuczynski, & Skinner, 2008; Song et al., 2012; Zaslow, 2012), but these studies focus mainly on content generated from patients and laypersons. This study extends upon previous sociological work by examining a municipal public health authority's use of web 2.0 and its engagement with citizen users. This is accomplished through discourse analysis and content analysis of a municipal public health Twitter feed elucidating emergent topics and themes including language, voice and temporality. Through a two-stage content analysis of initial inductive coding followed by a secondary thematic analysis, this study investigates the questions of, "How do we talk about public health

online?", and "Who is talking"? These two larger questions are explored specifically through three research questions:

i)        What are the emergent themes of biomedicalization (in content, tone and direction) that are represented on the Twitter feed?

      a.  Does the public health authority's use of Twitter re-affirm or challenge biomedicalization? Is biomedical power legitimated or delegitimized?

ii)      Can the participatory and real-time functionality of web 2.0 platforms (such as Twitter) be a useful interface for 2 way dialogue between government and citizen or does it reflect passive one-way information transfer of traditional media?

To clarify, within the first research question, the concept of tone is used to describe the manner in which a message is conveyed, examples could be the use of the expert voice; or the inclusion of imperatives for action. The term direction is used in the research question to describe whether communication is a passive one-way information transfer, or two-way involving one or more voices. This research provides an exploration of online public health communication and the process of citizen engagement that may be relevant to public health authorities, health experts and citizens concerned with health information.

## Literature Review

Within the past twenty years there has been a growth in sociological research critiquing the privilege of scientific knowledge within health and the political implications of the adoption of empirical health knowledge by governments (Ayo, 2012;

Clarke et al., 2003; Petersen & Lupton, 1996).  Much sociological writing on public

health examines the themes of health and illness; risk and surveillance; lay and expert

discourse; neo-liberalism and citizenship. Academic critiques of public health have

theoretical underpinnings often rooted in Foucauldian ideas of biopower,

governmentality, surveillance, and Beck's risk society (1992). Lupton (2012) draws

heavily on Foucault (1973, 1975), integrating the apparatuses of biopower and

governmentality into her discussion of mobile-health (m-health) and the digital patient.

She asserts that emergent mobile technologies have found new applications as patient

self-monitoring tools  and the use of such technologies develops users into 'digital

cyborgs' who are simultaneously treated as both objects of surveillance and responsible

citizens in the context of neoliberalism.  Similarly, (Petersen, Davis, Fraser, & Lindsay,

2010) and Ayo (2012) use a Foucauldian framework in their discussions of health

citizenship in a neoliberal context. Authors integrate Foucault into both their theoretical

discussions and methodological inquiries. Gagnon, Jacob and Holmes (2010) used

Foucault's concept of biopower as a theoretical framework for their discourse analysis of

fear-based marketing used in health promotion campaigns.   In their discussion of

biomedicalization, (Clarke et al., 2003) draw on Foucault and Beck to develop the

examination of risk and surveillance discourses in health. Lupton (1999) and Petersen and

Lupton (1996) draw on Beck's risk society in their discussions of public health.

Much current scholarship in the critical analysis of public health addresses

technology, communication and power. The works of Lupton (2013), Clarke et al. (2003)

and Nettleton (2004, 2005) take aim at the *intersection* of the discourses of health,

technology, and power in their analysis, rather than viewing them as separate and distinct

forces. Clarke et al. (2003) develop the concept of biomedicalization as an expansion of medicalization characterized by five principles:

i) the political economic nature of the 'Biomedical TechnoService Complex, Inc.';

ii) the emphasis on health risk and surveillance;

iii) increased influence of technoscience used in biomedicine;

iv) the transformation of medical knowledge and its distribution; and

v) the individual and collective embodiment of 'technoscientific identities'.

The authors use a historical argument to develop biomedicalization through the co-constitutive nature of technology and medicine. Nettleton (2003) also incorporates a historical analysis of the relationship between medicine and technology; arguing that the discourse of medicine has shifted. Once dominated by the expert's relationship with the human body, medical discourse is now held by experts *and* laypeople (in part) via creation, access and understanding of medical information.

Nettleton discusses medicine in terms of progressive cosmologies: bedside, hospital, laboratory, surveillance and e-scaped. Each is connected with socio-technological change. She develops 'E-Scaped' medicine literally, as medical knowledge 'escapes' from the bounds of medical institutions; it becomes situated in the abstract e-scape. Within the e-scape, facilitated by technology, medical knowledge becomes diffuse, multi-directional and complex and accessible to a wide variety of users and creators. Drawing on both Clarke's biomedicalization and Nettleton's e-scape, Lupton (2013), for instance, builds her perspectives of technology, health and power to argue that 'techno-utopian discourses' embraced by contemporary western medicine, public health and

health promotion have failed to address the complex notions of the emotional weight associated with self-surveillance and self-care.

The emergence of web 2.0 technologies has been a catalyst in transforming how both patients and health professionals relate to health information. Ready access to health information has given rise to what Nettleton (2004) has deemed as the 'expert patient'- an informed health consumer that carries out independent online research. Hardey (1999) argues that the proliferation of health information online has fostered a new medical pluralism wherein laypersons are empowered as they can access, share and create health information – a domain historically controlled by medical experts.

The expert or informed patient has been constructed as a conflicted identity, described in the existing research as both resisting and reaffirming biomedical power. Hardey (1999) concluded that online information seekers may find the internet to be a democratizing space where increased access to expert information is empowering, particularly in hierarchal interactions with health professionals. The sentiment that 'knowledge is power' resonates throughout the research concerning expert patients motivations for online information seeking (Broom, 2005; Pandey, Hart, & Tiwary, 2003; Schaffer et al., 2008; Song et al., 2012; Zaslow, 2012). Schaffer et al. note that expert patients "not only gain knowledge, but become co-producers of that knowledge and gain a sense of their own personal agency" (2008, 146). Broom (2009) attests that empowerment is rooted in the recalibration of power between doctors and expert patients in conjunction with lessened feelings of helplessness.  In their study of parents with chronically ill children, Schaffer et al. (2008) found that mothers described that their use of online information helped not only to prepare them to better understand medical

encounters with health professionals, but that they felt "armed with research" to critically

engage with their doctors (2008, 152).

In contrast, other research demonstrates that those who seek health information

online often reaffirm bio-medical knowledge as they confirm normalcy of bodies,

symptoms and behaviours. In their qualitative study of an online forum, X-online, for

patients who used the pharmaceutical drug Xenical to treat obesity, Fox et al. (2005)

observed that the users adopted predominant biomedical knowledge, demonstrated in

their discussions of fitness, diet and the use of medication to attain health by normalizing

their bodies. Similarly, Song et al. (2013) found that women used bio-medical

information online to normalize the uncomfortable bodily conditions of both normal and

abnormal pregnancies. Lupton (2013) contends that the digital technology of web 2.0

further extends the patient's relationship with medical knowledge beyond information

seeking as the use of mobile communication technologies that transgress temporal and

geo-spatial boundaries, are employed to survey the body, measure and record biomedical

information. Nettleton et al. (2005) note that much health information found online stems

from the traditional biomedical approach; asserting that the internet, as a new medium, is

actually reflective of old media, providing similar texts privileging scientific discourse.

Although online technology does certainly permit the creation and publication of

alternative forms of knowledge via blogs and forums, the configuration of internet search

engines renders results most often drawn from popular mainstream sources rooted in

expert discourse.

Existing research suggests that online health information seeking reaffirms

biomedical knowledge but also reinforces the neoliberal imperatives of public health as

patients survey themselves for health risks. Fox et al. (2005), Song et al. (2005) and Lupton (2013) see online technologies as extending the medical gaze beyond the walls of the clinic and into domestic and private places wherein "the medical gaze becomes virtual and moves towards self-government, as patients are expected to turn the gaze upon themselves and then report what they observe to their healthcare providers" (Lupton, 2013).

