Governance Through Mobile Apps:
The Construction of Public Health Problems

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ABSTRACT

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Carmen Lamothe

Mobile phone applications (apps) for health are proliferating at a tremendous rate and public health agencies are now starting to offer their own apps as a tool for promoting public health information. Taking a critical public health perspective, this thesis examines the emerging use of mobile apps by public health agencies and the ways that public health apps form and frame public health problems. It first provides a descriptive account of apps promoted by the Centers for Disease Control and Prevention (CDC) and the Public Health Agency of Canada (PHAC). Then, using a Foucauldian inspired policy analysis methodology (Bacchi 2009) two apps from the CDC are examined. These apps constructed public health problems in ways that explicitly held some groups accountable, while implicitly absolving others. The findings in this thesis illustrate that the app design process raises important (and under-researched) questions about how apps may come to emphasize certain types of public health knowledges and politics. The discourses on these apps can be understood as a guide to healthy behaviour, instructing subjects how to become productive and responsible. Findings highlight how apps can be understood as "mini-policies" where public health problems and policies come to be refracted and reframed.

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Chapter 1: The Critical Examination of Public Health Apps

Introduction

  The key aim of this thesis is to critically examine the growing use of apps in the realm of public health. "Governance Through Mobile Apps" asks how these apps construct public health problems and in turn how they might contribute to governing certain populations.

  Historically, public health in the United States and Canada have constructed certain subject positions, as framed in policy and public health campaigns; and these subject positions are applied to whole populations – such as women. Figure 1 shows an example of a public health poster from the 1940s. It states "Don't take chances with pickups" and "Loose women may also be loaded with disease" (First S.C. F.S.C). The message, comparing women with sexually transmitted infections (STIs) to a loaded gun, constructs and positions women's bodies as potential vectors of disease and as dangerous as a weapon. From this ad we can understand that the norms and politics of the time were also embedded into public health campaigns such as these posters. These ads take a certain political stance, framing the problem of STIs as a problem of women's promiscuity. Although these ads might seem amusing today in their outdated depiction, it is important to remember that today's public health campaigns were built on this history and it can help us appreciate why some public health policies might continue to be framed in ways that hold certain populations such as women more responsible both for the cause and solution of health problems.

Figure 1: "LOADED? Don't take chances with pickups" poster

Although public health messages can still be found in the form of posters today, newer media such at television ads and online websites amplify and expand the ways that public health agencies can get their messages out to the public.

Public Health Mobile Applications

In the past few years, public health mobile applications (apps) have proliferated; accompanying this proliferation are new possibilities for engaging users in a more interactive experience that allows them to monitor, upload and share personal health information (Lupton 2014). Apps for health are increasing at an astonishing rate with over half (58.23%) of U.S. mobile phone users in 2015 downloading a health-related mobile app (Krebs & Duncan 2015). Over 100,000 mobile apps for health are now available from iTunes and Google Play stores (Krisch 2015).

Lupton states that public health agencies are starting to take note of the potential of new technologies such as mobile apps and she argues that these apps "are represented as offering positive benefits…in relation to achieving personal goals related to monitoring one's body data and that of health education and promotion, healthcare and patient engagement" (Lupton 2015, p.

443).

Across the globe, high hopes are pinned on mobile technologies for health, especially for marginalized populations, with the World Health Organization (WHO) declaring that "if implemented strategically and systematically, mHealth (which includes apps) can revolutionize health outcomes, providing virtually anyone with a mobile phone with medical expertise and knowledge in real-time" (Kay et al. 2011, conclusion).

Key objectives of public health agencies include the monitoring of the populations' health and illnesses through surveillance, and the dissemination of health and safety information to promote healthy behaviours and disease prevention (McDowell 2015). There is a high expectation of mobile technologies such as apps to relieve health care costs and transform the way we access, understand and take up medical and health information. Public health agencies in Canada and the United States have started to promote apps as a tool to help meet these objectives.

Apps Promoted by Public Health Agencies

Public health tools then are shifting to online and onto mobile platforms such as apps. Few studies if any have thoroughly examined how and what public health apps are being promoted and deployed through national public health agencies in the United States and Canada and the authority and influence of established public health agencies such as the Centers for Disease Control and Prevention (CDC) and the Public Health Agency of Canada (PHAC) makes their apps particularly important to study.

Following on a trend of increasing popularity of health apps, these public health agencies have also started to promote their own public health apps. These apps are endorsed as a tool that aims to support both the layperson, "oriented towards the general public and consumers" and public health professionals, "oriented towards health care providers and clinicians" (CDC 2018). Apps are put forth as a way for users to be more engaged with their health monitoring and care, as well as to become more educated around important health issues (Lupton 2015).

Apps then present a novel and distinctive research terrain for sociology and critical public health scholarship. They are a relatively new foray for public health agencies, as initially online health and medical information was put forth in a static and non-interactive format (Lupton 2014). Apps are different, moreover, then offline public health (e.g. face-to-face) services. They promise a more personable and interactive platform for the user, who carries apps on their

person, within their phone or on other devices. The possibility of regular interaction with the app might therefore serve as a more intimate and individualized interaction with the message on the app.

Governance Through Public Health, Policy and Apps

Moreover, apps that are authorized and endorsed by national public health agencies carry both an institutional and technological weight. The public may potentially have both a trust in the authority of government health agencies such as PHAC and CDC and also a kind of trust in the technology itself. This thesis explores the way that these two levels of authority, government agencies and the technical acumen of apps might potentially impact the governance of populations in unexpected ways. "Governance Through Mobile Apps" aims to contribute to the developing literature of the potential unintended consequences of using these mobile apps as public health tools. Critical studies on public health apps are limited and the increasing pervasiveness of these apps calls for a critical study of these "apps as tools" for the construction of social problems. As apps continue to be touted as a way to save money, possibly replacing face-to-face amenities, we need to ask who benefits and who misses out if these mobile technologies supplant other public health services?

Apps as mini-policy

Norms and politics become entrenched into public health policy, and then, from policy, into the framing of public health promotions. I argue that technologies such as apps take this embedding of "politics into policy" another step further in that through the technology of the apps, public health policy is again translated, this time onto the app. It is in this sense that I take the position that public health apps can be understood as a kind of "mini-policy". I will refer to these app depictions of public health policy as "mini-policies" as they seem to be derived from the main health policies, yet reconfigured in ways that are unique to the technical affordances and space available on apps as a platform. At stake here is how this translation of public health policy onto mobile apps might have unintended consequences. This thesis aims to bring forward both the way that these problems are represented in unique ways as well as how we are governed through this "mini-policy" as it is represented on these apps.

Next chapters

This thesis is divided into 6 chapters in total. In chapter 1, I first state my research questions and describe the theoretical framework that I will employ for this thesis; including defining key terms such as responsibilization and neoliberal governance, governmentality, subject positions and problematization. Next, I break down what is meant by the term "public health app" and further define the notion of "mini-policy". Finally, I examine relevant literature on the current trend of using apps including who is most likely to download and use these apps, the authenticity of public health apps and the matter of apps and surveillance. Chapter 2 lays out my methodology and methods for this project including the theory and procedures for both the descriptive account (of the all of the CDC and PHAC apps) and the discourse analysis (of two of these apps). In chapter 3, I present empirical data, collected over almost two years. I provide a descriptive account of the public health apps being promoted through national public health agencies in North America. In chapter 4, I take a closer examination of the CDC's FASD app. I reveal the ways that public health apps such as the FASD app might create subject positions such as that of the responsible pregnant women. In chapter 5, I again take a closer investigation of a CDC app, this time the Heads Up concussion app. Here, I consider how policies contained within the text and images on these apps were problematized, uncovering how they might help to construct public health problems such as concussions. Finally, in Chapter 6, the conclusion, I summarize the key contributions of this thesis as well as offer some ideas for future directions.

Research contribution

The novel use of apps in the public health realm raises important sociological questions around the potential for unintended consequences. Although growing in number, there is still a dearth of critical academic research that has focused on mobile apps for health, and even fewer studies that have examined *public health* apps in particular (Lupton 2014).

I aim to contribute to this developing literature and to our understanding of the potential impacts of promoting, endorsing and taking up these mobile apps as public health tools.

Thesis statement

This thesis will critically examine the growing use of public health apps, specifically, those promoted by national public health agencies in Canada and the United States. This research takes apps not as a panacea, but instead it questions the implications, significance and effects that

technologies such as these apps might bring forth for different populations. This thesis will argue that there is a growing (and understudied) ecology[1] of public health apps, and that these apps can be understood as a form of governmentality, framing public health problems in ways that hold particular groups responsible, while absolving others from responsibility.

Research questions

Specifically, this thesis asks the following overarching research question:

➤ What are the public health apps being promoted through national public health agencies in North America and how do these apps contribute to the construction and governance of public health problems?

From this, the following sub-questions are also considered:

- Who are the imagined users of these apps?

- What public health problems are highlighted on these apps? And why?

- How might public health apps be understood?

- How might these apps frame and construct public health problems?

- How might they contribute to the governance of certain populations?

- How are these apps unique? How might they represent a distinctive space in need of critical examination?

- How might health policies be reframed in unintended ways through these apps?

Methodologically, this thesis will first undertake a descriptive account of the apps ecology supported by national public health agencies in Canada (PHAC) and the United States (CDC). It will then take a closer examination, through a discourse analysis, of two public health apps. First, the CDC's "FASD", for the prevention and awareness of fetal alcohol spectrum disorders, and secondly the CDC's Heads Up concussion app for awareness and prevention of concussions.

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[1] The Oxford English Dictionary defines ecology (in extended use) as: "the interrelationship between any system and its environment; the product of this" (OED 2018). In this thesis I use the term app ecology to refer to apps as organisms within a broader public health environment. My justification for using this term is to allow for the notion of interrelationship between the 'system' of apps within their environment of public health. I define "app ecology" as being informed by this definition of ecology, that acknowledges the interrelationship between the system and the environment in that there is a 'product' that can be understood as a result of this.

These two apps, FASD and Heads Up concussion, are particularly good examples for considering how apps might more generally contribute to the construction of governance of public health problems. They each take on historically well-established problems; fetal alcohol spectrum disorder, and concussions. Each of these health problems has a substantial amount of both academic research (regarding the causes and prevalence) and also written policy regarding prevention. This existing scholarly and policy material, supports and helps to better understand and give context to how and in what ways the problem became framed on the app. As mentioned, in this thesis I will refer to these specific policy framings on the app as "mini-policies".

Undertaking a discourse analysis on these apps will help to reveal and problematize these mini-policies on the apps to better understand how they might contribute to the construction and governance of public health problems.

Theoretical Framework

Broadly, the theoretical framework that I will use for this thesis employs a critical public health perspective. Within that, I focus this work in the sociology of public health literature. Finally, key concepts such as responsibilization and neoliberal governance, governmentality subject positions and problematization will aid to further focus the analytic lens. Below I describe and define this theoretical approach in more detail.

Critical Public Health

The overall theoretical framework for this thesis will employ a critical public health perspective (Bunton & Wills 2004). Unlike medical practitioners and public health experts, such as epidemiologists, taking a critical public health perspective taps into a unique position, enabling the researcher to stand outside of this public health surveillance network, and question the possible implications for different populations. This research aims to "…challenge the assumption of a simplistic or unidirectional relationship between public health campaigns and their intended targets, in which audiences are passive recipients of health information" (Haines-Saah et al. 2015).

Green and Labonté (2007) underscore the irreducible connection between an individual's poor health and the structural realities of poverty. The authors give the example that the highest rates (85%) of "road traffic injuries" globally, are attributed not only to low and middle income countries, but specifically to pedestrians in poor and rural areas, walking on dark and ill maintained roads for example. Yet, even if the "poorest are more exposed to risk",

> …the majority of health promotion activity is oriented towards individualistic behavioural interventions, such as teaching children to cross the road safely, or equipping rural Africans with reflective arm-bands for their evening perambulations, which while they are immediately helpful to some individuals, they make the vulnerable responsible for keeping themselves safe in environments which endanger their health (Green & Labonté 2007, p. 5,6).

Richard Klein argues that to be critical about public health is to "demystify their hidden moralizing and their political agenda, exposing what we might properly call the current ideology of health" (in Metyl &Kirkland 2010, p.16,17).

Unlike medical practitioners and public health experts, such as epidemiologists, taking a critical public health perspective enables the researcher to stand outside of the work and the ethos of institutionalized public health and question the possible implications for different populations.

Lupton describes taking a critical perspective on digital health as:

> … addressing the power relations and differentials that are inherent in digital health and identifying how the interests of some social groups, organisations and agencies are served, while others are ignored or, in some cases, undermined. This includes consideration of the ramifications for social groups who are already socioeconomically disadvantaged or people who are living with disabilities or chronic illnesses (Lupton (2017).

The aim of taking a critical public health perspective then is to illuminate those ways in which seemingly equitable public health policies might further marginalize or at least take away from the important job of advocating for social justice for marginalized populations.

Sociology of public health

Within this framework of critical public health, I take a sociology of public health perspective (Mykhalovskiy & Weir 2006; Weir & Mykhalovskiy 2010; French & Smith 2013; French & Mykhalovskiy 2013; French 2014). In a similar vein to critical public health, sociology of public health takes its stance from outside of the core of public health practices to examine the implications of these practices and policies at the level of the social. Sociology *of* public health can be understood as distinct from sociology *in* public health, or medical sociology which works within the medical ecosystem, to find solutions to medical problems. However, there is not a clean separation of the two, as French and Mykhalovskiy argue, sociology of public health "constitutes a complex, nuanced, diverse body of work that ranges across several issues and draws on multiple theoretical and methodological traditions" (2013, p.176).

Definition of Terms

Responsibilization and neoliberal governance

In the context of public health, we are expected to be responsible for more than just ourselves. It is expected that we will monitor and look out for our family and community as well, even being responsible for caring for the self so as not to inflict others with illness, or to burden others with the duty to care for you. Reuter, discussing the iteration of responsibilization in the case of Tay-Sachs disease argues that "this disease has been reconfigured in today's neoliberal context such that the *right* and the *responsibility* to know one's genetic self and potential risk have become one and the same" (2016, p.23).

Nevertheless, this responsibility does not fall equally to all citizens in that "Strategies aimed at responsibilizing are… found to carry stigmatizing subtext, which reproduce gendered and classed stereotypes that continue to place the emphasis of responsibility for health promotion upon particular groups of people" (Edwards & Fernández 2017, p.254). As a feature of neoliberal forms of governance, responsibility is put forth as empowering individuals to be responsible for their own health (Miller & Rose 2008). In this thesis, I understand responsibilization to be those strategies, such as policies, used by the state or state actors, for example public health agencies, that assign to the individual, the 'freedom' and 'independence' to take responsibility for their own care (Rose 1999).

The notion of a neoliberal style of government is a contested term and the concept of neoliberalism is 'oft-invoked but ill-defined'" (Flew 2014, p. Abstract). Davies gives a succinct definition of neoliberalism as "the disenchantment of politics by economics" (2016, p. xiv). There is a critique and discussion around whether or not we are still in a neoliberal style of governing, however for this thesis, I will define this concept of responsibilization and neoliberal governance broadly as the development of new strategies of responsibility, or taking responsibility for those who were previously the responsibility of a state agency (post welfare state), where subjects are rendered responsible for the care of themselves, their family and their community.

Governmentality

Foucault describes governmentality as:

the ensemble formed by institutions, procedures, analyses and reflections, calculations, and tactics that allow the exercise of this very specific, albeit very complex, power that has the population as its target, political economy as its major form of knowledge and apparatuses of security as its essential technical instrument (Foucault 2007, p. 108)

This thesis will use the notion of governmentality as a lens to focus in on, and bring forward for consideration, those strategies or 'tactics' used to govern and secure the population (Foucault 2007).

Problematization

For Bacchi, (and for this thesis), problematization is a tool used to "interrogate critically *how* [a certain issue or problem] is problematized, for example, in the 'problem' of single mothers" (Bacchi 2016, p. 1). It is "the premises [that] this representation of the 'problem' rests upon, and its effects" how, within a given policy, the 'problem' is framed and given meaning (Bacchi 2016, p.1).

Subject positions

Reuter examines the notion of subject construction in potential parents who seek genetic counseling for Tay-Sachs disease arguing that

> …genetic counseling is supposed to be nondirective, yet with its implicit prescriptivism the subjectivities of those parents who (actively) seek genetic guidance are transformed through its discursive techniques that teach 'new ways of making oneself and one's actions amenable to judgment' by others (e.g. insurance companies, employers) and even by their own selves. (Reuter 2016, p.159)

For the purpose of this thesis, subjectification "refers to the production, or making, of provisional 'subjects' of particular kinds through policy practice" (Bacchi & Goodwin 2016). The concept "subject position" refers to the kinds of "subject" that it is possible to become in specific discourses/knowledges (e.g., "the consumer," "the caring mother," "the delinquent," "the problem gambler," "the literate citizen") (Bacchi, 2016). Bacchi (and this research) uses the notion of problematization as a tool to examine and understand how subjects come to be constituted within policies (2009), and how they are ascribed subject positions in policy discourse.