The capability to act as an informed patient, "display[s] a particularly modern marker of competence and social fitness" to meet the "felt imperative to be (or present oneself as) an expert" (Ziebland, 2004, 1792). Song et al. (2012) found in their study of pregnant women that tremendous amounts of time are dedicated to finding reputable sources, and for many women the vetting of information was a source of anxiety, but also pride for those who felt confident in their assessment skills. The expectation for individuals to take responsibility for self-education to become informed patients dovetails with the broader obligations of the neoliberal citizen to be independent and self-sufficient. Much like the ideal neo-liberal citizen, the identity of the informed patient is often only attainable for the middle class, who possesses time, money and education required to meet the rigorous requirements. Song et al. (2012) note that one's "desire and ability to capably perform the informed patient ideal is strongly connected to her [or his] social location" (778).

Methodology

Critical Discourse Analysis

Despite the growing prominence of e-health, tele-health and mobile health there are a limited number of studies from a critical public health perspective that use content analysis of online health communication, and therefore the works of Barker (2008), Fox (2005) and Zaslow (2012) are especially relevant in guiding this paper. The aforementioned research explores individual's use and feelings around accessing and sharing health information via web 2.0 technologies. Barker (2008) examines consumer driven medicalization that takes place over one year in an online electronic support group for those who suffer from fibromyalgia. Given that Barker (2008) passively drew from the textual content of the online support to comprise her sample, rather than actively participating or revealing her research objectives to the participants, she deems her research as both content analysis and non-participant observation. The non-participant approach allows the researcher to analyze interactions as they naturally unfold online, but is also limiting in that no dialogue can occur between participant and researcher to allow for clarification and further information. Similarly, Zazlow (2013) used non-participant observation in her examination of seven years of content taken from an online support list serve for parents of children with a rare condition, sensory processing disorder (SPD). Additionally, Zazlow obtained informed consent from those participants who were directly quoted in the final draft and she also informed the list owner and all participants of the study upon its completion. Zaslow argues that this balance between informed consent, non-participant observation and archival research helps to address the ethical concerns of online researchers. Fox et al. (2005) apply a slightly different approach,

terming their research as a virtual ethnography of an online forum for users of a weight loss drug including content analysis, observation of online interaction and interviews with select participants. The use of interviews allows the researcher to gain further information and clarity from the participants than would be accessible through only content analysis.

Barker (2008), Zaslow (2014), and Fox et al. (2005) demonstrate that content analysis can be an effective methodological approach to examine textual samples of online social media from a critical public health perspective exploring themes of medicalization, responsibilization and lay/expert discourse.  The way these themes emerge on the Twitter platform has not yet been explored in existing research: this study takes a critical public health perspective and uses content analysis to explore how themes of biomedicalization emerge on Twitter.

Though content analysis of Twitter has not yet been applied in the area of critical public health, there is a growing body of research in medicine and public health that has explored Twitter using content analysis.  Research from the public health perspective is often concerned with measuring how effective Twitter is at disseminating health information to the public (Burke-Garcia & Scally, 2014; Dumbrell & Steele, 2013; Harris et al., 2014; Sullivan et al., 2012), and assessing lay person's understandings and experiences of health issues (Scanfeld et al., 2010a; Sullivan et al., 2012; Tsuya A, Sugawara Y, Tanaka A, Narimatsu H, 2014). Sullivan et al. (2012) utilized the hashtag search feature on Twitter to identify tweets that contained a hash tag referencing concussions which provided a sample to analyze lay discussion of concussions. Similarly, keyword searches of the Twitter database were also used to identify datasets: Tsuya et al. (2014) used the keyword 'cancer' found in user profiles to identify public Twitter

accounts of cancer patients; and Scanfield et al. (2010) used keywords related to 'antibiotics' to identify a sample of relevant status updates to analyze lay person's misunderstandings of antibiotics.

In contrast Burke-Garcia and Scally (2014), Dumbrell and Steele (2013) and Harris et al. (2014), used content analysis to explore how health organizations use Twitter to share information. Dumbrell and Steele (2013) completed exploratory research using a manual quantitative content analysis of health related tweets from governments, for-profit, and non-profit agencies in Australia and concluded that "government health-related Twitter accounts…were found to be the most successful in disseminating health information to the public" (2013, p. 2673). Conversely, Harris, Choucair, Maier, Jolani and Bernhardt, (2014) completed a content analysis of the followers of Twitter accounts of popular health organizations and found that many followers were health related organizations rather than individual users and therefore public health agencies were "tweeting to the choir" (p.15).

Existing research from the public health perspective demonstrates how Twitter content can be utilized as a rich data set that is relatively straightforward to sort, search and code. Although this study assumes quite a different perspective, the Twitter analysis done in the public health context serves as an effective methodological guide that highlights potential challenges that may arise: incomplete or missing demographic information and the importance of setting appropriate parameters around time frame, participants and textual information to be included/excluded; particularly temporal effects on the data set related to seasonal changes and topical events. A key methodological difference between the critical analysis and medical or public health approach to content

analysis of web 2.0 media is the sample type: critical sociological research favors case studies of blogs, support groups or newsfeeds, while the public health approach uses large random samples with broad parameters to ensure validity. The possibility of large random samples may be a reason why medical/public health content analysis increasingly use Twitter based data. This study analyzes Twitter based data in a different way, using a case study of a single twitter feed, much like what existing critical public health research has done with case studies on other web 2.0 platforms. One similarity between both public health and critical public health research was ethical concerns around when informed consent was required. In both cases, researchers argued that for publicly accessible sites, informed consent from participants was not required.

Ultimately the largest contrast between this study and existing public health orientated content analysis will in the theoretical underpinnings and their integration into the analysis. Drawing upon the Clarke et al. 2003 concept of biomedicalization and Nettleton's theoretical discussion of 'E-scaped health', thematic analysis will explore public health communication with respect to power, risk, surveillance and responsibilization. The intent of this study is not dispute or dismiss the use of Twitter as valuable tool of public health authorities, but to gain an alternate perspective to understand the relatively new medium of Twitter and how it is used to communicate health information.

Sample

Twitter and Health

Microblog services such as Facebook and Twitter have emerged as viable platforms to communicate health information, to ask questions and to share health

experiences. Particularly, the notion of 'mobilizing information', identified by Ledford

and Anderson (2012) is relevant to the study of public health authorities and health

promotion initiatives that provide advice to mitigate health risks and guide lifestyle

choices for healthier bodies. The Twitter platform represents a forum where dialogues

about health incorporating multiple voices are documented in real time; similar to "data

collected through letters to the editor in news publications or comments made at a town

hall meeting" (Ledford and Anderson, 2012, p. 254).

Talk that emerges on public health Twitter feeds represents transparent dialogues

between citizen and state providing a rich sample for discourse analysis. The discussions

that arise on Twitter are also useful for research purposes in that they are considered

public discussions that do not pose privacy concerns.  Comments made on web pages that

are publicly accessible and do not require a password, are considered to be public domain

and can be utilized for research purposes without signed consent, provided that the

researcher does not engage actively with users.

Sampling Parameters

The city of Toronto has been selected for this study for two reasons; the first is

that Toronto public health has demonstrated itself to be a prolific tweeter with a strong

following when compared to the other top ten largest North American cities; posting the

second most tweets and third highest number of followers, behind New York City at 27

900 and Boston with 17 600 followers (Twitter, 2014). Toronto is the fourth largest city

in North America, and relative to its population it has developed a strong presence on

Twitter when compared to other large North American cities, (Harris et al., 2014). As of

November 2014, the Toronto Public Health Twitter feed has 10 500 tweets and 16 500

followers. It outpaces the Los Angeles County Public Health Feed with 2152 tweets and

7144 followers and Chicago with 5895 tweets and 5728 followers (Twitter, 2014).

The second reason that Toronto was selected for this study was to add to the

limited critical public health research done within the Canadian context. Much of the

academic literature from the sociological perspective investigating public health has been

carried out in Australia, the US and the UK. This study explores the online public health

dialogue as it emerges in the Canadian context and offers a contribution from an often-

overlooked perspective.