Literature Review

What exactly is meant by the term "public health app?"

The object of study of this thesis is the growing ecology of public health apps. But what is a public health app? To break this down, I will first briefly define public health as it is understood by national public health agencies. I will then describe the technical side of mobile apps. Finally, bringing it all together, I will define and describe what I take to be a public health app for the purpose of this thesis.

First, What is Public Health?

The CDC prominently features this quote from CEA Winslow to illustrate key aspects of public health:

> [Public health is] … "the science and art of preventing disease, prolonging life, and promoting health through the organized efforts and informed choices of society, organizations, public and private communities, and individuals."
>
> — CEA Winslow (CDC 2017, public health)

Public health focusses on health at the level of the population. On their website, the CDC provides basic information about the goals of public health. They present this material in the form of a slideshow called "public health 101 series" (CDC, 2017b).

According to PHAC, public health is defined as:

> An organized activity of society to promote, protect, improve, and when necessary, restore the health of individuals, specified groups, or the entire population. It is a combination of sciences, skills, and values that function through collective societal activities and involve programs, services, and institutions aimed at protecting and improving the health of all people (PHAC 2008)

PHAC states that they are responsible for the following areas: disease control and detection, health and safety, travel alerts, immunization and vaccine, emergency preparedness, health promotion, injury prevention, research and statistics (PHAC 2018).

What are apps?

A smartphone performs similar functions to a computer in that it will usually have internet access and is capable of hosting apps. According to Statistics Canada, 76 percent of Canadians owned a smartphone in 2016 rising to 94 percent for those aged 15 to 34 (Statista, 2018). The percentage of Americans that owned a smartphone is 77 percent (Pew Research 2017). This is up substantially increased from 2011 when only 35 percent owned a smartphone (Pew Research, 2017).

"App" is short for software application; a computer program that runs on a mobile device. Apps can come preinstalled on the device or can be downloaded from an app store. The two leading operating systems for mobile apps are Apple's iOS and Google's Android, hence the two leading platforms for app distribution are the iTunes app store for iOS devices such as iPhone and iPad, and the Google Play store, (formerly called Android Market), for Android

devices. Currently, at the beginning of 2018, Google Play had over 3 million apps available for downloading while the Apple App Store had just over 2 million apps to choose from (Goode, 2017; Statista, 2018). These two stores represent the vast majority of app purchases worldwide (Medium, 2017).

Apps started as a way to offer users quick access to utilities and information such as email or the weather. There is often a difference between accessing a website on your phone and clicking on an app, a mobile website that is "optimized and scaled for mobile devices" with "smaller fonts, fewer page elements and less white space (when compared to desktop versions)" (Barnaart, 2017). I take up this point further below in my discussion of apps as mini-policy. Mobile apps can also make use of a device's features such as the phone's camera, microphone or location.

Bringing it all together: What are public health apps?

For this thesis, I will consider public health apps to be those apps that are promoted through financial support and official endorsement, by a public health agency. For apps outside of those agencies, I will identify a public health app as those apps that focus on "population" level health issues such as preventing an influenza outbreak as well as those apps that take on "traditional" public health problems such as vaccine tracking and promotion.

Apps as a "mini-policy"

What makes the mini-policy on an app different than an "official" policy? First, many pages of policy recommendations might need to be simplified and pared down for dissemination on the app (Barnaart, 2017). The CDC's webpage on concussion prevention can be understood as a policy, which presents the official stance taken by the CDC on the best practices and latest statistics on concussion awareness and prevention. App developers necessarily need to reduce this text even further when translating it onto the limited space on the app (Mergel 2014; Barnaart, 2017). Additionally, decisions around technical constraints of the technology might also affect how the information is presented on the app. As Lupton and Jutel argue, the content and technical affordances that end up on these apps "delimit the scope within which apps can be developed and used" (2015, p. 130). Accordingly, I argue that it is useful to think about the version of policy that ends up on the pages of the app as a different entity, and one that could benefit from its own critical examination.

The trend of using apps

The development of mobile apps for health is connected to a larger, international digital trend among many government agencies, pushed by financial pressures, to move face to face public services to online platforms such as websites, or mobile apps (Martin & Goggin, 2016, p. 436). The digital revolution in both the health and public health sector presents digital technologies as an effective way for resource-constrained organizations to provide services. Employing these apps, public health agencies aim to support and even augment these public health strategies (CDC, 2016). Public Health agencies then, promote the potential of technology such as apps as a means to better, and more widely disseminate, public health information, as well as to more efficiently monitor the health and wellness of the population. Further, mobile technology is also promoted as having the potential to transform communications between public health professionals and medical clinicians, by allowing them to quickly and reliably relate timely information about infectious diseases (Mandl 2014). Thus, public health agencies have many motivations for creating and promoting technological tools such as mobile apps.

Beyond public health agencies, other industries and professions are starting to endorse and encourage the use of health apps, mostly for their financial possibilities. For health insurance companies, mobile technology is seen as holding the potential for having substantial cost saving benefits as well as being a tool for increasing profits. The quote below is typical of the type of language used to promote "smart technologies":

> Through app technologies we can create an online health and wellness ecosystem that's accessed remotely, anytime, anywhere, via a mobile device...
> …for employers paying the bills, it minimizes cumulative claims costs. As an industry, we must continue embracing smart technologies and processes. It's one of the biggest opportunities ahead of us today. (Business Times, 2018)

Similar refrains, touting higher effectiveness at a lower cost are promoted by medical professionals in the United States for example "…apps give professionals, administrators, and patients greater flexibility. They are an inexpensive way for facilities to provide more high-

quality services, and – at the same time – are cheaper for patients to access" (Aims Education, 2018). The most often stated objective of this new "digital government" of public health and services then, is to make information and services more efficient and cost effective (Martin & Goggin, 2016, p. 438).

Who is most likely to download and use health apps?

According to Canada Health Infoway, 32 percent of Canadian adults use health apps (2017). Government digital transformation programs are tasked with developing digital "solutions" that focus on end users, with the user imagined as someone who is "mobile, connected, and digitally literate" (Martin & Goggin, 2016, p. 438). Who then might, and who might not, take up these technological tools? Canadians who track their health via apps are more likely to be younger (between 18-30), of a higher socioeconomic status, and healthier (Canada Health Infoway, 2017). Further, Robbins et al. found that having a chronic illness did not impact whether or not an individual would download a health app, however, individuals who reported "very good" and "excellent" health were more likely to have downloaded a health app than those who self-reported "poor" health (Robbins et al. 2017, p. 7).

Who are the likely app users and who might not adapt well to this technology? Peng et al. examined user's perceptions of mobile health apps and found that two key barriers to people's adoption of these apps were 1) a lack of awareness of their availability, and 2) a lack of app literacy and not knowing how to make sense of the many functions available on the apps (2016). Differences in socio-demographic factors such as gender, age, education and health status also point to those who are more or less likely to use health apps (Carroll et al. 2017). According to Krebs and Duncan, users who downloaded a health app were more likely to be young, Latino/ Hispanic, more affluent, in terms of income and education, and more likely to be obese (2015, p. 6). Ernsting et al. found similar results in a survey (N=4144) among German adults age 35 and older (2017). Of those who used a smartphone, two-thirds of the participants, (health app users) were more likely to be younger, and have higher literacy (Ernsting et al. 2017). Yet conversely they also found health app users more likely to have a chronic health condition (Ernsting et al. 2017, p. 8). Finally, Carroll et al. (2017) examined data from the Health Information National Trends Survey (HINTS) and found that those who are older, male and less educated were significantly associated with not using health apps (p. 2). As for those who reported using health

apps, they were younger, had higher education and reported excellent health (Carroll et al., 2017).

Health app users then typically have higher education, higher literacy, and are in good health. An exception to this rule, as Ernsting and colleagues found, are those dealing with some kind of chronic health problem and who may be more likely to use health apps even if they do not fit the other criteria of the likely app user.

In thinking about the abovementioned app users, how often might they download an app, use it once or twice and then forget about it? It is not sufficient to measure the success of an app based solely on the number of downloads it has. Krebs and Duncan (2015) for example conducted a survey (N=1604) of mobile phone users in the United States to better understand their use of health apps. While they found that about "65% of respondents opened their health apps at least once per day", they also found that almost half of the sample no longer used apps that they had downloaded (Krebs & Duncan, 2015).

Accordingly, public health agencies, in putting forth technical "tools as solutions" appears to be only taken up by a narrow segment of the population (young, healthy, etc.) and even then, may not be used, or not used as often as imagined, once the app is downloaded.

Authenticity of public health apps

Evidence on health apps is somewhat lacking and unsatisfactory (Krebs & Duncan 2015, p. 4). With so many health apps to choose from, how do users decide which ones are best? Lupton and Jutel call attention to the way that the developers of health and medical apps seem to entice users to download their health apps by claiming to impart important and relevant health information, by indicating potential advantages such as saving time and money, and by allaying people's anxieties about illness and improving their health (2015, p. 130). They argue that many health and medical apps, even ones that are not affiliated with a government health agency, are named using "proxies for physicians", for example WebMD or Virtual Doctor (Lupton & Jutel, 2015, p. 131). Furthermore, apps often include images of medical professionals or the use of computer science terms, all with the aim to give an "aura of scientific objectivity" (Lupton & Jutel, 2015, p. 131).

Amongst this sea of health and medical apps, the stamp of approval by public health authorities like PHAC and CDC is bound to cause apps to stand out, to appear more authentic. It

is for this reason that I chose to focus on the CDC and PHAC for my sample of public health apps.

Surveillance

Beyond the transition to website and mobile app platforms, the objectives of public health agencies have also changed considerably. In just over half of a century they have gone from retroactively reporting on diseases that had occurred, towards a new attention to "real time" reporting and prediction of future disease outbreaks or other dangerous events, such as bioterrorism (Fee & Brown 2001; French 2009). To accomplish these goals, public health agencies use various forms of surveillance.

There is a considerable amount of research that focuses on the positive and pro-technical aspects of apps and other technical platforms that have surveillance capabilities. Programs such as Google Flu Trends[2] or apps such as Flu Near You (Flu Near You 2018) have allowed users to have what they coined "Information Visualization", allowing abstract information to be interactive and visualized, for example in a map, thus becoming more accessible in terms of a user's language and education level (Card et al. 2009). Yet as Looijen (2013) writes, users of these programs may be oblivious to their contribution of the data, For example, Google Flu Trends used Google search records to provide the data for the flu maps. This seemingly negative point can also be explained as an advantage; obliviousness, Looijen writes, is helpful in the way that it does not distract from the user's experience (2013, p. 1, 3). In the most recent examination of the Flu Near You app, researchers stated that over 300,000 self-reports were submitted by users each year for the last two years, and argue that by having the public participate in flu reporting, they can complement other established health surveillance systems such as those in hospitals and laboratories (Smolinski et al. 2015, p. 2124, 2129).

Even apps that do not appear to have the outward goal of collecting population data still frequently have features that allow for data collection such as easy links to connect and repost information on one's social media platforms, or to grant access to one's location or contacts. Regarding the privacy of apps, Huckvale et al. looked at "certified" health apps and determined

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[2] Google Flu Trends was a program that aimed to use search data in order to monitor health related behaviors online with a goal to predict potential influenza pandemics in the population (Google Flu Trends 2018).

that many were not following their own privacy policies and therefore had "gaps in compliance" (2015, p. 7). Additionally, they found that certification programs relied on the developers to divulge their own technical issues and concerns, which did not always prove to be the soundest approach (Huckvale et al. 2015, p. 10).

Chapter 2: Methods

Methods

Introduction

In this chapter I give a detailed account of the methods I used to examine public health apps. I first started collecting data for this project as part of a Concordia University Undergraduate Student Research Award during the summer of 2016. As discussed in chapter 1, this thesis will focus predominantly on those public health apps promoted through the CDC in the United States and by PHAC in Canada.

First, I discuss the theory behind the methods used for this research. I then detail the procedure I used to select the apps for this study including an outline of the 2 time points that I used for my data collection. Following this, I lay out the detailed procedure (5 steps) for the data collection and analysis.

Methodology

For Bacchi, policy is understood as a cultural product that emerges "within specific historical and national or international contexts" (2009, p. ix). From this perspective the study of policy is a rich tool in which to understand the implications of governance of a population (2009, p. ix). Bacchi's approach to policy helps to bring out the ways that subjects are constituted in policy representations. Bacchi argues that policy is understood by the public as inherently good, a program or an action put forth to "fix" something (2009, p. ix). Yet, in this "fixing", Bacchi argues, it is also understood that there is or was a problem, something that was in need of fixing (2009, p. ix). Using a discourse-analytic procedure adapted from Bacchi to critically examine app-based text and images, I aim to reveal and expose the implied "problem" put forth on the apps considered in my study.

Descriptive Analysis

There have been studies of health apps, that used in their methods, an app store's description of the app. Knight et al. searched the iTunes and Google Play stores recording features such as cost, ratings, number of downloads agency affiliation and technological features such as connections with social media (2015, p. 3). Other studies have also undertaken a critical examination of health apps, relying on the descriptions housed on the app stores (Lupton, 2014;

Lupton & Jutel 2015; Thomas & Lupton, 2016). While the abovementioned studies were limited to recording the information contained on the store's site, Lupton (2015) looked at one type, sexual and reproductive self-tracking apps, more in depth by examining the text, data collection and interactive abilities of these apps. I argue that the methods I use for this research go somewhat further than previous studies in that I engaged deeply, beyond the app store descriptions, with the apps. I undertook a detailed examination of 35 apps over the course of almost two years, selecting two for an in-depth analysis.

Discourse analysis

I have relied on Bacchi's work to examine how power relations give shape to the way that public health problems are put forth. This method of policy examination foregrounds Foucault's notions of subjectification and subject positions, emphasizing the ways that subjects are constituted in public health policy (Bacchi 2009, p. 41). For example, Alexander et al. used Bacchi's method to analyze dominant narratives in the way that Canadian public health agencies have begun to promote play to combat the current "childhood obesity epidemic" (2014).

Bacchi's Questions

Bacchi's method offers 6 interrelated questions, of which this thesis uses the first 4, to guide in the analysis:

1. What's the 'problem' represented to be in a specific policy?

2. What presuppositions or assumptions underlie this representation of the 'problem'?

3. How has this representation of the 'problem' come about?

4. What is left unproblematic in this problem representation? Where are the silences?

(2009, p.xii)

I selected these 4 questions because they were the most useful for my study. Scholars using this method have also chosen to only use those questions (out of the 6) that seem relevant to their research (Alexander et al. 2014; Lancaster & Ritter 2014).

Specifically, these questions facilitate the examination of how problems, for example the problem of FASD, are represented and prompts a questioning of these representations. This method acknowledges the politics and biases that might be contained within institutional discourses, for example, those found on public health apps. It goes beyond assuming that this policy is written as a reaction to a problem "out there" (Bacchi 2009; Alexander et al. 2014).

These questions were applied to the text and images contained in the 2 apps; FASD and Heads Up concussion.

Procedure

  The CDC apps were located through the "CDC apps" webpage[3] which linked to their respective app stores; iTunes or Google Play store for downloading. The PHAC related apps were located on the PHAC website (T1) and through the Government of Canada website (T2).

Two time points for data collection
T1: July, 2016

  At this time (07/2016) there were twenty-nine apps promoted on the CDC mobile apps website, from the CDC website, ranging from educational games that children might play to various disease tracking applications. I took screenshots of all of the pages within each app as well as screenshots of the apps store(s) home page for each app. From the PHAC website, there was just one app; the ImmunizeON (now CANImmunize) app for vaccine information and tracking. The PHAC apps in T1 were located through the PHAC website. I took screenshots of all of the pages within each app as well as screenshots of the apps store(s) home page for each app. All the figures from my phone are on file with the author in database called "Inboard" (Inboard 2018). In T1 I took and saved the screenshots on my desktop, then, in T2, I started using this database. I tagged and labeled each screen shot, for example "CDC app" or "FASD" for easier locating.
T2: February, March 2018

  I did another thorough examination of all of the apps on the CDC webpage during March 2018, creating a comparable database to T1. Again I took screenshots of all of the pages within each app as well as screenshots of the apps store(s) home page for each app. This homepage gave information such as the number of downloads, user comments and ratings. It also included the developer's (CDC) brief purpose statement for the app. In T2 PHAC apps were located through

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[3] Note that there were other apps listed on the iTunes and Google Play store pages that listed the CDC as a developer of that app, but as these were not listed on the CDC "app page" I did not include them. My rationale for not including these apps is that they were not promoted in the same way. That is, one would have to come upon them through different routes, such as a self-directed search or a suggestion from a health professional or friend.

the Government of Canada website under the "Mobile Centre" page and the "Apps Gallery" page, as the configuration of this website changed by 2018 so that it was under the umbrella of the Government of Canada.