The sample was taken from the official Twitter feed of the Public Health

department of the city of Toronto.  It includes tweets, retweets and replies. All tweets

appearing on the feed were included in the analysis, including posts by other Twitter

users. It included a total of 467 tweets appearing on the @TOPublicHealth twitter

between May, 07, 2014 and July, 15, 2014.

Analysis

The sample of the City of Toronto public health Twitter feed was analyzed

through discourse analysis which has been shown to be an effective approach to health

and media. In a study of the media portrayals of Alzheimer's Disease, J.N. Clarke (2006)

used discursive/framing analysis to extend upon the predominantly discussed themes of

medical, political-economic and lifestyle to identify thematic media characterizations of

Alzheimer's patients as 'missing persons'. Drawing upon Clarke's methodology, this

study utilizes a two stage content analysis: an initial inductive coding of the text

contained on the Twitter feed to develop quantitative organizing categories; followed by

a discourse analysis of emergent manifest and latent themes.

J.N. Clarke (2006) notes that discourse analysis emphasizes, "the power behind the decisions to include some, and exclude other, information or perspectives" (2006, p. 274) which is congruent with A. Clarke's assertion in that "empty spaces and silences have implications" (2005, p.76). Clarke asserts that researchers need to be accountable to the silences in data diverging from traditional grounded theory of Glasser and Straus that insisted on "letting the data speak for itself" (Clarke, 2005 p. 75). This study examines both manifest and latent content, recognizing silences in the data, as they occur in online talk; examining how online talk about public health takes place and who is talking.

Pilot Coding

To better acquaint the researcher with the process of coding the unique medium of Twitter, and to establish preliminary coding categories, a pilot coding exercise was completed using Nvivo 10 software. The pilot coding sample included 100 tweets posted between August 17, 2014 and July 16, 2014. The pilot sample closely reflected the larger sample in that it included tweets from Toronto Public Health, retweets, and exchanges with other users posted on the Toronto Public Health Twitter feed.

Pilot coding was completed in two stages: initial coding categorized tweets according to subject and then secondary coding was carried out to sort the tweets according to theme or suggested tone. In both stages of coding, tweets could be coded into multiple categories, if applicable. Coding schemes established through initial and secondary pilot coding along with the adapted coding scheme from Dumbrell and Steele (2013) will guided the development of the final coding scheme (see Table 1).The pilot coding showed that initial coding for subject and secondary thematic

Table 1

*Coding Scheme Categories*

| Content | Information Type | Theme |
|---|---|---|
| Environmental and Infrastructure | Advice | Economic |
| Family and Children's Health | Community/Events | Expert/Lay knowledge |
| Food Safety | Conversation | Other |
| Health Care system | Critique | Resistance |
| Illness | Engagement | Responsibilization |
| LBGTQ | • Concerns | Risk |
| Men's Health | • Questions | Surveillance |
| Mental Health | • Recommendations | |
| Physical Activity | • Responses/Questions | |
| Policy | • Sharing Information | |
| Safety | Imperatives/Calls to Action | |
| Sexual Health | Information (Neutral tone) | |
| Social | Other | |
| Substance Use | Support | |
| Virus | | |
| Women's Health | | |

coding are effective ways for sorting and analyzing the text from the Toronto Public Health Twitter feed.

Initial Coding

Prior to coding, the data set including all accessible text from the City of Toronto Public Health Twitter feed (@TOPublicHealth) was loaded into Nvivo to facilitate digital coding. Text from dialogues appearing on the @TOPublic health Twitter feed were obtained and uploaded into Nvivo via the free online application Conweets, which is used to search the Twitter database for conservation strings featuring specific users.   The initial coding of the Twitter feed was inductive, but guided by the sensitizing themes, informed by Dumbrell and Steele's (2013) content analysis of Australian health agencies Twitter activity. Dumbrell and Steele categorize with emphasis on particular types of health related conditions, the type of health information being conveyed and dialogue including the voices or identities of the repliers and re-tweeters. They also categorized the connections that were made to other sites made available through the posting of links. This study draws on Dumbrell and Steele's coding categories, but also extends upon them to include categories to capture dialogue and assess emergent themes. All tweets were first individually coded for content and then, in the case of dialogue, were coded in relation to other tweets included in the conversation group. Each tweet may belong to one or multiple coding categories. Results of initial coding quantified potential patterns emerging in the text, and facilitated second stage thematic analysis**.**

Second Stage Analysis

The second stage of the analysis examined both manifest and latent themes as they appear in the text. The patterns determined in the initial coding supported the analysis of thematic discourses as they emerged in the online dialogue. This study adopts a critical perspective to health and technology, following on the work of Clarke et al. (2003), Lupton (1995) and Nettleton (2004) to explore the discourse as it appears in online talk about public health. The secondary coding built on the initial coding; organizing the wide array of categories further into discursive themes, and also identifying where silences occur in the data in terms of absent voices, identities, issues, and forms of knowledge, to name a few possibilities. Secondary coding was inductive, but strongly guided by the sensitizing concepts. The concepts that guided the thematic coding were adopted from Clarke's biomedicalization, the 'digital patient' of Lupton and the 'e-scapes' of Nettleton. The secondary pilot coding showed that tone and the direction of a tweet were useful signifiers to flag biomedical themes. For example, tweets often contained thematic qualifiers such as 'tips for healthy living' or the consequences of unhealthy behaviours. Advice based tweets signal the expert/lay knowledge divide, whereas tweets that reference the consequences of unhealthy behaviour support the risk discourse. In some cases, the tweets utilized both passive and imperative directives re: healthy behaviours. Directive tweets were coded into the responsibilization theme. Exchanges of dialogue on the Twitter feed between Toronto Public Health and other users represented a variety of themes including: public service, surveillance, and resistance to biomedicalization.

Ethics

This study analyzed media content and no human participants were involved; it was therefore not necessary to apply for ethics approval with the Wilfrid Laurier University Research Ethics Board. The researcher has completed the TCPS Tutorial Course on Research Ethics (CORE) and has examined potential areas of ethical concern.

Content analysis of publically accessible websites, at this time, does not require the researcher to obtain consent from individuals and collectives who post content that is made available to the public provided that sites do not require passwords to gain access and that researchers themselves do not solicit comments, pose questions, or interact with anyone posting content on the website (Ledford and Anderson, 2013). In the case of this study the researcher only engaged passively by reading the Twitter feed (just as any person could, as it is publicly accessible). To maintain confidentiality, pseudonyms are used to conceal the identity of individual users, although organizations with public profiles will be disclosed.

Another ethical concern to be acknowledged involves the identity of the Toronto Public Health communications staff person, whose job actually is posting onto the Twitter feed, on behalf of the Toronto Public health Division. Specifically, the concern is that the close examination of the text contained on the feed may be construed as an evaluation of this person's quality of work, and perhaps have negative consequences. To clarify, the purpose of this study is not to evaluate the quality of the Twitter feed, but rather to examine how talk occurs, what is discussed, and whose voices are represented in the dialogue. Value judgments will not be made about the strength or propriety of the messages posted on the feed, minimizing the potential for negative impacts.

The final ethical consideration concerns the researcher's duty to be accountable and to represent the data accurately through appropriate analysis. As the Twitter feed is a representation not only of the position of the City of Toronto, but also of the voices and identities of the individuals and groups that engage in the dialogue, it is of upmost importance to represent the data as accurately as possible throughout the analysis to minimize the potential harms of misconstrued data.

## Findings

### Overview

#### Content

Content coding was developed to show what topics were discussed as well as the frequency or infrequency of discussions that took place. All tweets were assigned either one or more codes describing their content. In many cases tweets were coded into multiple content categories, for example, a tweet reading, "Seeing people smoke encourages children & youth to start. Protect kids, follow the #SmokeFree bylaw in #Toronto parks http://t.co/FfM0FZDQHG", would be content coded under infrastructure, policy, substance use and children's health.

 The content of the sample represented a very broad range of public health topics, including more typical health promotion prompts aimed lifestyle orientated interventions, references to current events, and discussion of environmental concerns.