Five steps for data collection and analysis of apps

I first took a "snapshot" of these apps at two points in time, the first in July 2016, designated "T1", and the second in February 2018, labeled "T2". I then explored changes in the apps that occurred between these two time points. Finally, I examined two key elements of these apps; their intended audience, and the public health problems they choose to highlight. The findings of this descriptive examination are taken up in chapter 3.

Next, two apps were selected for a deeper, Foucauldian inspired discourse analysis (Bacchi 2009). The rationale for selecting these exemplars was as follows. First, 14 of the 29 apps were geared towards the consumer, or general public, whereas 15 apps were made for health professionals. Because my larger study investigates the relationship between public health apps and the public, I eliminated those apps that were designed primarily for public health or educational professionals. From the 14 consumer apps, I chose only the apps that were free and were available for download on the iPhone and eliminated those that were not geared towards caregiving or parents (as this was a goal for my larger project). This left seven apps. The following were then omitted: two game apps, one service location app, a flu reporting app and one app that no longer functioned. This left me with two apps—a feasible number for the type of in-depth analysis I wanted to conduct— those that predominantly targeted parents and caregivers: the Heads Up concussion app and the FASD app. These two apps were then examined in greater detail using Bacchi's discourse-analytic method. I take up the FASD app in chapter 4, and the Heads Up concussion app in chapter 5.

The data collection and analysis of these apps happened in five stages:

1) Taking all of the apps offered on the CDC website (N=29 in T1), (N=21 in T2) and the apps supported by PHAC (N=1 in T1), (N=2 in T2), screenshots were then taken of the store page and details recorded including ratings, download statistics and comments. Some of this information was provided to the app stores by the developer, for example the intended user via the description of the app. These apps were then downloaded onto a smartphone (iPhone 6).

2) Navigating through each app, screenshots were taken of all pages and links on each app. Screenshots were taken of both the app pages and the app's descriptions shown on the app stores for both T1 and T2. A total of 2,253 screenshots were taken for this research project; 1,080 for T1 and 1,173 for T2.

3) A brief descriptive analysis was then carried out on these apps, charting attributes such as price, interactive abilities, user data collection, user ratings, language(s), intended audience, user data collection, and privacy policies (Lupton & Jutel, 2015).

4) Next, and in order to get to know the apps, I spent some time on them, playing the games, inputting health information, clicking through diagnosis flow charts, etc. For example, in the case of the Milestones app, I inputted an alias name for my "child" and received (and continue to receive) push notifications for doctors visits as well as alerts regarding my child's upcoming milestones.

5) Finally, two apps; FASD and Heads Up concussion app were chosen for a more in-depth discourse analysis. These are taken up in chapters four and five.

Chapter 3: A Burgeoning App Ecology

Introduction

Key argument

I will argue that there is a burgeoning app ecology that the current literature has not addressed in a critical way. This chapter mainly presents empirical data, collected over almost two years, and aims to provide a detailed descriptive account of public health apps promoted by national public health agencies, specifically the CDC and PHAC.

Research questions

Key research questions for this chapter are:

What are the public health apps being promoted through national public health agencies in North America?

- Who are the imagined users of these apps?
- What public health problems are highlighted on these apps? And why?

Methods

Recall from chapter 2 (methods) that I took snapshots of the apps promoted by the CDC and PHAC in July 2016, labeled "T1", and again in February 2018, labeled "T2". I then described the details of these apps including their intended audience and the public health problems they chose to highlight. I also detailed the changes that occurred in the apps between the two time points (T1 and T2).

Findings

The CDC apps for T1 and T2 are shown in Table 1. The PHAC related apps are shown in Table 2.

Description

In T1, the CDC listed 15 apps for professionals and 14 for laypeople. In T2, there were slightly fewer apps for professionals (9) vs those for laypeople (12). There were also 8 fewer apps in total by T2. In T1, most of the CDC apps for laypersons were geared towards offering

general health and safety information, for example information about concussions in the "Heads Up" app or food safety information in the "Can I Eat This" app. In T2, most apps were either games, such as "the BAM! Dining Decisions" or aimed towards giving diagnostic or preventive information, such as the "Milestone tracker" app.

Both of the PHAC related apps were aimed at the consumer/ layperson. The one app from T1, ImmunizeON, was still available in T2 but now as "CANImmunize". Themes for PHAC apps were vaccine information and concussion awareness.

Table 1 shows the apps that were available for downloading from the CDC website. Column 2 in this table shows the apps at T1 (n=29). Column 3 indicates whether or not the app was still available at the T2 interval, for example if it was discontinued this is notated by an "N". Column 4 shows all of the apps available at T2. Note at the bottom of the table that there are new apps listed that were not available in T1. Finally, column 5 shows who the app was envisioned to be used by (based on the designation provided by the CDC), for the layperson or general consumer (C) or for the healthcare professional (H).

Table 1*:* CDC Apps T1 and T2

#	T1 App name N=29	Continues from T1 to T2?	T2 App name N=23?	Consumer (C) Healthcare (H)
1	Amyotrophic Lateral Sclerosis (ALS) Service Locator App	N	Not continued	C
2	CDC Blast Injury	N	Not continued	H
3	Can I Eat This?	Y	Can I Eat This?	C
4	Heads up	Y	Heads up	C
5	CDC mobile Application (Main Agency App)	Y	CDC mobile Application (Main Agency App)	C
6	BAM! Dining Decisions	Y	BAM! Dining Decisions	C
7	Fetal Alcohol Spectrum Disorders (FASD)	N	Not continued	C
8	FastStats	N	Not conticued	H
9	FluView	Y	FluView	C
10	Health-e-Cards	N	Not continued	C
11	Health IQ App	Y	Health IQ App	C
12	Healthy Swimming	N	Not continued	C
13	Influenza for Clinicians and Health Care Professionals	N	Not continued	H
14	The Laboratory Response Network Rule-Out and Refer app	Y	The Laboratory Response Network Rule-Out and Refer app	H
15	Ladder Safety	Y	Ladder Safety	C
16	Latent TB Infection (LTBI): Guide for Diagnosis and Treatment	N	Not continued	H
17	MMWR Express	Y	MMWR Express	H

18	Prevent Group B Strep (GBS)	Y	Prevent Group B Strep (GBS)	H
19	Preventing Chronic Disease Journal (PCD)	N	Not continued	H
20	PTT Advisor Support (prolonged partial thromboplastin time)	Y	PTT Advisor Support (prolonged partial thromboplastin time)	H
21	Solve the Outbreak	Y	Solve the Outbreak	C
22	STD Treatment	Y	STD Treatment	H
23	Tickborne Diseases	N	Not continued	H
24	TravWell	Y	TravWell	C
25	U.S. Medical Eligibility Criteria for Contraceptive Use	Y	U.S. Medical Eligibility Criteria for Contraceptive Use	H
26	Vaccine Schedules	Y	Vaccine Schedules	H
27	Web-based injury statistics Query and Reporting System (WISQARS)	Y	Web-based injury statistics Query and Reporting System (WISQARS)	C
28	The Yellow Book *Developer: MedHand International	Y	The Yellow Book *Developer: MedHand International	H
29	2011 Guideline for Field Triage of Injured Patients	N	Not continued	H
New T2 apps				
30	Not in T1	N	Dental checks	H
31	Not in T1	N	Ergomine	C
32	Not in T1	N	Milestone tracker	C

Table 2 shows the apps promoted by PHAC from T1 (N = 1) to T2 (N = 2). Note that in T2 the ImmunizeON app changed their name to CanImmunize. This was to reflect their new capacity as a national (capacity) app versus one that was only for users in Ontario. Column 4 shows the intended user, in this case both apps were geared to the general public.

Table 2: PHAC Related Apps T1 and T2

#	T1 App Name	T2 App Name *PHAC affiliation	Intended User
1	ImmunizeON	CanImmunize (renamed) *third party but funded by PHAC	General Public (geared towards parents)
2	N/A	Concussion Ed	General Public (geared towards parents)

Chart 1 shows the breakdown of the apps geared towards the health professional or the layperson in each time point.

Chart 1: CDC Apps Intended Users in T1 and T2
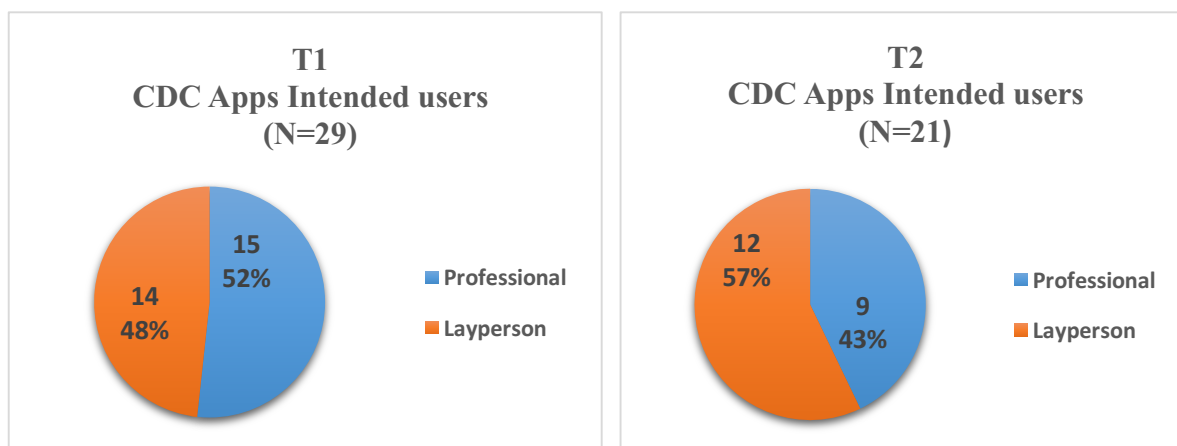
Chart 2 shows the breakdown of subject themes in those CDC apps that were geared towards the layperson user.

Chart 2: CDC Layperson Apps Subject Themes in T1 and T2

T1
Breakdown of App Subject Theme for Layperson (N=14)

- General Health Information
- Caregiver
- Game
- Diagnostic/Preventative

T2
Breakdown of App Subject Theme for Layperson (N=12)

- General Health Information
- Caregiver
- Game
- Diagnostic/Preventative
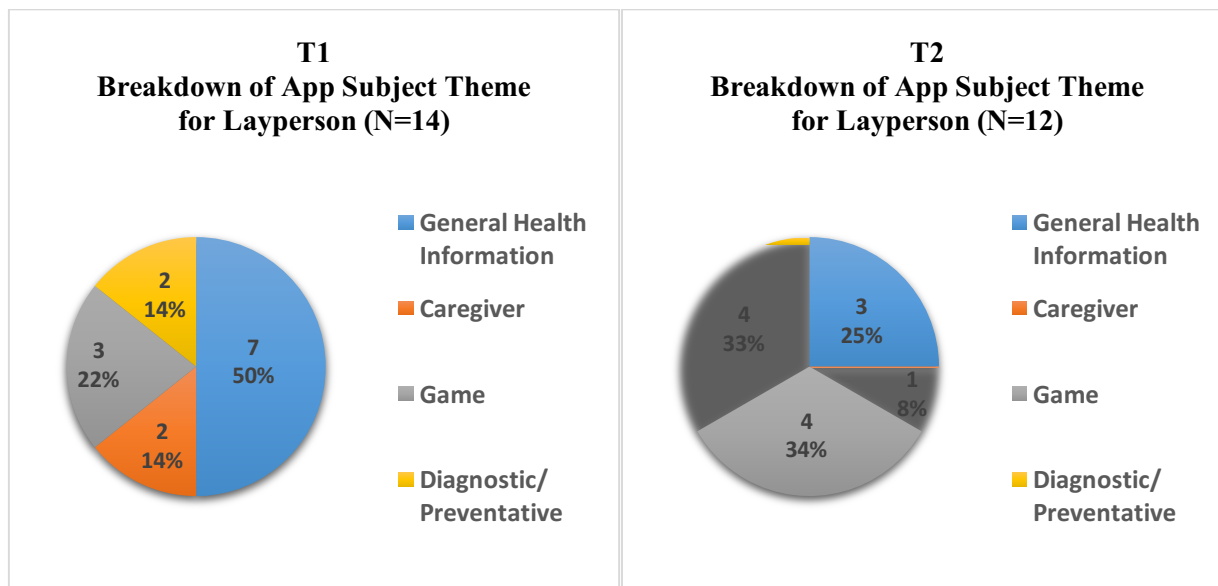
General App features

The CDC apps in both T1 and T2 were available on either iTunes or the Google Play store or both with most at least available on iTunes. Some apps were accessible for both iPhone and iPad, others only for one or the other device. All apps except one, "The Yellow Book" ($13.90), were free. All CDC apps had English as the default available language. Nine of the CDC apps in T1 were offered in English and Spanish, two of these apps were offered in 16 languages. All of the PHAC apps were offered in both French and English. In addition to the iTunes and Google Play store, the PHAC apps were offered on the Blackberry app platform. All of the CDC apps carried the same terms of use policy. The PHAC related apps each had an independently written terms of use and privacy policy. Each policy detailed terms around privacy, sharing of data and the use of cookies.

Many apps asked to access other features on the user's phone, for example, their photo library and camera ("Can I Eat This" app) or their microphone to record audio ("Solve the

Outbreak" app). Most apps also offered a way to connect to social media such as Twitter or Facebook in order to share information with others.

Download statistics were only available from the Google Play store. The following, table 3, shows the available download statistics for those apps in T1 and T2.

Table 3: Download Statistics for CDC apps

(available only from Google Play store)

#	T1 App Name	Number of Downloads	T2 App Name	Number of Downloads (format for this changed in Google Play) Not continued (NC)	Increase between T1 and T2 *Last update (if notable)
1	Amyotrophic Lateral Sclerosis (ALS) Service Locator App	10-50	Amyotrophic Lateral Sclerosis (ALS) Service Locator App	NC	n/a
2	Can I Eat This?	5,000-10,000	Can I Eat This?	5,000+	No *last update: April 16, 2014
3	Heads up	1,000-5000	Heads up	5,000+	yes
4	CDC mobile Application (Main Agency App)	5,000-10,000	CDC mobile Application (Main Agency App)	50,000	yes
5	Fetal Alcohol Spectrum Disorders (FASD)	1,000-5,000	Fetal Alcohol Spectrum Disorders (FASD)	NC\retired: March 31, 2017	n/a *last update: July 31, 2014

6	Health IQ App	1,000-5,000	Health IQ App	5,000+	yes
7	Influenza for Clinicians and Health Care Professionals	5,000-10,000	Influenza for Clinicians and Health Care Professionals	NC	n/a
8	Ladder Safety	1,000-5,000	Ladder Safety	10,000+	yes
9	Solve the Outbreak	1,000-5,000	Solve the Outbreak	1,000+	no
10	STD Treatment	5,000-10,000	STD Treatment	10,000+	Yes
11	Tickborne Diseases	1,000-5,000	Tickborne Diseases	10,000+	Yes *last update: Sept. 17, 2015
12	TravWell	1,000-5,000	TravWell	10,000+	yes
13	Vaccine Schedules	50,000-100,000	Vaccine Schedules	50,000+	no
14	Web-based injury statistics Query and Reporting System (WISQARS)	100-500	Web-based injury statistics Query and Reporting System (WISQARS)	500+	yes
15	The Yellow Book *Developer: MedHand International	50-100	The Yellow Book *Developer: MedHand International	1,000+	yes

Between T1 and T2, in Table 3, there was a large change in the number of downloads for the CDC mobile Application (Main Agency App). Note also that the scale used for the downloads changed between T1 and T2.

Discussion

Imagined users

Apps are geared towards various intended audiences; healthcare professionals, caregivers, parents and children. Yet, there does not seem to be a consensus around the categories and audience appropriateness via the ratings, between the CDC (they only indicate which app is meant for professionals and which are for laypeople), and the iTunes app store, which gives four age rating tiers: 4+, 9+, 12+, and 17+. The Google Play store offers ratings, but their system seems arbitrary compared to the descriptions on the apps and does not necessary align with the iTunes store's scale (see discussion below).