Overwhelmingly, the majority of the content in the sample was related to sexual health, with 169 references coded, (see Table 2).  The emphasis on sexual health content on the feed was related to topical factors such as the preparation for the World Pride event that took place in Toronto in June 2014. In conjunction with the lead up to the

Table 2

*Content Areas Addressed On @TOPublicHealth Twitter Feed*

| Content Area | References Coded |
| --- | --- |
| Sexual Health | 169 |
| Environmental and Infrastructure | 137 |
| Family and Children's Health | 57 |
| Substance Use | 49 |
| Physical Activity | 46 |
| Food Safety | 28 |
| LBGTQ | 27 |
| Social | 26 |
| Mental Health | 25 |
| Policy | 25 |
| Virus | 18 |
| Safety | 15 |
| Illness | 14 |
| Men's Health | 7 |
| Health Care system | 6 |
| Women's Health | 6 |

World Pride event @TOPublicHealth introduced a related Twitter based sexual health campaign #condomTO, which fostered user engagement through the development of the City of Toronto branded condoms and followed the distribution of millions of free condoms throughout the city. Across the sample time frame #condomTO campaign was heavily promoted by @TOPublicHealth, but also was successful in fostering user generated content in the form of comments, jokes, suggestions and photos related to the campaign. Another topical factor which increased the number of references to sexual health was a live question and answer period, #STI chat, where Twitter users could tweet their questions and have them answered by a health professional. The #STI chat generated a number of references from both @TOPublicHealth and a variety of users. The second most referenced content area (with 137 references) was environment and infrastructure which described any reference to the city's built environment, including parks, transportation, water treatment and city planning. Similar to the area of sexual health the numbers of references to environment and infrastructure were increased by a topical event; live Twitter coverage of the #HealthByDesign media event. The coverage of the event included many live tweets from @TOPublicHealth, but also included responses and questions from other users. Family and children's health was the third most referenced content area with 57 references. It should be noted that the area of family and children's health were not connected with any formalized Twitter based event (like those described re: sexual health, and environment and infrastructure).

Content coding was included in this analysis with the intent of showing both popular topics as well as detecting possible silences in the data (A. Clarke, 2006; J. N. Clarke, 2006). However, given the short sampling time frame of this study and the

finding that much Twitter activity on the @TOPublicHealth feed is influenced by topical

events, it is difficult to identify silences in the text.  Had the sample been drawn from text

posted from each month in an entire year, silences in data would be easier to identify.

However, it was surprising that there was not more discussion of disease and specific

medical conditions, outside of frequent references to STIs. This could be linked to the

fact that many common diseases and health conditions already have established

awareness months which @TOPublicHealth may reference as they occur throughout the

year. The discussion of poverty as a social determinant to health was another content area

that was not referenced in the sample, though this is likely a consequence of the small

sample size. Similarly, few references to disability and accessibility were noted.


Information Type

All tweets were assigned either one or more codes to describe the type of

information conveyed. Information was coded based on the message, the tone and the

direction of communication- one way passive or two-way active communication. One

way communication refers to broadcasting or sharing of information, whereas two-way

communication refers to a dialogue which may include 2 or more voices.

Out of the total of 467 tweets included in the sample, over half (52 percent) of the

tweets were passive one way communication from @TOPublicHealth, and 48% of the

tweets coded were a part of two way communication (see Table 3). Within the category

of two way communications, the majority, (70%) of the tweets, were from

@TOPublicHealth and the remainder (30%) were posted by other users. One reason that

@TOPublicHealth appears to dominate the dialogue may be because of the tendency to

Table 3

*Communication Direction on @TOPublicHealth Twitter Feed by References Coded*

| Information Source | One-Way Passive Communication | Two-Way Communication | Total References |
|---|---|---|---|
| @TOPublicHealth | 243 | 157 | 400 |
| Other Users | 0 | 67 | 67 |
| Total references | 243 | 224 | 467 |

post multiple tweet responses to questions posed by other users in a single tweet. Within the dialogues, tweets were coded into sub-categories: responses/answers, questions, sharing information, comments, and recommendations. The majority of dialogue was comprised of responses/answers (114 references) mainly posted by @TOPublicHealth. Other types of dialogue were, questions (42 references); and sharing information (33 references).

In addition to the direction of communication, tweets were also coded according to the type of message conveyed or the tone, including categories such as community and events, advice, and imperatives/calls to actions. Given the public health authority's interest in community health it is understandable that community and events featured heavily with 205 references. Community and events category coding was influenced considerably by the large number of references from the #condomTO campaign. Other information types that featured prominently were advice (87 references) and imperatives/calls to actions (82 references), the majority of which were posted by @TOPublicHealth (see Table 4).

Themes

Thematic coding was completed inductively but also guided by prominent concepts discussed within critical public health literature that emphasize the individual responsibility for health. Major themes were: responsibilization, risk, surveillance, and expert/lay knowledge (see Table 5). In many cases major themes overlapped as references were coded into multiple thematic categories. Often the categories of risk,

Table 4

*Information Type*

| Information Type | References Coded |
|---|---|
| User Engagement | 233 |
|    Responses- Answers | 114 |
|    Questions-Concerns | 42 |
|    Sharing information | 32 |
|    Comments | 27 |
|    Recommendation | 2 |
| Community and Events | 205 |
| Advice | 87 |
| Imperatives, Calls to Action | 82 |
| Information-Neutral tone | 31 |
| Support-Help | 19 |
| Other | 9 |
| Critique | 7 |

Table 5

*Emergent Themes on @TOPublicHealth Twitter Feed*

| Themes | Number of Tweets Referenced |
|---|---|
| Responsibilization | 229 |
| Risk | 110 |
| Expert-Lay Knowledge | 102 |
| Surveillance | 71 |
| Economic | 5 |
| Resistance | 5 |
| Other | 5 |

surveillance, expert/lay knowledge overlapped with responsibilization. The responsibilization theme, which was assigned to any tweet that implied a duty or obligation to reduce risk and/or act in the interest of healthy living, was prominent throughout the sample, referenced 229 times. Risk was also a notable theme within the sample, with 110 references. Any direct or indirect references to health risks, environmental risks or risk prevention were included within the risk theme. The expert/law knowledge theme, with 102 references, described the exchange or sharing of expert health and lay health advice. Most commonly, expert biomedical advice was shared with laypersons, but there were a few occurrences where lay information was shared. The surveillance theme described any direct or indirect reference to the surveillance of the body or environment. With 71 references, it is surprising that surveillance was referenced much less frequently than risk, as the two themes logically dovetail. An explanation for this lies in the way @TOPublicHealth applies the concept of risk; risk is often referenced as a motivator for prevention activities and these discussions do not always include a reference to surveillance.

Establishing authority through voice, tone and direction

The @TOPublicHealth uses the direction of communication and the expert voice to maintain authority. The majority of the tweets posted by the health authority are in the form of one-way passive communication, reflective of traditional prescriptive public health media (Lupton, 1995; Petersen and Lupton, 1996). When dialogue with other users occurs on the feed it is often initiated by the health authority to solicit engagement. To clarify, any Twitter user may tweet to @TOPublicHealth at any time

(which will be discussed later on), but the majority of two-way dialogue is guided and initiated by the health authority. While it is probable that @TOPublicHealth uses such initiatives to encourage engagement with the general public (both solicited and unsolicited), still, the nature of the engagement initiatives serve to re-establish the authority of the municipal public health agency, as it can select the topic of discussion and appropriately frame it to best underscore its chosen message.

Within the sample, a prominent campaign that solicited numerous posts from other users was the #condomTO that coupled Twitter coverage with the distribution of free city of Toronto themed condoms. The campaign encouraged users to tweet their ideas about designs for packaging, and to share photos of the condom distribution bus as it delivered condoms throughout the downtown in the month leading up to World Pride. The #condomTO campaign encouraged a broad discussion about safe sex, most often describing where one could obtain the free condoms or what image should be on the packaging, with tweets such as, "Spread the word. #condomTO is coming soon to a location near you http://t.co/q8dZ2vR1Da @WorldPride2014 @PrideToronto @WP14TO @InterPride", and, "If Toronto inspired a condom, what do you think would be on the wrapper? #condomTO coming soon http://t.co/YUjCIldbR7".The dialogue of #condomTO was framed to raise awareness about free distribution of the Toronto themed condom rather than emphasize more challenging issues around condom use, such as how to negotiate safe sex in relationships. It should be noted while issues re: the challenges around safe sex were raised, they were not explored in detail.