On their apps website, the CDC groups their apps into two categories, those geared towards the public health professional, labeled Health Care Provider/ Clinician and those intended for everyday or laypersons to use, what they have termed Consumer/ General Public. Most of the "professional apps" were geared towards the health or public health professional, for example apps for aiding in diagnoses, such as the "STD Treatment" app or the "Prevent Group B Strep" app. Some apps such as "Healthy Swimming", "Flu View", "Heads Up" concussion app and the "Amyotrophic Lateral Sclerosis (ALS) Service Locator" app were geared towards "lay caregivers" such as parents or those caring for elderly family members. Most of the "layperson" apps were geared towards adults. Within the apps that were geared towards teens and children, the game format was most popular, for example "BAM!" dining decision app (children) and "Solve the Outbreak" (teens).

Regardless of the intended age or whether for professionals or laypersons, all apps were unrestrictedly available to anyone. That is, a child or teen could download and "use" the apps meant for healthcare professionals. There were also recommendations for age ratings and the theme category of the app from both the iTunes and Google Play stores. Interestingly these two stores often did not align in their "reading" of the app use, for both the age and category theme. For example, the "Ladder Safety" app had a rating of age four and up and was listed as "E" for everyone by Google Play. "Latent TB" was also rated for age 4 and up and "unrated" by Google

Play. Conversely, apps like "Can I Eat this" which gives food safety information to travelers, earned a rating of age 12 and up for the following: "infrequent/ mild alcohol, or tobacco, or drug use or references" (Google Play store, 2018). The use of alcohol in this app was in reference to the app pages containing warnings to travelers per the dangers of ice in drinks (in certain countries) and the dangers of imbibing too much in a foreign country. For example, when clicking on information about consuming mixed drinks in China, the message states: "Drink at Your Own Risk" and "The alcohol content of spirits is usually high enough to kill bacteria, but mixers such as fruit juice could be contaminated" (CDC, 2018).

Apps are for everyone but are imagined for a narrower audience. Over half of the CDC apps in T1 were intended for "professionals" yet there was nothing to stop the layperson or child from downloading these specialist apps. Jutel and Lupton (2015), in their examination of diagnostic apps, found that these apps have the potential to shift the traditional patient/medical professional interaction and power dynamic in that "they contain highly detailed and specialized medical information that previously was not available to lay people" (Jutel & Lupton, 2015, p. 95). These apps also have the potential to "guide the patient to shape the diagnosis she will present to the clinician and thus potentially redistribute power in the doctor-patient relationship" (Jutel & Lupton, 2015, p. 95).

The ephemeral nature of apps

In the case of the CDC apps, between T1 and T2, eight apps were discontinued or dropped and three apps were added. The sole PHAC app at T1 was renamed and rebranded to reflect the new national level scope of the app. Some comments on the Google Play store about the apps were quite critical. An overarching theme of these comments centered around the apps being too "buggy", for example frustration with features that do not work or the app crashing. On the CDC Vaccine app one commenter wrote: "White screen Does not work on galaxy S2" by Benjamin Hayek, March 1, 2016. And on the Group B Strep app page: "Android app doesn't work. Only the disclaimer tab shows anything. So disappointing" by Andrea Fick, January 29, 2014 (Google Play store 2018).

Some apps (see Table C) have not been upgraded for years, for example the "TravWell" app shows a last update on Google Play store in September 2015. This brings up the possibility

that some apps are not being serviced or improved from the initial release. It is not clear from the public health websites who is overseeing the app upkeep after the initial release. As another example of this, when I recently (June 17, 2018) tried to open the "Can I Eat This" app, a bright red message popped up stating "Updates to this application have been temporarily suspended, so the information provided may be out of date" and then "We apologize for any inconvenience. For the most up to date information regarding food and water recommendations for international travelers, please visit www.cdc.gov/travel" (CDC 2018, apps page). Interestingly, when you click on this link one of the options on the page brings you back to the "TravWell" app download page, with no warning about the suspension of upgrades. Beyond just the basic inconvenience of having an app disappear, one could imagine that there could be real, although unintended, harm or consequences to the user's health, or even to the healthcare provider's reputation. For example, an online FASD site supported by Florida Public Health still contains the now broken link to the discontinued CDC FASD app (Florida Fights FASD, 2014). Why might this matter? What questions does this raise? If apps are not long-term, then there might be a problem with these apps being touted as essential tools to use by the public. For example, vaccine or other health data stored on them might be lost. In the case of those apps geared to professionals, the latest health statistics might not be updated leading to, at the very least, a risk to their professional reputation, but at the worst, danger to the health of their patient.

Professional tools, but at your own risk

　　All of the CDC apps, even those that are geared towards health professionals such as the STD Treatment app or Tickborne Diseases come with a legal disclaimer that releases the CDC from responsibility for any loss or damages resulting from the use or performance of the apps.

> …IN NO EVENT SHALL THE CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC) OR THE UNITED STATES (U.S.) GOVERNMENT BE LIABLE TO YOU OR ANYONE ELSE FOR ANY DIRECT, SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND, OR ANY DAMAGES WHATSOEVER, INCLUDING WITHOUT LIMITATION, LOSS OF PROFIT, LOSS OF USE, SAVINGS OR REVENUE, OR THE CLAIMS OF THIRD PARTIES, WHETHER OR NOT CDC OR THE U.S. GOVERNMENT HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH LOSS, HOWEVER CAUSED AND ON

ANY THEORY OF LIABILITY, ARISING OUT OF OR IN CONNECTION WITH

THE POSSESSION, USE OR PERFORMANCE OF THIS SOFTWARE. (CDC 2016,

all caps in original)

This disclaimer renders the app user as ultimately responsible for the accuracy and the consequences of the information on the app. Jutel and Lupton examined diagnostic apps and found that many failed to provide author credentials or supporting evidence for the efficacy of the information on the app (2015). Further, they also found that many of the app developers "do not guarantee the accuracy, completeness or the reliability of information provided" (Jutel & Lupton 2015, p. 94). What risks might be incurred, both for the "patient" and the professional, when unverified and unsupported apps are used for diagnostic information?

The "story" of the apps

Why are certain public health problems highlighted on these apps and not others? One thing that struck me when looking at the CDC apps website is the seemingly arbitrary selection of public health problems that ended up being translated into apps. For example, there is an app for ladder safety, fetal alcohol spectrum effects and Latent TB all affecting relatively small portion of the population. Why is there not an app for smoking cessation for example?

Why would certain public health problems get promoted? How then do these apps come to be? That is, why are the chosen apps depicting *these* certain public health problems? On the surface one might assume that the apps that are promoted would reflect the most important current public health problems. Yet in 2016, the CDC conducted a study to find the 10 most important public health problems. The aim of the report was to rank the principal public health issues per state and overall in the country (STLT Gateway, 2017). The highlighted problems in this report were as follows: Alcohol-related harms, Food safety, Healthcare-associated infections, Heart disease and stroke, HIV, Motor vehicle injury, Nutrition, physical activity and obesity, Prescription drug overdose, Teen pregnancy and Tobacco use. Yet even this list is not indicative of the "true" pressing health problems in the United States, for example, gun deaths and injuries remain a major public health problem in the United states (Weinberger et al. 2015). But longstanding political battles with the National Rifle Association (NRA) have resulted in a fear of funding cuts if the CDC were to engage in firearm studies. Since 1996 the CDC has

avoided studying guns in any way after wording was inserted into the CDC's appropriations bill that stated, "None of the funds made available for injury prevention and control at the Centers for Disease Control and Prevention may be used to advocate or promote gun control." (Washington Post, 2015). Regardless of this, just taking the top 10 problems listed by the CDC, their apps listed on the apps page still only touch on 2 out of 10 of these problems. Specifically, alcohol-related harms with the FASD app, food safety with the "Can I Eat This" app and nutrition issues with the "BAM! Dining Decisions" app. The problems tackled on other apps, such as concussions, swimming safety and Latent TB, seem more random. Furthermore, while apps seem to be promoted to "everyone", there were no apps for example, specifically geared towards the elderly.

Conclusion

Mobile apps are promoted as a means to better, and more widely disseminate public health information. By deploying these public health apps, the CDC and PHAC aim to support and augment existing public health strategies. PHAC and the CDC in the United States are certain to be seen as trusted sources.

I have argued that there is a growing app ecology that current literature has not addressed in a critical way. This chapter aimed to provide a detailed descriptive account of public health apps used by national public health agencies, specifically the CDC and PHAC. The public health problems highlighted on these apps were geared towards various intended audiences; healthcare professionals, caretakers, parents and children. There was a seemingly arbitrary selection of public health problems that were translated into apps. For example, there were no apps that addressed healthcare-associated infections, heart disease and stroke, HIV, motor vehicle injuries, physical activity, teen pregnancy or tobacco use even though these were 6 of the categories on the top ten list of public health problems the CDC reports as urgent. Some of the public health apps did not endure over time, and others were not updated regularly. Many of the CDC apps are intended for "professionals", yet the app user is ultimately held responsible for the accuracy and the consequences of the information on the app.

More studies are necessary to understand how state, provincial and city public health agencies make use of public health apps. In chapters four and five I take a closer reading of two of these apps; "FASD" and "Heads Up" concussion app.

Chapter 4: The FASD app

Introduction

This chapter (and chapter 5) will critically examine two of the CDC apps; FASD and Heads Up concussion. For this chapter I take a closer look at the CDC's FASD app, examining the text and images contained within its pages. I first pose two key research questions to guide this examination, and then briefly review the methods that I will use. Next, in the findings section, I describe FASD as it is defined as a medical problem, followed by a more technical description of the FASD app. I then respond to Bacchi's questions as they apply to the discourse on the app. Following this, in the discussion section, I explore the different ways this app governs; framing women's bodies as sites of risk and women in need of surveillance. In this section, I also look at the democratization of FASD; the idea that "anyone" could be at risk for this disease. Finally, I discuss how apps are unique, and are put forth as a tool for anyone or everyone yet are taken up and understood in very distinctive ways. I conclude by summarizing the app's implications in terms of governmentality.

Research Questions

I pose the following research questions for this chapter:

1. How is the CDC's FASD app understood and how does it frame and construct the problem of FASD?

2. Are there ways the FASD app operates that might contribute to the governance of certain populations?

Methods

Recall in chapter 2 (methods), I discussed how I conducted a discourse analysis on the text of two of the CDC apps; "FASD" and Heads Up. I used the framework established in Bacchi's Foucauldian inspired methodology for policy analysis (2009*)*. Recall that this method of policy examination helps to bring focus on the ways that subjects are constituted in public health policy (Bacchi 2009). Recall also that I use 4 questions in Bacchi's method to guide this analysis:

1. What's the 'problem' represented to be in a specific policy?

2. What presuppositions or assumptions underlie this representation of the 'problem'?

3. How has this representation of the 'problem' come about?

4. What is left unproblematic in this problem representation? Where are the silences?

(2009, p. xii)

These questions were applied to the text and images contained in the FASD app.

Findings

Fetal alcohol spectrum disorder (FASD) "is a non-diagnostic umbrella term that covers several medical diagnoses associated with prenatal alcohol exposure" (Popova et al. 2011, p. 336). Affected children can experience lifelong physical, mental and behavioural difficulties. Although confirmed statistics are hard to come by, FASD is estimated to affect one percent of the general population in the United States (Canfasd 2018). Canada reports similar rates and estimates that nine babies in every one thousand are born with FASD (Canada Health 2017). Recall in chapter 3, I discussed the top health issues that are a priority for public health agencies such as the CDC. As a public health problem, alcohol-related harms, and thus FASD, would fall under the CDC's list of top ten imperative public health problems to be tackled.

The FASD app

The fetal alcohol spectrum disorder "FASD" app is a free app, available in English and Spanish. Available from the Apple and Android app stores, the CDC is listed as both the app developer and seller. This app is marketed to women, healthcare providers, families and educators. It predominantly targets women of childbearing age with a stated goal to "provide the latest information related to the use of alcohol during pregnancy and fetal alcohol spectrum disorders (FASDs)" (CDC 2016). FASD on this app is defined as "…a group of conditions that can occur in a person whose mother drank alcohol during pregnancy" (CDC 2016).

From the home screen on this app, there are five main categories for the user to click through: "facts", "signs and symptoms", "treatment", "get help" (to stop drinking) and "get help" (for your child with potential FASD) (CDC 2016). One of the app's central messages is of the dangers of drinking, even one drink, for women, age 18-44, who are having sex and not using birth control. The app also provides links showing statistics of alcohol use and binge drinking rates for 18-44-year-old women per state. Educational pages on this app inform the user of the

possible adverse outcomes for a child who is affected by FASD. It also briefly lists treatments and interventions available for the affected child such as therapy and parent training. This app also offers the user links to enable sharing on social media.

The CDC's FASD app states that it is targeted towards women, families, healthcare providers and educators. A key focus of this app, according to the CDC, is to prevent fetal alcohol syndrome, as well as its associated secondary conditions, by persuading women not to drink any alcohol during pregnancy. The central message, that there is "no known safe amount of alcohol to drink while pregnant" is restated multiple times throughout the app. A secondary focus of this app is to ameliorate the effects on children who are already affected by fetal alcohol syndrome and fetal alcohol spectrum disorders. This is done primarily through listing the common symptoms of FASD and offering referral advice and contact information regarding medical experts, special education and early intervention programs.

Question 1. What is the 'problem' represented to be in the prevention of fetal alcohol spectrum disorders?

As stated, this app proposes to tackle the 'problem' of FASD. Through text, illustrations and links to statistical tables, this problem is represented variously as: 1) the problem of drinking alcohol during pregnancy, 2) the problem of women who are "problem drinkers" along with its interrelated problem of unexpected or unknown pregnancies and, 3) the problem of children living with FASD.

The problem of drinking alcohol during pregnancy

Through the text and images contained on this app, the CDC is problematizing alcohol consumption by women, specifically women of childbearing age. Looking at the "fix" or the measures taken to counter the problem can alert us to what we think the problem is (Bacchi, 2015 p. 132). The "fix" in this case is for women to not drink alcohol "while she is pregnant, or when she might get pregnant" (CDC 2016). The consequence of the 'problem' is the physical and mental health impairments to unborn (and born) children that may transpire if the pregnant mother drinks alcohol.

The women on this app are depicted as needing to be both very concerned about the seriousness of this problem, as well as their important role in its prevention. Figure 2 shows one of the first pages of this app. It states that "FASD's are 100% preventable if a woman does not drink alcohol during pregnancy" and that "There is no known safe amount of alcohol to drink

while pregnant" (CDC 2016). The image shows a woman of colour in a tucked-up position who seems to have a pensive or concerned expression on her face.
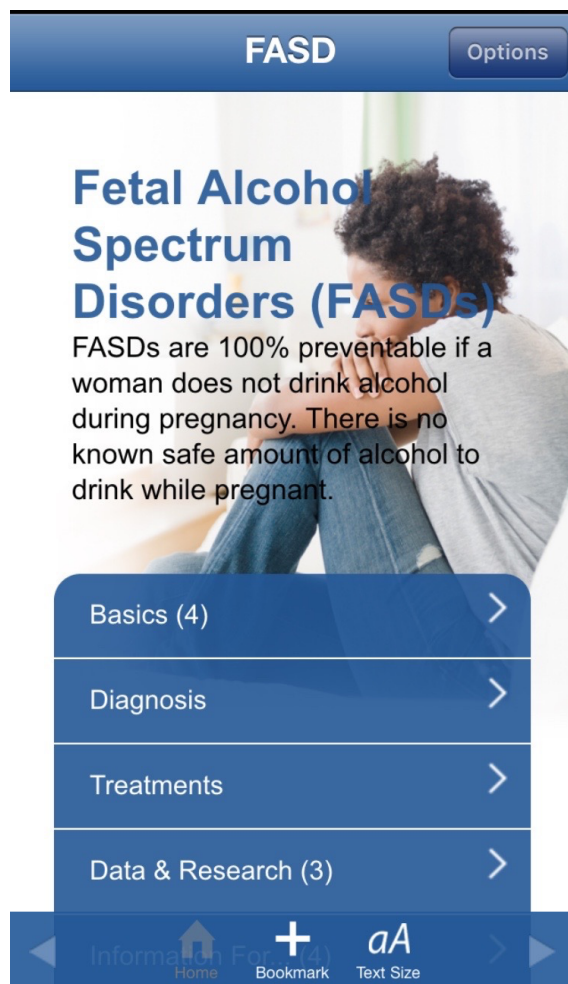
Figure 2: Screenshot from front page of FASD App

Women who are 'problem drinkers'

Beyond not drinking any alcohol during pregnancy, problem drinking in general is put forth as an additional iteration of the problem of FASD. On the app, "Problem drinking" is defined as binging on 3 or 4 drinks at a time or consuming 8 drinks or more in one week (CDC 2016). Although the app upholds a zero tolerance policy with alcohol and potential pregnancy, there is an underlying thread that is speaking to women who might be using alcohol in ways deemed problematic even before getting pregnant. Thus on one hand, this app seems to be for "every" women who might become pregnant, yet much of the text seems geared towards alerting

us to the problem drinker in general. The solution is that problem drinkers should seek profession help.