Another campaign that facilitated two-way communication was the #STIchat, which offered an opportunity for users to tweet questions about sexual health and have

them answered via Twitter in real time by a health professional. Similar to the #TOCondom campaign, the #STIchat allowed the municipal health authority to select the topic of discussion and the frame. The nature of the question and answer period implicitly framed @TOPublicHealth as a source of expert knowledge, especially biomedical knowledge. For example, one user tweeted, "@TOPublicHealth I heard gonorrhea is becoming incurable, is that true? #STIchat", which reinforced the idea that citizens look to their public health authority to reaffirm biomedical knowledge. The responses from @TOPublicHealth, "Great question! Gonorrhea is getting smarter & becoming resistant to more antibiotics #STIchat #gonorrhea ", and "That's why safer sex and screening when you've had risks is so important #STIchat #gonorrhea", demonstrate that it is a credible source of biomedical knowledge, but also the imperative for safe sex and screening are emphasized. The prescriptive tone itself marks @TOPublicHealth as an authority.

Although engagement campaigns such as #STIchat and #condomTO demonstrated how two-way communication reaffirmed the @TOPublicHealth as a source of expert biomedical knowledge, the use of passive one-way communication was the predominant communication style, information flowing from the expert to the lay user. Much of the one-way communication reviewed in the sample was in the form of advice or imperatives to make healthy choices, and in many cases tweets contained both advice and imperatives for healthy living. For example, @TOPublicHealth tweeted, "For the best defense. Breastfeed. For more benefits of breast milk visit http://t.co/LZgbMhuCii", which included the imperative to breast feed but also offered a link that advised of the benefits of breastfeeding. Similarly, another tweet stated, "Reduce the risk of

#WestNileVirus around your home by following these simple steps

http://t.co/ICXvn2cp0t #FightTheBite", used both the imperative to reduce risk while

providing advice. The above tweets are representative of the type of tweets that were

coded into the imperatives and advice categories. The incorporation of imperatives and

advice into the tone of the tweet reaffirmed @TOPublicHealth as a source of expert

knowledge, the tone parallel to the advice and direction one might receive from health

professionals.


 User Initiated Dialogues

Two-way communication, where a dialogue emerged between @TOPublicHealth

and other Twitter users, was less prominent than one-way passive communication, but

still accounted for a considerable amount of the tweets in the sample.  Out of a total of

400 tweets from @TOPublicHealth in the sample, 157 of those tweets were a part of a

two-way dialogue. All 67 tweets from other Twitter users were a part of a two-way

dialogue. @TOPublicHealth responded to all posts on its feed by other users, thus it

incorporated any outside post into a dialogue. Considering the entire sample of 467

tweets, both from @TOPublicHealth and other users, 224 tweets were a part of a two-

way dialogue.

As previously discussed, in many cases two-way communication took place in a

way that was initiated, guided, and framed by @TOPublicHealth; however there were

also instances where citizen users initiated with @TOPublicHealth. Often such dialogues

were initiated to make comments, ask questions, and report concerns about health and

safety. In a few cases user initiated dialogues were used to share lay information such as

recipes or exercise routines that users practiced.  A common theme amongst the user

initiated dialogues was that they usually referred to some type of environmental risk and

expressed concerns about what solutions may be put in place (by Toronto Public Health).

Several of the tweets reported concerns about food contamination at local

restaurants, leveraging the immediacy and transparency of Twitter to get their concern

addressed quickly. In some cases the users named the offending establishment and

implored a de facto public shaming, exemplified with tweets such as, "Just had a good

chat with @TOPublicHealth. They are taking a mouse in a restaurant seriously! Don't eat

at Prohibition in Leslieville", or, "@TOPublicHealth who regulates food vendors at

@HarbourfrontTO I just I've been served raw chicken at their Terrace Bar!" In cases such

as these, the users have gained some form of empowerment from their communication on

the Twitter feed: the platform allows one to instantaneously message potentially

thousands of people who live in a society that respects and values the notion of

surveillance, particularly about health issues. So, the threat or act of reporting serves as

an act of willful resistance to a contaminated environment.

The commitment to the surveillance of the environment for possible harms was

demonstrated by users who went beyond simply reporting risks, but augmented their

complaints with video and photo evidence, as demonstrated with tweets such as,

"@topublichealth @brazenheadto great place to store booster seats and high chairs!

Pretty gross" with an attached photo of a high chair stored inside a restroom; or "The

@xchangecafe at the @rotmanschool has a serious rat problem: t.co/tWOu5p5O5t

@TOPublicHealth" with attached video footage depicting rats scurrying around a rubbish

bin.  A number of factors may have influenced how this pattern of surveil and report

behavior has emerged:  occurrences of online reporting suggests that users may feel that

the notion of surveillance and reporting risk, especially   health risks is justified.

Secondly, the Twitter platform itself seems to be an effective conduit for reporting

behaviour- though it was not designed for this purpose, users have recognized that its

potential for real time mass communication and capability for sharing multimedia

information make it the perfect tool for spontaneous reporting. Most importantly, the

surveillance motivated tweets may be a reflection of the users' view of the public health

agency; the public health agency is constructed as an authority charged with the

surveillance of our bodies and the spaces they pass through.

Similarly, in other user initiated dialogues that concerned infrastructure and

policy, the tweets framed @TOPublicHealth as an authority. However, in the case of

infrastructure and policy concerns, the users implored the health authority itself to do

better, rather than simply reporting infractions. With respect to the ongoing renovations

of Toronto's Union Station, one user critiqued, "@TOPublicHealth @unionstationTO

Have windows that can open! More plants integrated into design! Probiotic air!" In

another tweet directed at the transportation infrastructure a user posted, "Now these r

proper bike paths! Key to longevity: a city with better transit t.co/GOpNizXCWa

t.co/FyxcrDIByo @TOPublicHealth" with an attached link to photos and an article that

praised  the nearby city of Hamilton's new separated bike lanes. Regarding a recent

report concerning infrastructure for health, one user tweeted, "@TOPublicHealth - Great

report - plans to advocate for policies as discussed in 'Improving Health by Design'?" In

these cases users have taken advantage of the Twitter platform to talk back to the public

health authority and have questioned the influence (or lack thereof) it exerts in the city planning process.

Another area where users posted critiques concerned the city's municipal by-laws controlling tobacco smoking. One user suggested, "@TOPublicHealth is there a way for the city to place smoking signs on benches that are within a playground?", to which the city promptly responded that there is in fact a by-law in place. While another user who posted her exasperation about the futility of anti-smoking by-laws remarked, "@TOPublicHealth Why are people allowed to smoke in their homes in the same room as their children but not in the car? Protect the children." This post also garnered a quick response wherein @TOPublicHealth acknowledged the challenges with assuring smoke-free housing. Critiques and inquiries posted on the public health feed, similar to user initiated reports, worked to reaffirm the public health agency as an authority.

Twitter is unique in that it allows a citizen to pose a question to an authority re: its position on current events, news articles, etc. Of course, it has always been possible to pose such inquiries by phone, but the transparency of Twitter demands that the organization respond with clarity and accountability. Upon reading an article in the Globe and Mail about asbestos being used in the construction of new condos, one user posted, "@TOPublicHealth What is the city doing to prevent asbestos- laden materials from being installed in Toronto bldgs? t.co/4M596TI46p", which forced the health agency to weigh in on the issue. @TOPublichealth quickly responded noting that it would look into the matter, but when it didn't follow up with an answer of substance the user again prompted, "@TOPublicHealth Any news on the asbestos issue?" This comment prompted a thorough response from @TOPublicHealth which noted that while it

discourages contractors from using asbestos, regulation falls beyond its jurisdiction. In this example the user leveraged the transparency and immediacy of the Twitter platform to facilitate a timely answer about a contentious issue. Public accessibility of the content obligates the health authority to respond quickly and accurately in order to maintain its credibility.