This "problem" for women is predominantly represented as a problem of the availability of alcohol combined with the self-control (or lack thereof) to resist drinking. Importantly, this definition of problem drinking holds true whether or not the woman is pregnant. Accordingly, there is an important connection made between women engaging in "problem" drinking (before getting pregnant) and those women "at risk" for drinking any amount of alcohol during pregnancy. Being at risk in this case is understood as being a "problem" drinker before the time of possible pregnancy, as a kind of pre-existing condition. The supposition is that these "risky" individuals will be more likely to drink at all while pregnant and be more likely to not have the self-control to resist the temptation to drink. It is also suggested on the app, that the women can enlist the father's help to avoid drinking during pregnancy. The father can encourage her to abstain "by avoiding social situations that involve drinking" and can also help her by avoiding alcohol himself (CDC 2016).

Figures 3 and 4 show screenshots taken from the FASD app that advises women to get help if they are struggling to stop drinking alcohol. In figure 3, the app page states that "if a woman is drinking alcohol during pregnancy, it is never too late to stop. The sooner a woman stops drinking, the better it will be for both her baby and herself" (CDC 2016). Bold letters then exclaim "Get Help!" (CDC 2016). This is followed by advice to contact "your healthcare provider, local Alcoholics Anonymous, or local alcohol treatment center" (CDC 2016). Figure 4 shows the continuation of this app page. It offers a link to a substance abuse treatment facility locator as well as a link to the Alcoholics Anonymous (AA) website. This theme of problem drinking and alcohol abuse adds to the perception of women being at risk for being out of control and not able to manage their alcohol intake.

Figure 3: Screenshot from FASD app advising women to get help if they are struggling to stop drinking
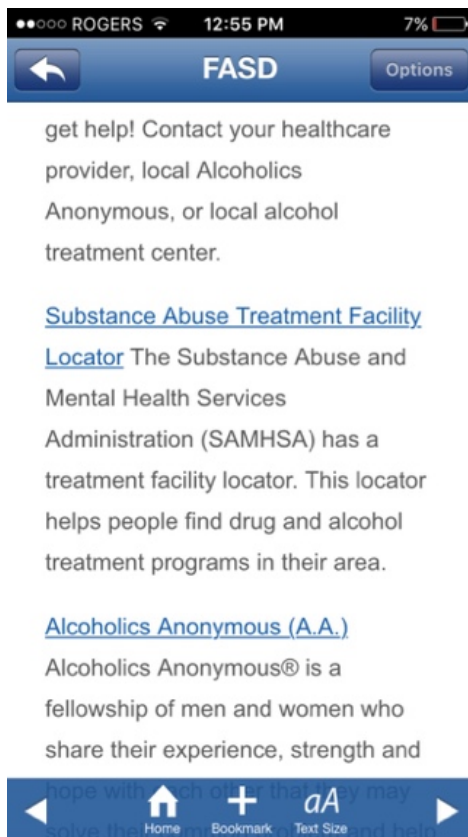
Figure 4: Screenshot from FASD app advising women where they can get help for alcohol abuse

Certain app pages that are in this same thread of "problem drinking" discourse, seem more geared to the public health professional (although it does not say this explicitly) in that the page shows links to statistical tables showing problem drinking broken down state by state. These state charts show the prevalence of women who binge drink as well as those who consume "any alcohol" per state. These statistics seem like a leap, as far as useable or helpful information, for the layperson using the app. For example, the user would need to go from reading their own state statistics, which ranks the percentage of women who binge drink, to reconciling this information to their own situation or potential risk for becoming a problem drinker in the future.

Unplanned and unexpected pregnancies

Contained within this main problem of women's self-control with alcohol, is the "problem" of unplanned and unknown pregnancies, where women are unaware that they are pregnant for the first few weeks after conception. "If you drink alcohol and do not use contraception (birth control) when you have sex, you might get pregnant and expose your baby to alcohol before you know you are pregnant" (CDC 2016). The app states that "Nearly half of

all pregnancies in the United States are unplanned. And many women do not know they are pregnant right away" (CDC 2016). Noteworthy is the assumption here that an unplanned pregnancy will develop into a full-term pregnancy. There is no mention of abortion or links for counseling services. This particular discourse seems to be built around the politically charged idea that the fetus is already a person. The text on this app seems to assume consensus and is built on a foundation, that of the fetus as a person, which remains unsettled in the wider American community. The fetus is sometimes referred to as "your baby", even during what is assumed to be the first few weeks of conception. There is also the assumption that women of childbearing age, who have an "accidental" or "unplanned" pregnancy will become future mothers.

With the current administration in the USA, under president Trump, Roe v Wade is currently under attack. Jeffrey Toobin, CNN's chief legal analyst states that "in a little more than a year, 20 states will pass laws banning abortion" (Global News 2018). Here we can consider that the app developer's choice of words is perhaps not intentionally political, yet they play out into a highly charged political decision. Moreover, because the CDC supports this app, there is a greater institutional weight given to this discourse of the problem, that might have political implications.

Figure 5: Screenshot from FASD app; even if you are not trying to get pregnant, you are still at risk

Children living with FASD

The third problem that is represented on this app is related to the child that is born with FASD. The child is represented here as the innocent victim, with the mother being understood as the one producing the problem through her drinking. There is a third player in this representation, that of the state and its many interventions needed for treatment of FASD. The app states that although there is no cure for FASD, early intervention through involvement in special education and social services, treatment options such as "medication to help with some symptoms, behavior and education therapy, parent training, and other alternative approaches" can improve a child's development or even have a "protective factor" (CDC 2016). The threat of children being born with developmental problems, which in turn becomes a state problem, reinforces the desire to subject women to alcohol monitoring. The explicit problem is children being unnecessarily inflicted with FASD. The *implicit* problem is a child "at risk" of not reaching their "natural" potential. The implicit problem is understood as the child becoming a

concern or even a burden on society through an increase in school dropout, crime, and addiction. This area of the problem seems to be represented as one of financial burden to the state with the app stating that: "The lifetime cost for one individual with FAS in 2002 was estimated to be $2 million" and that "It is estimated that the cost to the United States for FAS alone is over $4 billion annually" (CDC 2016).

There are also pages on this app that give referral and diagnostic information for those caring for children potentially exposed to alcohol during pregnancy. However, the app warns that "[t]hese criteria have been simplified for a general audience. They are listed here for information purposes and should be used only by trained health care professionals to diagnose or treat FAS" (CDC 2016). This brings back the point from chapter 3, where I discuss the use of apps for professionals and that they are to be used at their own risk.

Question 2: What presuppositions or assumptions underlie this representation of the 'problem'?

The implied problem understood in this policy is that a women's problem or "risky" drinking leads to possibilities that her child might be born with FASD. Defining a population "at risk" justifies bringing them under surveillance and bringing them under control (Pratt 2016). The two "at risk" groups in this policy representation are 1) Women, who are "at risk" of inflicting harm, and 2) Babies, who are at risk of receiving harm.

Bacchi, in posing this question for analysis, suggests that we examine the conceptual logics underpinning the representation of the problem (Bacchi 2009, p. 81). I consider some of the key binaries and concepts that emerged in the discourse of this app.

Helping the child with FASD

The app user seems to need to be able to make sense of ambiguous "proof" with regard to the effects of alcohol on the fetus. For example: "Every pregnancy is different" Drinking alcohol might affect one baby more than the other". You could have one child who is born healthy and another child who is born with problems" and "[w]e do not know exactly how many people have fetal alcohol spectrum disorders (FASDs)" (CDC 2018). This ambiguity also continues after the birth of the child, into the discussion around what can be done to help children who are diagnosed with FASD. One "remedy" or protective mechanism that I found particularly problematic is that of providing the child with a "loving, nurturing, and stable home environment" (as seen in figure 6) (CDC 2016). One highly cited research article (not linked to

the app) states that the risk factors for "adverse life outcome[s]" of FASD can be greatly mediated by "being reared in good stable environments" (Streissguth et al. 2004, p. 237). Since it is up to the parent(s) to cultivate this environment, there seems to be a judgment of the parenting or parent going on here as well.

Another way of understanding this concept, of a loving nurturing and stable home environment, or a "good" stable environment is to explore its opposite. Of course there are all of the moral implications that come with stating that a home environment is "good"; that it (and its providers) are worthy or virtuous. Its opposite, a "bad" home environment then would suggest one that it is poor or deficient. What is understood when a mother or parent is not "loving" or the environment she provides is not "good" Is she simply apathetic? Or is she cruel, neglectful or even abusive?
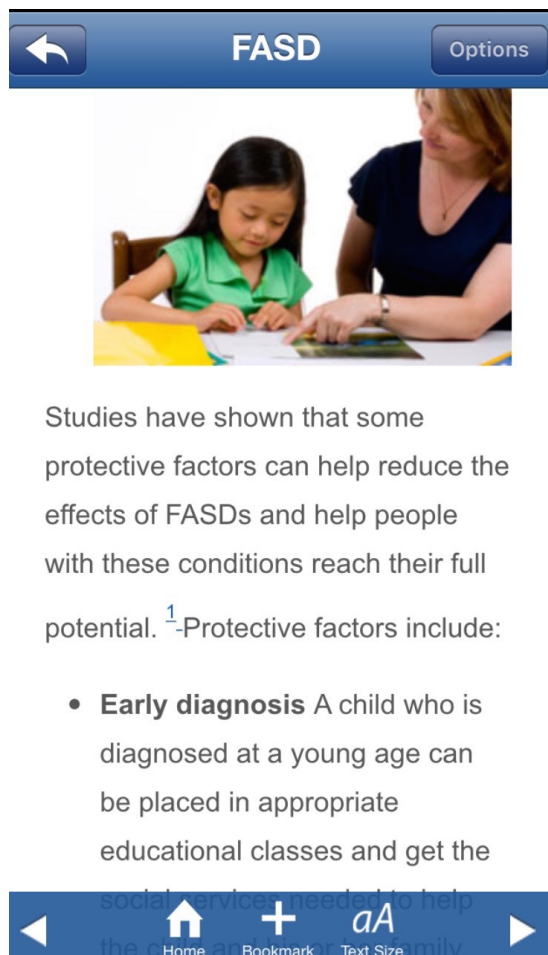
Figure 6: Screenshot from FASD app showing protective factors to reduce the effects of FASD
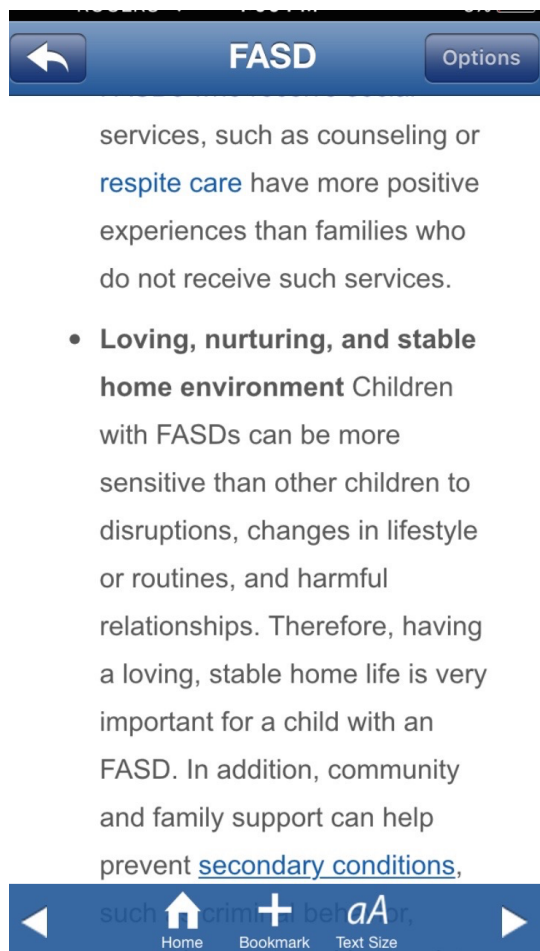
Figure 7: Screenshot from FASD app; a loving, stable home life

As stated, one of the "solutions" to the problem of FASD is to provide the child with a loving and stable family environment during school years. If a loving, nurturing and stable home can be seen as protective, then the dichotomy of cold, neglectful and unstable home might be understood as contributing to the effects of FASD.

The father's role

As figure 8 illustrates, the effects of alcohol on "the male sperm is currently being studied" (CDC 2018). Interestingly, in spite of this evidentiary uncertainty, the app continues by noting that "whatever the effects are found to be, they are not fetal alcohol spectrum disorders. FASDs are caused specifically by the mother's alcohol use during pregnancy". This framing effectively absolves males of any responsibility to regulate their consumption habits and, by extension, it largely absolves males of responsibility for harms related to FASD.

The father's role, in terms of alcohol effects on the sperm, in terms of fetal development is unknown. While studies are ongoing, there is no conclusive evidence that a man's drinking will lead to ill effects on the fetus. Even though the amount of alcohol that can be safely drunk by the women is also not known, the women are understood as being a direct link to giving potential harm: "when a pregnant women drinks alcohol, so does her baby", whereas the father is exempted from this direct link and is relegated only to that of supporting the woman's self control as seen on the screenshot in figure 9: "The father's role is important. He can help the woman avoid drinking alcohol during pregnancy. He can encourage her to abstain from alcohol by avoiding social situations that involve drinking. He can also help her by avoiding alcohol himself" (CDC 2016). Moreover, heteronormativity here is presumed and reproduced by the app, for example, the use of "father" instead of partner in the text "the father's role is important…" (figure 9).
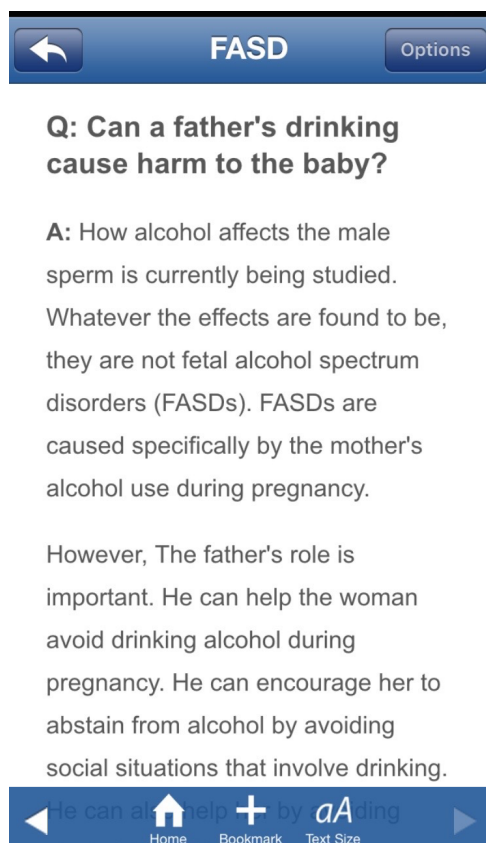
Figure 8: Screenshot from FASD app; alcohol affecting sperm
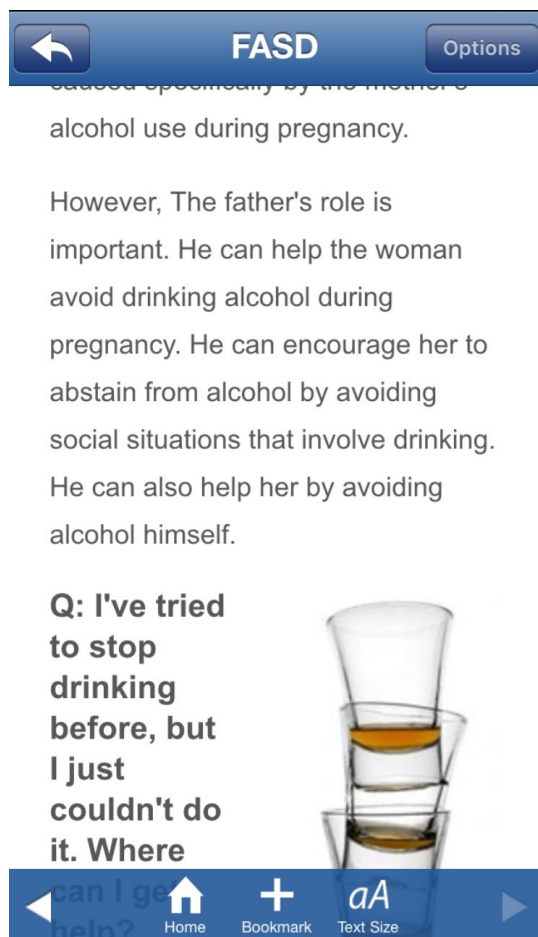
Figure 9:Screenshot from FASD app; the father's role

Question 3. How has this representation of the problem come about?