The user initiated dialogues that included reports, questions and concerns, all framed the public health agency as an authority that may be able to take action, or at the least offer answers to their queries. These dialogues certainly reaffirmed authority, but at the same time the users responsibilized the public health authority to effectively manage risks: by-laws must be evaluated; food service establishment adequately examined for risk and the public health perspective must be integrated into city planning to mitigate infrastructure related health problems.

Responsibilization, Risk and Surveillance

The majority of communication on the @TOPublicHealth feed, with the exception of the user initiated dialogues, reinforced the individual's responsibility to make healthy choices. Responsibilization of the individual was affirmed in the text through the chosen topics of discussion, the way content was framed and through emergent themes. Tweets were coded for the theme of responsibilization if they contained any reference to a directive that implied responsibility, duty or obligation for the individual to reduce health risks or to make healthy life choices. Consequently, responsibilization often overlapped with themes of risk, surveillance and expert and lay knowledge.

Risk and surveillance were notable themes, referenced 110 times and 71 times respectively. Most often the two themes overlapped as many tweets referenced the importance of surveillance for potential bodily and environmental risks. Tweets that focused on risk and surveillance were delivered in the form of imperatives for healthy living, advice, and in question and answer dialogues. Risk based references were expressed in both one way and two way dialogues, with 48 and 68 references respectively, whereas surveillance based tweets were more often a part of a two way dialogue with 60 references compared to 11 references for two way dialogue. The most common content areas that concerned risk and surveillance were sexual health, water, and food safety. An interesting distinction that emerged was that the majority of tweets regarding risk addressed environmental concerns, with 78 references rather than bodily risks with 32 references.

In addition to risk and surveillance concerning food (discussed in the user-initiated dialogue section, there were a number of environmental references to water contamination from both @TOPublicHealth and the individual users. Many tweets identified water quality as a potential risk and encouraged individuals to take part in surveillance for contamination. For example, @TOPublicHealth tweeted, "Want to know more about the quality of your #drinkingwater? Learn about sources of lead and how to reduce exposure http://t.co/hDhQC1cnem"; "Learn the basics of managing #Legionella with these simple tips http://t.co/FbuLf2qbLf #WaterTreatment #StopLegionella", and, "The first step in testing your water is to pick up a sample bottle at one of the 4 locations http://t.co/g4bR9sqRgW". Individuals also consulted @TOPublicHealth for advice on where to find testing kits and to obtain information about potential risks, in tweets such

as, "@topublichealth Do you know if last night's rain caused bypasses at any wastewater treatment plants?" In contrast, a few tweets from @TOPublicHealth communicated low risk in water quality at the beach, boasting "To get #blueflag status, beaches must meet 29 water quality criteria. Toronto beaches are exceeding these criteria". Even there were references extolling low risk, the discussion still framed water as a potential source of environmental risk that must be constantly monitored, threats being chemical or bacterial. Tweets from @TOPublicHealth frame the surveillance of water for contamination as a duty that is shared between health authority and citizen; individuals must be diligent in learning about potential risks and obtain their own testing kits to ensure that their home's water is safe.

Given that the sample time frame spanned May through July, a high number of references were coded with imperatives and advice imploring individuals to "Reduce the risk of #WestNileVirus around your home by following these simple steps zhttp://t.co/ICXvn2cp0t #FightTheBite", and, "Empty standing water from birdbaths & flower pots. Remove mosquito breeding sites. Reduce risk of #WestNileVirus http://t.co/sjOZIDGXKN".  @TOPublicHealth's discussion framed West Nile Virus as an environmental risk, demonstrated in the aforementioned tweets, but their discussion also emphasized the bodily risk of infection through mosquito bites. @TOPublicHealth warned, "Working in the garden or heading out camping this long weekend? Protect yourself from mosquito bites #WestNileVirus http://t.co/eSSTBcfgL6", and, "#WestNile season is here. Avoid the bite. Wear mosquito repellant". However, the management of both environmental and bodily risks is framed as an individual responsibility, shared in part with the public health authority. For example, "Find out what TPH is doing to reduce

the risk of #WestNile virus in Toronto at today's media event http://t.co/uqSxDHTvG7",

and, "TPH is setting up traps around the city to monitor mosquitoes for #WestNileVirus

http://t.co/Nyb34Eyg93", tweeted by @TOPublicHealth  notes the responsibility on the

part of the health authority to mitigate  environmental risks.

   Compared to the communication of environmental risks, there was far less

discussion around the management of bodily risks. Some tweets offered advice and

imperatives about the longstanding public health concerns of tobacco smoking and

drinking responsibly, urging individuals to consider, "What does one "drink" actually

mean? Learn more about "low-risk" alcohol drinking here http://t.co/IV9Kawp60s

#ThinkB4UDrink". However, most references to risk and surveillance of the body

involved the discussion of sexual health. The #condomTO campaign rendered many

tweets that encouraged individuals to practice safe sex, including imperatives to make

healthy choices, such as, "#condomTO are available now – check out this map to grab

some http://t.co/Eak3dHkplO", and "Up all night to get lucky". Don't leave home without

#condomTO @GMSHAlliance @PrismEventsinc @SquirtOrg @Grindr @tripproject

#WorldPride". Many other tweets about sexual health delivered advice about medical

interventions to prevent disease such as testing: "Testing for Chlamydia & Gonorrhea can

be as easy as peeing in a cup #STIchat", or, "Syphilis, chlamydia & gonorrhea are all

transmissible through oral sex. If you're having unprotected oral sex, ask for throat swabs

#STIchat". Vaccinations were also recommended as a form of prevention, "TPH advises

gay men to consider #meningitis C vaccination due to recent #outbreaks in gay

community in LA & NYC http://t.co/0YM5mrenpp." Regardless of content or

information type, tweets that were coded for responsibilization referenced either directly

or indirectly the individual's role in the prevention of health risks, whether it be through shielding one's body from external pathogens, using biomedical science to detect or fight infection, or altering the environment to reduce risks- the text affirms that all these actions are incumbent upon the individual.

The #condomTO Campaign

The #condomTO campaign significantly influenced the results of this study, and its prominence warrants in depth examination and explanation. The data re #condomTO can be viewed as a case study within a case study: within the case study of a public health twitter feed,  there is another case study of a Twitter based social marketing campaign, with significant data gathered specifically covering the launch, implementation and conclusion of the #condomTO campaign. The campaign is a dynamic example that has demonstrated how Twitter and health promotion initiatives can be integrated. Conceptually, Twitter and public health, dovetail naturally in that they essentially share a common goal: to engage with a large number of people. Twitter as a communication technology and public health as a structure of the neoliberal state both require public participation to be successful.

The most interesting aspect of the #condomTO campaign is that its message was squarely rooted in the responsibilization of the individual (for the prevention of STI's via safe sex), but it initiated a Twitter discussion to reframe prevention behaviour in a new, fun way. Historically, health promotion campaigns that targeted safe sex have been fear motivated and have used language, symbolism and imagery that depicts risk, disease and death. Fear based campaigns were particularly popular in the wake of the AIDS epidemic

(Gagnon et al., 2010). In contrast, the #condomTO campaign did not mention the potential risks of unprotected sex, but instead focused on issues of logistics, access and awareness about the free Toronto themed condoms that were distributed throughout the city. Tweets from @TOPublicHealth used tongue and cheek jokes, and a variety of posts to encourage engagement while they shared how, when, and where condoms could be obtained. The campaign solicited user input by encouraging users to share their ideas about clever designs for condom packaging and prompting users to post photos of them with the condom bus as it delivered condoms throughout the city. Such interaction is largely made possible by the technology of the Twitter platform which support sharing of multimedia information in real time. Twitter was a useful tool to foster engagement with citizens about public health and to reframe the prevention discussion from individual responsibility to community awareness and participation. Ultimately, the aim of the campaign was to encourage more individuals to practice safe sex, but this was messaged indirectly. One possible explanation for this approach is that it is reasonable to assume that people will more readily engage with a positive discussion about prevention rather than one that uses fear, guilt, shame and the risk of disease to reinforce its message. Another reason that the campaign did not directly emphasize individual responsibility could be that Canadian adults may already have a high level of awareness about their personal responsibility for disease prevention via condom use and so, to frame the discussion this way may seem redundant and limited. The #condomTO campaign can be viewed as a reaffirmation of the 'technology of self': it is only because people willingly control and surveil their own bodies for risk that allows public health to frame its discussion as "here's where you can get free condoms", as opposed to, "Here are the

reasons you should practice safe sex…". The campaign assumed a high degree of individual self-governance which allowed the focus to be on engagement driven aspects of the discussion. The #condomTO campaign framed the prevention discussion as participatory and community based.

Discussion

This case study of the @TOPublicHealth Twitter feed provides insight into online communication styles used by public health authorities, the interactions between health authorities and citizen users, and how the dialogue reflects citizen users' ideas about what public health is and the role of public health in the community. Twitter, as a relatively new communication technology provides a novel platform for transparent and real-time interactions between health authority and citizen, though most often these interactions reflect rather than reshape dynamics of biomedical power.

Using the biomedicalization framework as a theoretical lens, this study examines how themes of biomedical power emerge on a public health Twitter feed, and if the Twitter feed itself is a site where biomedical power is legitimated. The biomedicalization framework, defined by Clarke et al. (2003), articulates the transformation of biomedical power as it intertwines with the expansive reach and increasing capacity of technology. The @TOPublicHealth Twitter feed itself is a platform where both biomedical power and technology intersect, and thus it provides a suitable site of inquiry to explore how themes of biomedicalization emerge and are reaffirmed. The analysis of interactions between individuals and the health authority demonstrate that themes of biomedicalization emerge through: the focus on health, risk and surveillance; the transformation of bodies and

identities, and the transformation of information and the production and distribution of knowledge.

Given that existing critical public health research about web 2.0 and health has demonstrated the prevalence of risk and surveillance (Barker 2008; Fox et al. 2005 and Song et al., 2012; Zaslow, 2012), it is not surprising that the findings of this study also affirm biomedicalization through the themes of risk and surveillance. Individual responsibility for health, prevention behaviours and surveillance of risk were strongly emphasized in both one way and two way communication styles. Health advice tweets often used imperative language to underscore that it is the individual's duty to make healthy choices. Particularly, sexual health was an area of emphasis for both prevention and surveillance addressed through the specific campaigns of #STIchat and #condomTO.

Surprisingly, the #condomTO campaign did not emphasize the risks of unprotected sex: out of 81 references to #condomTO in the sample, only one of those reference mentioned STI's, although the goal of the campaign was obviously to reduce the risks of STIs. Similarly, discussion aimed at smoking cessation did not reference any biomedical risks of disease, but did note the social risk of encouraging children to smoke, and the environmental risks of air pollution and littered cigarette butts in public spaces. These two examples are noteworthy, because in the past they have both served as the loci of risk and fear based health promotion campaigns (Gagnon et al. 2010; Petersen and Lupton, 1996). In contrast, the #STIchat campaign was almost entirely focused on the biomedical risks associated with sex and what individuals can do to protect themselves, and thus it contributed to many of the references to embodied risks.

However, the majority of discussion concerned risks rooted outside of the body-socially and environmentally. The attribution that health risk is also located beyond the confines of the body may signal a shift in the application of public health, from health promotion lifestyle based approached grounded in encouraging individual's to make healthy choices to a model that is more focused on the social determinants of health. For example, many discussions involved risks associated with both the chemical and/or biological contamination of food and water. Even though these risks are located outside of the body, the text still suggests a strong imperative for individuals to do their part to reduce potential harms. In the past, public health emphasized the individuals' responsibility for the health of their own bodies, through fitness, nutrition and the uptake of advice from health professionals (Lupton, 1997). Now the individuals' role in risk surveillance has expanded beyond the body to include the environment, demonstrated, for instance, by tweets that call upon individuals to have an active role in testing for water for contamination and sharing in the duty diminishing the risk of West Nile Virus by removing standing water. The duty of individual to manage bodily and environmental health risks dovetails with the broader socio-economic individual responsibilities inherent in neoliberal citizenship (Ayo, 2012).

The most interesting and unexpected finding that affirmed responsibilization, risk, and surveillance themes was the occurrence of user–initiated surveil and report behaviours, mainly addressing food safety concerns at local restaurants. The notion that the @TOPublicHealth feed can be a forum for reporting appears to have arisen organically; though @TOPublicHealth does address these queries, it does not promote the feed as an avenue for health risk reporting. Thus, the motivation for users to post tweets

of potential risks must be based in the individuals understanding of public health as an authority concerned with risk, surveillance and prevention. The public health authority reaffirms that citizens practice self-surveillance, of which the natural extension is the surveillance of one's environment for risk. User initiated dialogues also reinforced responsibilization in another way: reports, critiques, and concerns posed by users shifted the responsibility back onto the health authority: questions demanded answers; by-laws required reinforcement, and the public health division was expected to advocate for health positive infrastructure decisions.  To be clear, the citizen's responsibilization of public health reaffirms biomedical power rather than challenges it. The report and questions appeal to @TOPublichealth as a form of authority. There were no posts that questioned the value of the public health system or the veracity of biomedical knowledge.

In addition to the emphasis on risk and surveillance, biomedicalization is affirmed through, "remaking the technical, informational, organizational and hence institutional infrastructures of life sciences and biomedicine via the incorporation of information technologies" (Clarke et al., 2003, 162).  The communication and interactions on the @TOPublicHealth feed demonstrate certain hallmarks of a transformative shift: embedded notions of historical sources of power and processes are present, but are reformed in new ways. Twitter, as a communication platform, does not reinvent the power dynamic between health authority and the individual citizen, nor does it alter public health's emphasis on prevention as a key to improved population health. Historical notions of biomedical power are evident in the predominance of one-way passive communication on the @TOPublicHealth feed, the direction of information transfer from expert to layperson is analogous to that of public health communication in other forms of

media (Lupton, 1995; Petersen and Lupton, 1996). In fact, Twitter as a communication tool, retrenches biomedical power as it extends the reach of the public health authority throughout space and time, but simultaneously alters the interface where interactions between citizen and state take place.

Social media technology serves to broaden and extend the reach of traditional health communications from major media sources and institutional forums, to an ongoing dialogue accessible anytime, anywhere. In the case of mobile Twitter users the potential for this information is almost embodied as the physical and emotional connection between users and their mobile communication devices grows culturally ever stronger. The use of mobile technologies for health extends the biomedical gaze beyond the walls of the clinic and into homes and private spaces (Lupton, 2012). In fact, the individual's decision to engage with the public health Twitter feed is a further demonstration of the Foucauldian 'technologies of self': to better govern oneself to reduce risk, the individual opens the door for the biomedical gaze to reach further into once private spaces.

In line with Nettleton's 'e-scapes' (2004) which describe contemporary medical knowledge as diffuse, multi-directional, and existing beyond institutional walls, the @TOPublichealth feed integrates multiple voices situated throughout space and time. The sample contained posts from 50 different users (in addition to @TOPublicHealth), located throughout Toronto, across Canada, as well as internationally. The @TOPublichealth feed is publicly accessible anywhere there is internet access, so local discussions about public health may be readily transformed into global discussions via input from voices situated internationally. Though international discussions were infrequent within the sample time frame, the possibility of such certainly marks a

transformation in dialogue about municipal public health. Particularly, this is relevant as global trends become increasingly influential in local health issues, for example, global warming and its impact on weather, or, the international spread of diseases- most recently the Ebola outbreak in 2014.