Who gets counted and how does this feed into the way this problem is represented? When "statistics create knowledge of a particular kind" it becomes important to pay attention to the way people are counted and become categorized" (Hacking 1986 in Bacchi 2009, p.11). The app states that the:

"CDC monitors alcohol use among women of childbearing age in the United States. This type of data is important to help reduce alcohol-exposed pregnancies by identifying groups of women at increased risk and designing prevention programs aimed at reducing risk behaviours and improving pregnancy outcomes". (CDC 2016)

Foucault's use of governmentality helps to explain the current way that individuals are both monitored through external measures, and also encouraged to self-govern, all with a goal of

being normal, that is to function in a "normal" manner. Government and governing does not happen only from the top down, but also, as Foucault argues, populations are monitored and rules and regulations are created to assure "normal" functioning of subjects across a range of institutions such as schools, hospitals, social services and the courts (Nettleton et al. 2012, p. 175).

Question 4. What is left unproblematic in this problem representation? Where are the silences? Can the 'problem' be thought about differently?

A few key silences emerge in the way that FASD is represented in this app. The first is the fading importance of the women for example her health, happiness, and life circumstances. The moment she becomes pregnant (or even potentially pregnant), there is little mention of the woman's agency over her body and her ability to make her own risk assessment regarding alcohol consumption. The silence with this particular representation of the problem of FASD then, is in the way that women are left out. In the privileging of the fetus and the importance placed on the plight of the child, discussion is omitted around a women's life situations. Added to this, her freedom of choice, level of risk aversion and even pleasure are not taken into consideration in this representation. In advocating that a woman must abstain from drinking any alcohol, it silences any notions around the idea of women making those choices for themselves based on their standpoint.

There is also a racial and socioeconomic component to FASD that is left out of the discussion on the text of this app. In Canada, FASD is seen as an Aboriginal disease of poverty (Inuit, 2007) and in the United States, FASD is understood to be more prevalent in African Americans and Native Americans (Russo et al. 2004). These groups also experience structural barriers to government services. Salmon and Clarren (2010) cite a study done in Washington that found that "women who have had children with FASD have very high frequencies of mental health problems that go far beyond substance abuse; often, they have also had lifetimes of physical, sexual and emotional abuse [and] are often isolated (p. 431). Further, there is a social unease about race differences and, more hidden social divisions, such as "what constitutes a 'good mother'" (Armstrong and Abel, 2000, p. 280). Yet the FASD app seems to responsibilize women without regard for these social barriers.

Also silenced in this representation is the responsibility of the alcohol companies. By omitting the alcohol companies from the discourse of being part of the problem, it might

minimize the possible legal action that a mother (or adult FAS child) could pursue. If the discourse of the problem is constituted as a problem of maternal self-control, then both the government (social services for the poor) and alcohol companies are omitted from being seen as responsible.

Discussion

For this chapter, I have attempted to examine the ways in which public health apps might be understood as a form of governmentality. Specifically, how the CDC's FASD app frames and constructs the problem of FASD. These findings show that, by and large, women are held responsible for this problem, while men, and alcohol companies are absolved of liability. The discourse on the FASD app operates in covert ways, contributing to the governance of women, and holding them responsible for the health and well-being of the fetus. This app takes up a neoliberal position of individual responsibility, requiring the women to control their own drinking and to use effective birth control. In addition, on this app, children with FASD are understood to place a financial burden on the State. Salmon (2011) argues that "in the relevancies of neoliberal politics, 'good citizens' are good workers, who contribute monetary wealth to local and national economics while placing few (if any) demands on state resources" (p.173).

One of the central concepts that appears throughout the discussion of this policy is that of "problem drinking" and its binary of unproblematic (no alcohol consumption) drinking. This binary is closely linked to another notion, that of "responsible" alcohol use and its implied binary; irresponsible alcohol use. "Risk" is understood as a risk to the fetus and not to the woman. In this way the "problem" is not framed in a way that emphasises the risk of problem drinking as being potentially detrimental to one's own personal health or well-being. The negative consequences, of a woman's irresponsible and risky behaviour around alcohol are understood in this app as expressly impacting the future life of the child. This problem representation also ignores other possible reasons for drinking such as enjoyment or diversion. The assumption is that drinking alcohol is not a choice of pleasure but a problem to be monitored. It also assumes that there are no safe levels of alcohol while pregnant and that there is a proven link between FAS and its related effects, even if research on this matter is inconclusive.

Governing women's bodies

The CDC's "FASD" app presents the problem of fetal alcohol spectrum disorder as one

of alcohol consumption in young women of childbearing age. This presentation of the problem deems women to be responsible for the potential (ill) effects of FASD on the fetus. The woman here is constructed first and foremost as a "mother to be". She is seen as needing the support of her *male* partner to help her with both her judgment and will power to refrain from drinking. Further, this app also seems to leave out the role of alcohol marketers, many of whom use images of young women to help sell their product, playing on linking alcohol with sex and youth.

Valverde argues that the recent public health promotion around the risk to the fetus from alcohol can be understood as an additional way of governing women's bodies, framing their body as risky and the women as incapable of making an informed decision. Valverde notes that "…the mother is presented…not as a responsible parent but as herself the main source of risk" (1998 p.180). Further, there is no room for individual discretion, just a blanket rule not to drink at all during pregnancy. These public health campaign warnings around fetal alcohol risk feature "the complete subordination of maternal subjectivity" and "the insistence on the universal zero tolerance" (Valverde 1998 p. 180). Women are constructed as an important part of producing the "product", the baby, and must be responsible "vigilant and ever-rational" (Valverde 1998, p. 180, 181).

The men on this app are constructed as being in a position of power; they are above the fray of needing surveillance and, in fact, are instructed to be the one to monitor their spouse. The underlying assumption – perhaps unintended by the app designers – is that women lack the willpower to resist drinking alcohol on their own. Lupton and Thomas note that "in self-tracking apps, pregnant women are portrayed as ideally self-responsible, enthused about their pregnancy and [fetus]" (Lupton & Thomas 2015, in discussion). Conversely, the male on the FASD app is constructed as being in a position of power, whose only role is to support a woman who may otherwise lack the judgment or willpower to avoid risky drinking behaviour.

Democratization

The idea that FASD can happen to anyone allows for and justifies surveillance of minority or poor women. This may act as a closing off of an alternate discourse around the need for state funding to shore up nutrition for impoverished families, which could possibly act as a protection against FASD. When we perceive a "protective" home environment as stable, it also implies that a risky home environment is one where the parent(s) might be lacking good parenting qualifications or that they are unstable. This can bring to mind insecurity, for example

in the form of insecure access to food and or shelter which, in another way, could be put forth as the "impacts" of poverty. Bell et al. (2009) argues that when poor women and women of colour are targeted or singled out as problematic, "the focus tends to remain on the individual mother and her responsibility and obligation to protect her [fetus] and children from harm (p. 163). Yet placing the responsibility on the individual "obscures the role of structural and environmental factors (Bell et al. 2009, p.163).

Apps are unique

More than just a public health promotion, apps are unique. They operate as a distinctive and personalized tool with which users might interact. What might be the risk of having this app on your phone? Could it be used as legal proof that you should have known that even one drink might cause harm to the fetus, or even that you were somehow concerned about this for some reason? For example, Hoppe (2014) imagines future complications that might stem from legally penalizing what once were traditional medical problems. What if parents of children found to have diabetes, for instance, were now investigated for child abuse, assuming that the parents allowed them to get overweight, putting them at risk for the disease (p. 46)? Women have been charged in the United States for harming or putting at risk their unborn children under the "fetal homicide laws", for example if a woman takes illicit drugs while pregnant (Kole & Kadetsky 2002).

Apps such as this one are developed and imagined as a tool for "everyone" and yet, impoverished women might understand and take up the information on this app in different ways. Abel and Hannigan argue that "FAS [under the umbrella of FASD] occurs predominantly among poverty-stricken women" as they "experience, or are characterized by, many more 'permissive' factors, such as smoking and poor diet, that exacerbate the effects of alcohol" (1995 in Armstrong & Abel 2000). The assumption here is that stability is a choice and furthermore, that this might be understood as a way "out" of the problem for middle and upper class families.

Apps are developed and imagined for use by "everybody", yet there are pronounced contextual differences between users. Users from diverse backgrounds can be imagined to engage and employ these health apps in distinct ways. The silencing of the life circumstances of the women, including those such as poverty that might impact the effects of alcohol, might on one hand be seen as an attempt to be more egalitarian, at least on the surface. Yet benefits from health apps, I argue, might hinge on a user's socio-economic status as well as other factors such

as their comfort with technology and their health literacy. Do marginalized populations and the affluent, technically adept belong to one and the same population in this case? Who might be overlooked or even disenfranchised in this understanding of apps as important health tools? Beyond "access" to the expertise, what might it take to utilize this knowledge in meaningful and valuable ways?

One of the discursive effects stemming from this representation of the problem is the closing of other discourses. When the problem is framed as a problem of "any" young women who drink "any amount" of alcohol in their childbearing years, the discourse around certain groups, such as indigenous peoples or those living in poverty, who might need more support for their living environment, becomes closed. If "anyone" (any young women) can produce a victim (the unborn child), then why would we need to focus discussion around a specific at risk groups? After the effects, after the child has been born, the discourse around assistance for the child includes protective measures such as a loving, stable family. This has the effect of opening back up this discourse around certain groups being more at risk, but now the mother is blamed, the family is judged and assistance is offered only to the child in the form of governmental medical and educational intervention There is not much in the form of intervention (beyond AA) for the women – for example the social situation or structural violence that might have contributed to the poor health of the mother (and by extension the child) prior to pregnancy.

Conclusion

I have argued that we can understand public health apps such as the CDC's FASD app as a form of governmentality in that the discourse found on the pages of this app creates and locates women's bodies as sites of risk in need of surveillance and control. Key questions in this chapter concerned not the relation of the rate of alcohol consumption to FASD but rather the relation of information about FASD to normative assumptions about men and women as presented in this app. The purpose of this chapter was not to downplay the seriousness of FASD. It was to bring forth the ways that public health apps such as the FASD app might, inadvertently or not, serve to reinforce social norms or create subject positions such as that of the responsible pregnant women or the stable and loving parent. In the representation put forth on this app, the woman is presumed to lack the willpower to resist drinking alcohol on her own. Women who lack self-control and self-responsibility are seen as particularly problematic. As stated, women who cannot control their drinking, deemed as binge drinkers, outside of pregnancy are seen as a risky group.

Using Bacchi's method of policy examination foregrounded Foucault's notions of subjectification and subject positions and emphasized the ways that subjects are constituted in public health policy. Specifically, it set out to examine how the FASD app has constructed public health problems in ways that explicitly hold women of childbearing age accountable, while implicitly absolving others such as alcohol companies and men, of responsibility. In terms of governmentality, the institution of public health, through the discourse put forth on this app, exercises control over and governs women by sanctioning women (and their male partners) to monitor women's drinking behavior. This discourse also serves to responsibilize women for the health of their fetus, and later for the child, with little discussion of the role of the state (beyond programs to help with alcohol abuse) to provide support, for example, in the form of healthy food or access to health care. Women are imagined as both incapable of controlling their drinking and as those who provide a stable and responsible home environment. This creates an interesting juxtaposition that constructs women as both primarily responsible for the health of the fetus, a woman that knows about and limits her risks on one hand, yet on the other, as not having the inner control necessary to limit her drinking during pregnancy potentially requiring medical intervention or needing to attend Alcoholics Anonymous (AA).

Chapter 5: The Heads Up Concussion App

Introduction

In chapter 4, I examined the FASD app, bringing forth the ways that it served to create subject positions of the responsible and irresponsible pregnant women. In this chapter, I similarly take a critical examination of the Heads Up concussion app. This chapter aims to explicate how governing comes to be enacted on the Heads Up concussion app and by whom this governing is enacted.

Concussion, also known as mild traumatic brain injury (MTBI), is a "public health problem of large magnitude" with over one million people in the U.S. experiencing MTBI per year, and with 20 percent of cases occurring as a result of "sports-related injuries" (CDC 2003, preface, executive summary, p.10). Public health apps such as Heads Up concussion are put forth as a personable and interactive platform for disseminating important health information about the problem of concussions.

This chapter will critically examine the CDC's Heads Up concussion app. I first present two key research questions that will guide this examination, followed by a brief review the methods that I will use. Next, in the findings section, I describe the problem of concussions as it is defined in the medical literature. This is followed by a more technical description of the concussion app as well as my findings as they correspond to Bacchi's questions. In the discussion section, I explore the different ways this app governs; framing the parent as responsible for their child's concussion and overlooking the responsibility of sports bodies to play the game in a way that does not risk head injury. In this section, I also look at the potential legal risks in light of who is held accountable in the problem of concussions. Finally, I conclude by summarizing this app's implications in terms of governmentality.

Research Questions

I ask the following research questions for this chapter:

1. How does this app construct the public health problem of concussions?
2. How does it determine which groups of people are held accountable for this problem? And what material effects (for them) are produced by representing concussions this way?

3. Conversely, who is implicitly absolved of responsibility for this problem?

Methods

A Key concept that Bacchi's framework is helping to focus on in this chapter is governmentality, specifically how apps might configure health problems in such a way as to make some interventions seem reasonable while being silent on other ones. Bacchi argues that in this approach we should assume that policy, by its very nature, is a "problematizing activity" and that a goal of this policy interrogation is to bring forward the way that specific policies are framed (2009, p.31).

Recall how I discussed downloading 29 apps from the CDC apps page and then chose two of these apps for a more in-depth discourse analysis (chapter 2). The first, CDC's FASD app, was examined in chapter 4. In this chapter, I examine the CDC's Heads Up concussion app. As in Chapter 4, I used 4 of Bacchi's questions to examine the ways that problems for example, the problem of concussion, are represented on this app (2009):

1. What's the 'problem' represented to be in a specific policy?

2. What presuppositions or assumptions underlie this representation of the 'problem'?

3. How has this representation of the 'problem' come about?

4. What is left unproblematic in this problem representation? Where are the silences?

(2009, p.xii)

These questions were applied to the text and images contained in the Heads Up concussion app.

Findings

In this section I start with a detailed description of the Heads Up concussion app. I then take each of Bacchi's 4 questions as a guide to discuss the insights gathered from this app. First, I examine what and how the problem of concussions is represented on the app, including the underlying assumptions that are made. I then uncover some of the silences contained within the discourse on this app, exploring what is left unproblematic in this particular representation of concussions.

The CDC's "Heads Up Concussion" app

The "Heads Up" concussion app is a free educational app, offered in English, and available from the Apple and Android app stores. The CDC is listed as both the app developer

and seller. This app was predominantly marketed to parents, with a stated goal to inform them about the signs and symptoms of concussions as well as the importance of a proper helmet fit. The first line used to describe the app on the app stores states that "The CDC HEADS UP Concussion and Helmet Safety app will help you learn how to spot and what to do if you think your child or teen has a concussion or other serious brain injury" (CDC 2016).

Question 1. What is the 'problem' represented to be in promoting the prevention of concussions in children and teenagers?

Concussion awareness on this app is brought forth using two approaches: firstly, with a signs and symptoms section, including how to spot a possible concussion and what to do if you think your child or teen has a concussion. This section also links to written and video stories from children and parents of those children who have dealt with concussions. Highlighted in these stories is the need to rest and abstain from the sport until feeling better. There is an assumption that the "athlete" will fully recover and will eventually return to their sport. One of the video vignettes is titled: "you are gonna get better. It's just gonna take time". In this video Molly's mother speaks about her daughter, who sustained a concussion while playing lacrosse. She relays that the most assuring thing about the whole ordeal is that her daughter's pediatrician said to Molly "One thing you can feel good about Molly is that you *are* gonna recover from this, it's just going to take time" (CDC 2018). Figure 10 shows another video, this one from Molly herself, stating that she was fully recovered from her concussion after one year of precautions and rest. The text next to the video image (Figure 10) reads "Molly, 17 years old, sustained a concussion playing lacrosse, fully recovered after 1 year" (CDC 2018).
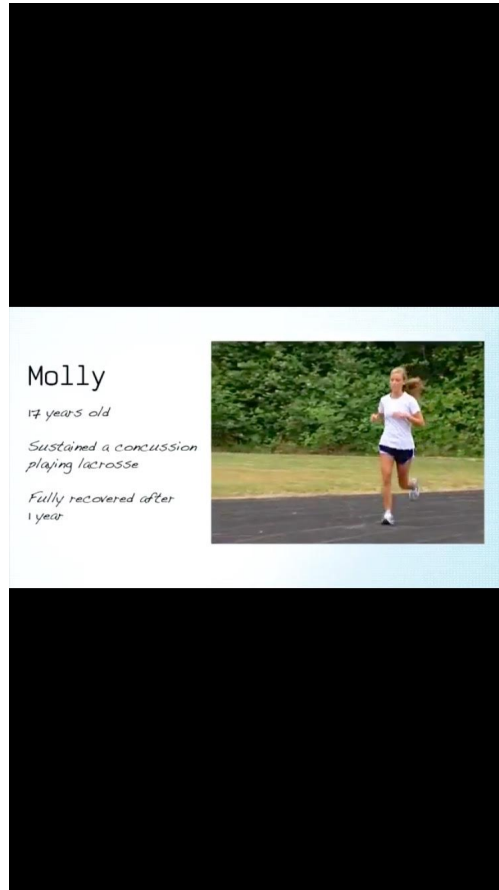
Figure 10: Screenshot from video on Heads Up concussion app; Molly's story

The second approach to the problem of concussions on this app is through the advocating for "helmet safety". "Helmet safety" is conveyed through having sport-specific renderings of different helmets and their fit requirements. Parents are encouraged to click through and pick the child's sport, for example baseball or football, which then brings forth detailed instructions, including renderings of different views of the helmet for fitting the child. Figures 11 and 12 show screenshots of the interactive fit instructions.
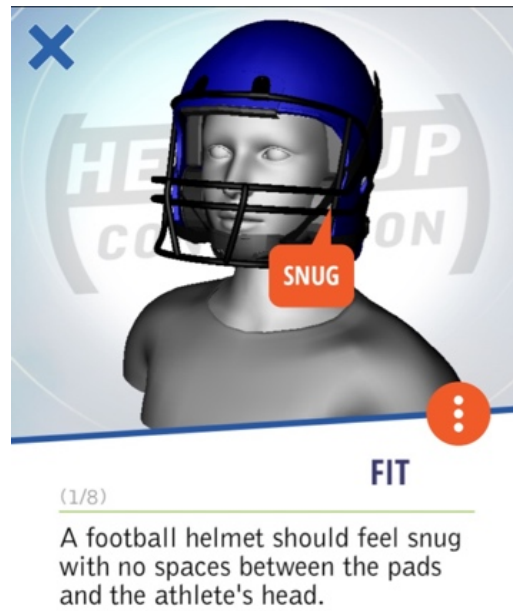
Figure 11: Screenshot from Heads Up concussion app; snug helmet fit image
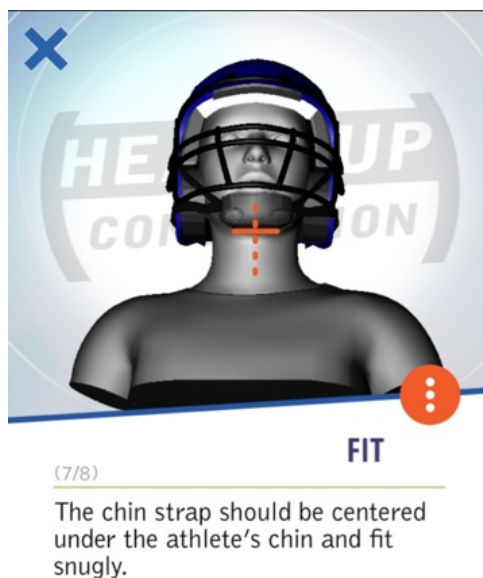
Figure 12: Screenshot from Heads Up concussion app; chin strap fit image

CDC's Heads Up Concussion app is targeted mostly towards parents but also towards community sports league and high school coaches. The main purpose, as stated on the front page of the app, is to inform parents about both helmet safety and concussion awareness. This is the app description from the Google Play store:

> The CDC HEADS UP Concussion and Helmet Safety app will help you learn how to spot and what to do if you think your child or teen has a concussion or other serious brain injury. The application includes a helmet fit feature that teaches about proper helmet fit, safety and care as well as providing other tools and materials for youth and high school sports coaches, parents, athletes, and school and health care professionals that provide important information on preventing, recognizing, and responding to concussion. (Google Play Store 2018)

Locating the problem through the "fix"

This app is problematizing concussions in children who play sports. Bacchi states that the measures we believe that should be taken to fix the 'problem' indicates what we think the problem is (2015, p. 132). The "fix" in this case is both helmet safety and concussion symptom awareness. Concussions, in this app, are represented as being under-recognized and under-appreciated by parents and coaches. The solution offered by this app is that the risk for concussions can be reduced by buying a correctly fitted helmet as well as educating oneself about the symptoms and dangers of concussions.

Even the act of promoting the Heads Up material to the rest of the community is also understood as "fixing" the problem of concussions: Figures 13 and 14 show screenshots of the app pages promoting this; in figure 13, the app page states that "You can make a big difference in educating your community about concussions and keeping kids and teams safe from this injury" and figure 14 states that the "CDC has created free tools for youth and high school sports coaches, parents, athletes, and school and health care professionals that provide important information on preventing, recognizing ,and responding to a concussion" (CDC 2018, mobile app page).
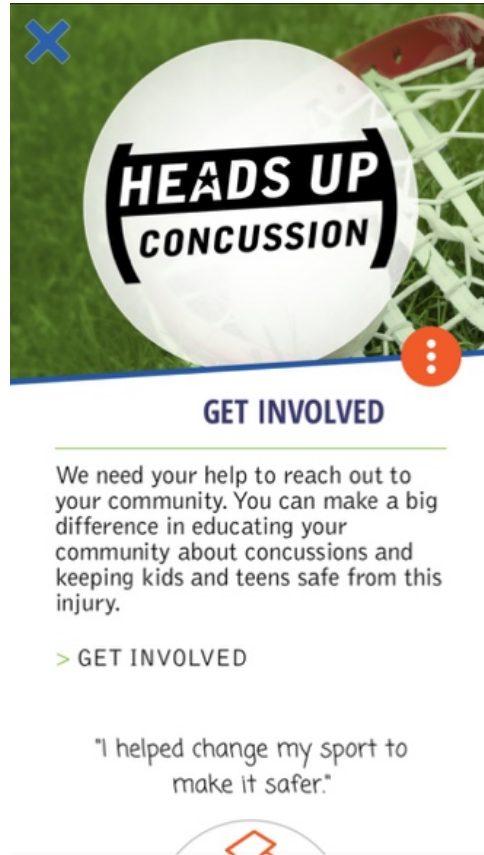
Figure 13: Screenshot from Heads Up concussion app; "get involved"

Figure 14: Screenshot from Heads Up concussion app; about Heads Up

The explicit problem stated in this app is that there is an increase in concussions in youth who engage in sports, even to the point where there is an "epidemic of concussions". Promoting "helmet safety", where the parent must be sure to measure, select and buy the correct helmet, and concussion education, where the parent must be alert to the signs of their child's head injury, are the only two means of addressing the problem of concussions. Concussions then, according to this app, are predominantly a matter of parent responsibility. The parent is instructed, step by step, how to achieve "helmet safety" for example: "When helmet shopping, be sure to bring the athlete with you to check for a good fit" (CDC 2016). Time consuming research is required, related to the individual child's fit which might change based on the brand of the helmet. Further research for a proper fitting helmet might be required with the app stating that "[e]ach helmet will fit differently, so it is important to check out the manufacturer's website for the helmet brand's fit instructions and sizing charts, as well as to find out what helmet size fits your athlete's head size" (CDC 2016).

As well, a high level of literacy seems to be assumed on this app. Instructions such as: "When the athlete is looking straight forward, the bill of the batter's helmet should be parallel to the ground" might not be clear to all parents (CDC 2016). This complex wording might make it difficult or even impossible for some parents to acquire this information.

Concussions are also presented as a community problem, with the app stating the need for all of us to reach out, spread the word and make a better community. The solution here is to enlist the parents to continue to push the message out via social media, in-school presentations and community events. "Get your community involved" "create your own Heads Up Program" "Spread the word on social media" and "post... on your child or teen's school or league's website" (CDC 2018, mobile apps page). Here the parent is responsibilized to hold the community more responsible.

Follow the money

Another way to locate how the problem is represented to be in a given policy, Bacchi argues, is to uncover how and where the funding is materializing within the proposal (2009, p. 4). Following this assumption, it is important to call attention to the many sport bodies that the CDC lists as helping to support and fund the Heads Up program, as laid out on the CDC website. This app is part of the toolkit developed within that program. One of the longest running partnerships for the "Heads Up" program, helping to fund and coordinate the dissemination of the policy information, is with the National Football League (NFL). The NFL puts substantial resources into the Heads up programing (Bachynski & Goldberg 2017). "Many organizations have contributed to the reach and success of HEADS UP…materials have landed in the hands of parents, school and healthcare professionals, coaches and athletes…" (CDC 2015). Thus, the flow of information is constructed by the sport body in a certain way, focussing on helmet safety and education around concussions, and presented to parents and coaches in a way that encourages them to take responsibility.

Question 2. What presuppositions or assumptions underlie this representation of the 'problem'?

As stated, this representation of the problem assumes that concussions are the result of improper helmet use. Bacchi asks us to pay attention to the meanings and cultural values that

need to be in place for something to happen or to be thought of in a certain way. The app takes the position that the nature of sports is inherently risky and that individuals are responsible for their lives and for the lives of their children (Bacchi, p.7). Helmet use is implied to protect against head injury. This app also assumes that parents are not aware of concussion signs and symptoms. There is also an assertion that education about concussion symptoms can go a long way towards preventing concussions.

The notion of helmet safety

How is the concept of "safety" conceptualized in this policy of concussion prevention? And conversely, how is the notion of being "unsafe" communicated? The notion of "helmet safety" is referenced throughout the app and seems to evoke a cue or signaling to the knowledge around how to avoid the risk involved in sport. This seems slightly different than just stating that the athlete should use the helmet safely (proper fit, etc.) and instead, seems to stand in for the whole message of "fixing" the problem of concussion awareness. In the more precise sense, the assertion that there is a safe way to wear and care for a helmet, infers that there is also an unsafe or even irresponsible way to use a helmet. The binary of helmet safety/ unsafe helmet use, forms one of the main structures around this dialogue, with unsafe or ill-fitting and or poor-quality helmets being put forth as a main risk factor for concussions. Accordingly, it is not enough to just wear the helmet, one must also choose and maintain the acceptable helmet, correctly fit, adjusted, maintained and stored.

Beyond promoting the discussion around using the correct helmet, there is no mention of those sports that traditionally do not use a helmet. For example, "risky" sports such as soccer, which had the highest injury rate per athlete- exposure among 7- to 13 year olds, does not come into the discussion on this app (Levey et al. 2014). There is also no mention of changing the way the sport is played, for example, or changing the road conditions to make biking safer. There is never *any* discussion about the way football is played and promoted in an aggressive and spectacular fashion.

Related to this, there is a need to take a broader look at molding these kind of preventions, to tailor them to specific groups and settings. Kairouz has consistently called for the need to tailor gambling harm prevention materials to specific risk groups (such as college students) and to account for different risks embedded in specific settings such as casinos

(Kairouz 2016). Here we could also imagine that the operationalization of a tailored approach, if it is not subject to critical reflection from sociologists and other critical public health scholars could also raise new problems.

The notion of "athlete"

In this policy, the helmet user on this app is alternately referred to as athlete, teen or youth. For example, the parent is instructed "to find out your athlete's head size". The overall theme carries a competitive sports focus. How is the notion of "athlete" and "sport" imagined? The use of these words indicate that we are not to understand these players as engaging in leisurely or pastime-like endeavors, but rather that of a competitive sports player. Images on the app include trophies as well as children and teens decked out in full uniform or playing gear. Video and written stories of teen athletes talk about feeling pressure to hide their concussions. "Zack's story" is called "shake it off syndrome", a reference to coaches telling players to "shake it off" and keep playing after being hit in the head.

 Actions such as these speak to a level of sport seriousness and importance that is far and above the casual or recreational player. This way of envisioning the helmet user as an athlete helps to create a certain expectation around the personal risks that come with sport. Yet, what about non-athletes? What about the child who is playing for "fun" or is biking to the store, school or a part-time job? Creating categories of people is part of how governance takes place (Bacchi 2009, p. 9) Bacchi quotes Hacking's observation (1986) that "people are made up" and the way that categories are organized in policy "reflects a way of organising behaviours and people that has not always existed across space and time" (Bacchi 2009, p. 9). In this app for example, age and ability categories such as youth, child, student and athlete each function to give particular meaning to problem representations.

Assumptions about parents' means

This concussion policy also assumes that parents will have the choice to buy a new helmet which costs anywhere from $60-$350 US dollars (Dicks 2018). If they buy used, it assumes that they will be able to know the crash history of that helmet. Beyond this, parental time constraints and research skills are not addressed. For example, the time required to research helmet fit assumes that parents have access and ability to do comprehensive research on the internet with the app warning parents that it is "important to check out the manufacturer's website for the helmet brand's fit instructions and sizing charts" (CDC 2018 mobile apps page). This level of

research requires a higher level of skill than might be envisioned at first glance. For example, I located online the top selling helmet in each of the sports listed on the app and then attempted to check out the manufacturer's website for the helmet fit. After much searching, I was able to find only a few of these current helmets with their suggested fitting instructions. I can only imagine a parent or coach that might be less versed in internet research than myself trying to track down this somewhat elusive information, especially for a used helmet. Even when the information was available, the instructions were often quite technical. For example, Bell helmets states that "There are five key steps in determining proper helmet fit: measurement, try on, horizontal and vertical movement check, retention check and pressure point check" (Bell Helmets 2018). A sample from this page-long instruction guide reads: "The circumference of the head should be measured at a point approximately two centimeters above the eyebrows in front and at a point in the back of the head that results in the largest possible measurement" (Bell Helmets 2018).

Assumptions about the seriousness of concussions

Finally, there is the assumption that the concussion, while to be taken seriously, is not a permanent injury and that children and teens will return to "play" after a period of recovery.

Question 3. How has this representation of the problem come about?

According to Bacchi, examining the conditions that allowed this representation of the problem to "take shape and dominate" draws on Foucault's genealogical theory in that things could have progressed much differently (2009, p. 11). Tracing the history of concussions, we can highlight key moments in time where the path changed and where it could have gone differently. And taking a brief history of the NFL's handling of concussion serves to shed light on how this app came to frame concussions in this way. The NFL acknowledged that concussions were dangerous for the first time in 1994, even though it was well known since at least 1933 (Coates 2013). Yet also in 1994, the MTBI committee, which is affiliated with the NFL, released its first findings in the journal *Neuroscience* and determined that concussions have *no long term* effect (Coates 2013). In 2000, retired football players begin to file lawsuits over their long-term brain injuries (Coates 2013). Through this exercise we can identify that it is not necessary to think of the problem this way, for example that a helmet will necessarily protect youth playing sports from a concussion.

If sports corporations and even helmet companies are feeling legal heat, it makes sense for them to want to push some of the responsibility of risk back to the individual. We are left

then with a contradictory message regarding helmets and sport, that on one hand they are mandatory for reducing and even preventing concussions, so we must invest in a different helmet for each type of sport, yet, it falls to the parent or coach to assure that the helmet is fitted, chosen and stored correctly.

Question 4. What is left unproblematic in this problem representation? Where are the silences? Can the 'problem' be thought about differently?

Gaps and silences emerge in the way that the problem of concussions is represented in this app. The problem of concussions is considered to be a problem of helmet fit and concussion awareness. Yet there are also institutional factors that allow this problem to be constituted in this way. In the case of bike helmets for example, there are countries where there is strong bike use, yet people do not routinely wear bike helmets and have lower injury rates than in the USA (Adams 2001, p. 90). Why is this? What are the factors that allow "safe" helmet-free biking in another country that are different from the way biking and bikers are imagined in the USA? Research conducted on the connection between helmet and biking safety found that "Countries where cycling is safest – those with low fatality rates per cycle-km – typically have high cycling rates but low helmet wearing. This might indicate that helmets make only a minor contribution to overall cyclist safety" (Robinson 2007). Neurosurgeon Henry Marsh states that "In the countries where bike helmets are compulsory there has been no reduction in bike injuries whatsoever." Walker (2007) argues that helmets can put cyclists at greater risk, reducing visibility as well as affecting the way drivers interact with the cyclist on the road with drivers cutting closer to bikers wearing helmets and allowing a larger berth to those without a helmet.