The most dynamic example of how Twitter has reshaped the interface between public health authority and citizen is apparent in the frequency of user initiated dialogues re: health related questions, concerns and reports which signal that the municipal public health Twitter feed may present a forum similar to a "town-hall style meeting" (Ledford and Andersen, 2013) where citizens are able to "talk back"(Lupton, 2012) to public health authorities. Users engage with the health authority to draw attention to potential areas of concern: food and water contamination, ineffective by-laws, and the lack of advocacy for public health in city planning- issues that potentially challenge the legitimacy of the health authority. Concerns, reports, questions and challenges posed by individuals serve to reaffirm public health as an authority: questions reinforce public health as an expert source of biomedical knowledge; challenges to by-law decisions imply the perception of public health as a source of political power; and the notion that public health can be more effective as an advocate infers a perception of influential power.

Clarke et al. (2003) assert that technoscientific identities can be formed as "biomedicalization…enables the acquisition and performance of identities as patients and communities through new technoscientific modes of interaction" (182). Twitter users who post on the @TOPublichealth feed may not necessarily perform as patients, but in their interactions on the feed they do engender 'technoscientific identities'. In this case

study, Twitter users that interact with municipal government via @TOPublicHealth, maybe considered online citizens, engaging in civic interaction in an online forum. The identity of the online citizen is parallel to that of expert patients who seek knowledge and empowerment through the internet (Broom, 2005; Pandey et al., 2003; Schaffer et al., 2008; Song et al., 2012; Zaslow, 2012).

With respect to public health, the identity of the online citizen is paradoxical: the individual enters into the dialogue to gain information and/or to responsibilize authority, but in such a relationship the individual is simultaneously subject to biomedical power. Hardy (1999) has argued that the internet has had a democratizing and empowering influence on the relationship between medical experts and laypersons, however, the analysis here supports the findings of (Barker 2008; Fox et al. 2005 ;Song et al., 2012; and Zaslow, 2012) who have argued that while the internet does permit access to expert information and the forum where individuals can produce and share lay information, these interactions still reaffirm biomedical power and often demonstrate the individual's obligation for self-surveillance and normalization.

The transformative notion of the 'technoscientific identity' can be extended to public health's organizational identity. @TOPublicHealth's interactions on Twitter facilitate the remaking of the face of public health, or in other words, alter the public perception of the health authority. Using the platform of Twitter, the health authority works to construct itself as responsive to the needs of the public. Discussions about health information are framed around topical events which convey image of the organization as dynamic and current, deemphasizing static institutional associations. @TOPublicHealth reinforces the responsive identity by literally responding to every comment posted on the

feed. The public health authority has recognized that Twitter is a media platform where it can foster engagement with the public and in renew the organization's public image. This begs the question who really benefits from the @TOPublicHealth Twitter feed, the health authority, or citizen users?

This concern can be addressed within the study's second research question which asks, "can the participatory and real-time functionality of web 2.0 platforms (such as Twitter) be a useful interface for two-way dialogue between government and citizen or does it reflect a passive one-way information transfer of traditional media?" The @TOPublicHealth feed does offer some benefits to citizen users; a forum in which voice questions and concerns with the assurance of a clear and timely response, is certainly a valuable tool in navigating the muddled waters of municipal bureaucracy. However, this benefit of convenience for users must be balanced against the weight of obligation felt by online citizens to surveil their bodies and environments to prevent risk. The predominance of one-way passive communication over dialogue based interaction suggests that Twitter may benefit the public health authority more than citizen users. The analysis shows that the @TOPublicHealth feed was a useful tool to reaffirm the authority of the public health agency while simultaneously casting it as responsive and engaged government.

## Limitations

This research has a number of limitations. As discussed in the ethics section, the identity of the staff person who posts on and maintains the Twitter feed on the behalf of public health may have posed some limitations for the study.  The focus of this study was

to analyze the discourses that occurred in Twitter dialogues about public health rather than the influence exercised by the identity of the person who manages the feed and how that may come to shape the voice conveyed by the organization. However, it must be acknowledged that the individual in charge of the Twitter feed may exert some influence in the direction of the content, attitudes and voices expressed as Toronto Public Health, but this lies beyond the scope of this study and is not addressed here. Such a relationship, between organization and spokesperson in online contexts, may be an area that holds potential for future study. Additionally, there are practical problems with the unknown information about the individual users themselves who post on the @TOPublicHealth. As socio-economic information about these individuals is not available, the analysis is limited in this respect.

The major limitations of this research are a result of time constraints. Had more time been available, the author would have restructured the sample to include content from each month of the year, to compensate for the high number of references to topical issues. Seasonality greatly influenced the analysis and made it difficult to determine whether there were silences in the data. Also, coding would have been completed to theoretical saturation, rather than limited to a discrete time frame. If possible, a consideration would be to extend the sample to include the Twitter feeds of other large North American cities such as New York City, Boston, Los Angeles and Vancouver. Additionally, budget constraints allowed for only one researcher to complete coding and so there was no opportunity to test for inter-coder reliability. The examination of online talk about public health raised many important questions about voice, identity and

knowledge. Unfortunately, the scope of this study is too narrow to address many concerns that arise beyond the data presented on the Toronto public health feed.

## Conclusions

The findings of this study support the existing critical public health research which predominantly argues that online engagement with health information sources usually reproduces biomedical power, rather than challenges it (Barker 2008; Clarke et al., 2003; Fox et al. 2005; Song et al., 2012;  and Zaslow, 2012) In addition, citizen interactions with the public health agency via Twitter reinforced 'technologies of self' active in the surveillance of one's body and environment for risk (Lupton, 2013). Elements of transparency and immediacy characteristic of Twitter based communication did allow citizen users to initiate dialogue that raised concerns, questioned and responsibilized the health authority, although in all interactions biomedical power was reaffirmed via responsibilization, risk and surveillance. Though Twitter is effective at fostering engagement, it does little to change the existing power dynamic between citizen and state.

In contrast to existing critical public health research about web 2.0 technologies that explore laypersons experiences with online information seeking and the users of online support groups, this study assesses the interactions between governmental health authorities and citizen users. Notably, citizen user generated content was framed for public consumption, devoid of overly personal details, and addressed shared public concerns. People used the public health feed to address problems of a public nature that might have a broad impact i.e. food and water contamination and issues of general access

to health services. Conversely, user generated content explored in previous research (Barker, 2008; Zazlow, 2012) contained highly personal accounts of emotional and physical experiences of illness and treatment. This suggests that one's real world conceptions of public and private spaces are transposed onto interactions in virtual space.

Compared to existing research about Twitter from the public health perspective this study offers an alternative understanding of how interactions between health authority and citizen take place. Public health focused research has argued that governmental health authorities are successful at delivering information to the public via Twitter (Burke-Garcia & Scally, 2014; Dumbrell & Steele, 2013; Harris et al., 2014; Sullivan et al., 2012), but are most often followed by health focused groups rather than individuals. While this study does not explore the characteristics of the @TOPublicHealth followers, it does demonstrate that many dialogues were initiated by individual users, rather than health based organizations (Harris et al., 2014). Similarly, it shows that Twitter can be a useful tool for individuals who seek quick responses from expert sources about health related queries. The analysis of the @TOPublicHealth demonstrates how governmental agencies can promote engagement by leveraging the interactive elements of web 2.0. It is interesting to note that despite this study's critical public health perspective, certain findings may be useful to public health practitioners. As this study employs such a different methodological and theoretical tract from public health studies about Twitter, it offers unique findings about interactions between state and citizen. To understand the value and meaning of a communication tool, analysis at the level of interaction is helpful. Therefore, the case study is an appropriate methodology as it makes possible the examination of tweets in relation to each other in dialogue, as

compared to public health based studies which focused largely on descriptive findings from large samples grouped by hashtag or word similarity.

It must be again noted that due to the very topical nature of discussion on the @TOPublicHealth feed the findings were impacted by a seasonality effect. The sample time frame included social media campaigns and a number of references about the World Pride event held in Toronto, which skewed the discussion particularly towards sexual health. However, @TOPublicHealth's coverage of the World Pride event itself, may offer an interesting direction for further study.

It is likely that social media will continue to play an important role in public health communication and may be a useful communication tool for other governmental structures. This study suggest that there is value in exploring state and citizen dialogues online to investigate broader power dynamics, as well as users' experiences in navigating bureaucracy.

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