What is not said, how else might the risk of concussions be explained?

Missing in the construction of the policy as it appears on the app then, is the way the sport itself is played, for example, as a contact or impact sport. The message does not pose a challenge to professional sports organizations that valourize and glamourize spectacular high-impact contact sports, and that often make billions doing so.

Discussion

This study aimed to understand how public health apps construct certain problems and the findings were illustrative in this sense. The discourse on this app can be understood as a guide to engaging in risk reduction and safe behaviour, while at the same time *choosing* to

participate in 'risky' activities such as organized sports. Public Health Apps instruct subjects how to become productive, healthy citizens. The "Heads Up Concussion" app frames the problem of concussions as one of improper helmet fit and concussion awareness. This representation of the problem deems the parent responsible for making sure that the helmet is fitted correctly and that they attend to their child's concussion symptoms. While it explicitly holds parents accountable, it also implicitly leaves out the way the sport is played. This app seems to have come about in response to a sharp increase in rates of concussions being diagnosed in children. According to the CDC, emergency room visits for concussions have doubled in the last 10 years (CDC 2015).

Legal risks

Another, less talked about reason for this kind of policy response (found on the app) might be the increase in legal cases against sport governing bodies from athletes who have suffered the effects of concussion (Chicago Daily Law Bulletin 2018). While there have been some high profile professional athletes that have successfully sued for compensation due to concussion, it is also the trickle-down effect to the community and school level sports that has many sports bodies worried:

> Repetitive head trauma often begins in youth sports, and the impact on young brains may be the key to future sports concussion litigation…Developments in chronic brain injury diagnosis may also raise the odds of suits by youth and adult amateur players against equipment manufacturers, schools and non-profit sports leagues. Paul Anderson, a plaintiff's lawyer …sees a "tidal wave" of litigation ahead as a result of the settlements. (Sellers 2016)

How does this app construct the public health problem of concussions? (RQ1)

The "Heads Up Concussion" app problematizes concussions in children who play sports. The "solution" in this case is both helmet safety information and concussion symptom awareness that is principally directed at parents. The construction is one of the responsible parent subject, who fits and buys the "correct" helmet, who informs themselves about the symptoms of concussions, and takes action after a child hits their head. The implicit message is that athletes, in reality mostly children, who don't wear a helmet, or wear it incorrectly, will be put at an increased risk for concussions. What is also implicit is that the irresponsible parent lets the child play sports without a helmet, or ill-fitting helmet, and/or misses the often subtle and vague

symptoms of concussion. Parents or coaches that send children back to "play" too soon, without recognizing the concussion, put the child at great, even deadly risk.

Who is held accountable in the problem of concussions? (RQ2)

Bacchi argues that "[s]ome problem representations create difficulties for members of some social groups more so than for members of other groups" (2009, p.15). Bacchi states that discursive effects are those that might close off other discourses, for example with regard to possible social interventions. This app may close the discourse around changing or blaming the way a "risky" sport such as football is played. Bacchi draws on Foucault's "dividing practices" noting that they "set groups of people in opposition to each other" (2009, p. 16). Bacchi argues that "we become subjects *of a particular kind* partly through the ways in which policies set up social relationships and our place (position) within them" (2009, p.16). These subjectifications and associated dividing practices, can have the effect of stigmatizing minority populations, in order to encourage a desired behaviour in the majority (p. 16). Representing parents and coaches as responsible for the problem of childhood concussions objectifies them as either responsible or irresponsible (p. 17). It's not far to imagine then that by objectifying those who are irresponsible, we might also be influenced to feel differently about those who end up with a concussion, for example, "athletes" with a concussion, created within this policy as the problem, are also constituted as irresponsible, with all of the moral implications that go along with that. Leaving out information about the violent way that football is played, has the discursive effect of closing the discourse around who is to blame for concussions.

Bacchi argues that the "representations of 'problems' usually have built into them implications about who is responsible for the problem" (2009, p. 17). In this app, the desired parent, who follows the helmet safety rules, are constituted as responsible, educated on important health matters and involved in their children's care. Conversely the "other" parent, whose child might be wearing an ill-fitting helmet, or is implied to be uneducated about concussion symptoms and, by extension, is putting their child at greater risk for concussion. This has the material effect of placing blame on those parents who do not, for whatever reason (socio-economic/poverty, low literacy) follow the prescribed guidelines. What subject positions are made available and how this might modify our behaviours and thoughts about ourselves. For example, how might this concussion policy set certain groups against another?

What material effects are produced by representing concussions this way?

What material effects do these implied attributions of responsibility have? A responsible parent or coach is one who takes all of the steps to fit and buy the correct helmet, and who is well informed about the symptoms of concussion. The irresponsible parent lets the child play sports without a helmet (or ill-fitting helmet), misses the (subtle and vague) symptoms of concussion, and does not involve the medical "experts" when the child has a blow to the head. Parents who cannot afford a "safe" helmet are thus configured as being irresponsible parents. The construction of the responsible parent subject may have the effect of stigmatizing parents who cannot afford a different and new helmet for each sport, or don't have adequate health insurance to medically check each hit to the head. These parents will continue to be at greater risk for blame. Just as in chapter 3, where women who drink while pregnant might be held legally responsible for ill effect to their children, parents might also be held liable for their children's concussions. The more "common" knowledge that is out there in the community about how concussions can be prevented with helmet use, the more the sports bodies who are the target of lawsuits regarding head injuries can point to the irresponsible parent who did not take adequate actions towards preventing these concussions. Furthermore, as with the FASD app, having the Heads Up concussion app on one's phone might add further proof (in a legal sense) that the parent should have known better.

Finally, with the responsibility resting on the parents, there is less institutional incentive for change. In the case of biking, the discourses that frame concussions as a problem of helmet safety and symptom awareness, limits and even silences any kind of social analysis around, for example road and bike path development or motor vehicle driver responsibility. In the case of sports bodies such as the NFL, they have less institutional incentive to change the way the game is played and marketed.

Who is absolved of responsibility? (RQ3)

The delivery of this specific framing of the problem of concussions is realized through the text and images on an app. This app is developed, distributed and promoted by the CDC. This adds legitimacy and secures the authority to the way the problem of concussions is portrayed.

As mentioned, the NFL is listed on the CDC's concussion webpage as a key sponsor of the "Heads up" program (CDC 2017). It is noteworthy that the NFL is educating citizens about how they should think about concussions (Wright & Halse 2014). Through the funding and

crafting of the message largely funded sports bodies, corporations such as NFL and helmet manufacturers are able to control the discourse in their favour. Furthermore, their influence is hidden on the app, as one needs to visit the CDC's Heads Up concussion webpage to find information about the funders of the program, and even then it's not salient.

The messaging on this app does not pose a challenge to professional sports organizations, some of whom also valourize and glamourize spectacular high-impact contact sports, and often make billions doing so. I argue that there is a potential conflict of interest when corporations such as the NFL and national public health agencies such as the CDC "work together" to develop policy. Reminiscent of the way tobacco sunk billions of dollars into public health messaging (Brownell & Warner 2009) this app seems to obscure the politics and economic interests around framing concussions in a certain way. The use of these apps, classified as public health tools by an authoritative entity such as the CDC, raises important sociological questions around the partnering of industry with public health agencies.

Conclusion

The purpose of this chapter was not to downplay the importance of reducing concussions in children. It was to alert public health professionals and scholars to the ways that apps might, inadvertently or not, serve to reinforce social norms or create subject positions such as that of the responsible parent.

This chapter set out to examine how public health apps represent problems and how these apps come to be fashioned in certain ways. This specific CDC app has constructed public health problems in ways that explicitly hold some groups, parents, coaches and individual athletes, as responsible, while implicitly absolving others such as sports bodies and helmet manufacturers, of responsibility. In this chapter I have illustrated that studies of public health apps such as the Heads Up concussion, can benefit by taking a governmentality perspective, which foregrounds the different types of authority, and different sites implicated in public health governance.

Chapter 6: Conclusion

In this concluding chapter I will first summarize the key contributions of this thesis and its overall argument. Following this, I will clarify some limitations of this study as well as proposing possible future avenues of research.

Key contributions

This thesis contributed the following important findings regarding public health apps:

- Public health apps are geared towards different audiences, some for healthcare professionals while others are intended for laypersons.
- The public health problems transferred onto these apps were seemingly arbitrary, not necessarily addressing top pressing public health issues.
- Apps can be understood as forms of governmentality:
  - ➢ Creating the subject position of the responsible parent (Heads Up concussion app)
  - ➢ Specifically constructing women's bodies as risky sites in need of control (FASD app)
  - ➢ Absolving others of responsibility such as
    - o men and alcohol companies (FASD app)
    - o sports bodies and helmet manufacturers (Heads Up concussion app)
- Public health apps used by government public health agencies warrant further attention and study because they are understood as trusted sites of health knowledge.
- Apps are different (and therefore merit their own analysis) because they are personable and interactive compared to those of traditional public health services.

Overall Argument

An expanding app ecology

PHAC in Canada and the CDC in the United States, are established as trusted sources of public health knowledge and guidance. Mobile apps are promoted as a means to disseminate vital public health information and are upheld as tools in which to support and augment existing public health strategies. Following my introduction (chapter 1) and discussion of method

(chapter 2), chapter 3 argued that there is a burgeoning and understudied app ecology within the domain of public health. A descriptive account of national, Canadian and American, public apps was completed. All but one of the apps were free and available for everyone. Apps were geared towards various intended audiences: healthcare professionals, caretakers, parents and children.

An arbitrary selection of public health problems seemed to be translated into these apps, for example, none of these apps took on major important issues such as motor vehicle injuries, teen pregnancy or tobacco use. Further, there was an ephemeral nature to these apps with many not enduring over time, or when they did endure, not being regularly updated. The CDC apps that were intended for healthcare professionals ultimately held the app user to be responsible for the accuracy and the consequences of the information contained on the app.

Governance through apps

In chapters 4 and 5, I argued that apps might be understood as forms of governmentality. Using Bacchi's method of policy examination foregrounding Foucault's notions of subjectification and subject positions, I emphasized the ways that subjects are constituted in public health policy. Policies contained within the text and images on these apps were problematized to uncover how they constructed the public health problems of FASD and concussions.

The FASD app

Available for free from the iTunes and Google Play store, this CDC app was marketed towards women to provide them with information about the dangers of using alcohol while pregnant as it pertains to the risk of having a child born with FASD. The discourse on this app creates and locates women's bodies as risky sites in need of surveillance and control. Key questions in this chapter concerned the normative assumptions about men and women as it pertains to consuming alcohol during pregnancy. The CDC's FASD app was found to serve as reinforcement of social norms and to create subject positions such as that of the responsible pregnant women or parent. It also freed others, fathers (men) and alcohol companies of responsibility.

The Heads Up concussion app

The main notion inferred on this app was that helmets could protect athletes from concussions. Parents were also assumed to have the means and research literacy to procure the

specifically fitted helmet required for each sport. CDC's Heads Up concussion app was composed in such a way that explicitly held parents as responsible, while implicitly absolving helmet manufacturers and sports bodies such as the NFL, of responsibility. This app seemed to come about in response to an increase in both the number of concussions and the increase in legal cases against the NFL. I argue that there are serious issues of conflict of interest between the NFL, a major funder of the Heads Up program and the CDC. The NFL stands to benefit if the responsibility of preventing concussions falls to the parents and athletes (Bachynski & Goldberg 2017; Health Review 2018).

I argue that a key takeaway from the findings in this thesis is the many ways that governmentality can come to be embedded, often in covert ways, into technologies such as public health apps. With these apps, a new kind of "self-governing citizen" is constructed, imagined more in universal terms as one who self-regulates their potential harm, shifting the regulation and support from the state and other powerful actors (e.g. the NFL; Alcohol companies) to that of the responsible and self-sufficient subject (Humphry & Torres 2015).

The reconfiguration of policies on to apps also raises more profound questions that sociologists have theorized with reference to the concept of responsibilization. Taking responsibility for one's health is often seen as both empowering for the individual and economically beneficial for the state (Rose 2013). However, as Rose argues, responsibilization can be problematic when "individuals are *obliged* to take this role, subject to new expectations about their skills and capacities to understand and manage the information, to choose between different options with their own costs and benefits, and to accept at least some of the consequences of their choices for their future health" (2013, p.349 - emphasis mine).
In order to examine the complex issues associated with the interactivity that apps permit and presuppose, Katz and Marshall (2004) point to the way that vocabularies around "functional" and "dysfunctional" are the new "normal" and "pathological" and that to be functional, indicates an active participation ("doing"), versus just "being" normal (58). This really speaks to the active work we are now expected to engage in, such as making use of an app, to "take advantage" of health education, public health programs, etc. There is an understanding that nature can (should) be modified to best meet the goals of best health and we are now stigmatized, not for needing treatment, but for resisting treatment (59). Often there is a moral judgement made of the sick for making poor choices and failing to take action towards a healthy lifestyle.

The CDC's apps for the most part are taken from a larger body of policy discourse found on the websites to which the apps are linked. For example, both the FASD app and the Heads Up concussion app have links to the main CDC web pages on FASD and concussions respectively. These main pages seem to give a wider coverage and scope of the problem with links to more statistics, and research as well as offering connections to other relevant CDC pages (CDC 2016; CDC 2018).

I argue that apps generate another possible layer of governance, beyond stemming from the inherent power and politics contained in public health policy. This form of governance results from the way technologies such as apps further conceal their particular political framing of the policy, after being translated onto the app. The way the problem is framed, in the version that ends up on the app, such as the FASD app as governing women's drinking behaviour or the Heads up concussion app as responsibilizing parents for their child's concussions, is an example of how governmentalities can be embedded in technology. Further, apps are unique in that their technical affordances dictate what we can and cannot do with them, as Lessig argues, it is the computer code itself that regulates conduct and

> …implements values, or not. It enables freedoms, or disables them. It protects privacy, or promotes monitoring. People choose how the code does these things. People write the code. Thus the choice is not whether people will decide how cyberspace regulates. People--coders--will. The only choice is whether we collectively will have a role in their choice--and thus in determining how these values regulate—or whether collectively we will allow the coders to select our values for us. (Lessig 1999)

Thus, both the framing of the policy in the form of text and images that ends up on the pages of the app, as well the configuration of the technology of the app itself combine to make apps unique and important to study.

Broader Implications and Directions for Future Research

Who creates public health apps? And why does this matter?

Apps are typically not produced "in-house" by public health professionals (Kunkle et al. 2016). Most public health professionals don't have a computer science background or extensive knowledge of app development. However, public health is integrating more and more computer-

based technologies for data collection, analysis and communication (Kunkle et al. 2016). The CDC, *The Lancet* and the Institute of Medicine, among others have called for changes to be made to the curricula of public health schools to add these essential skills (Kunkle et al. 2016).

One way that public health agencies are getting around their current expertise gap where apps are concerned is through collaborating with outside technological communities, for example offering a public contest to build apps (Mergel 2014). Mergel found that there were three pathways that agencies would typically follow when tasked with creating mobile technology such as apps: "1) in-house development and contracting to external vendors, 2) top-down policy mandates to develop at least two mobile apps, and 3) running government contests to ask the public to solve public management problems and relying on civic hackathons" (2014, p. 3).

Currently, the "Health Data Challenge" app contest is being jointly run by PHAC, the CDC, and the US Department of Health and Human Services (CDC 2017a). The "Flu App Challenge" was another contest held by the CDC in 2011. It asked developers to create a public health app. In its call for apps, the CDC declares: "YOU PICK THE TECHNOLOGY AND DESIGN THE IDEA, WE'LL PROVIDE THE DATA" (CDC Launches the Flu App Challenge 2011). In this contest, it is the developer who subjectively chooses what angle of the public health problem to tackle as well as which aspects of that problem's policy and data to highlight.

These "highlights" might (one could even say should) be selected based on their importance to the public health concern being advocated for on the app. Yet instead, these critical choices might be made based on marketability such as creative or esthetic features. As an illustration of how these public app contests might be encouraging this, the judging of these apps in the above CDC contest was not merely based on the efficacy or accuracy of the app. Fully 40 percent of the evaluation was based on the app's creativity (CDC 2011).

These app contests might help alert us to the ways that public health knowledges come to be refracted and reconfigured. The app developers in this case are not necessarily in face-to-face discussion with the public health professionals who devised the contest. Instead, the contest website is used by public health professionals to post the rules and regulations leaving the developers to make key decisions, taking into account the posted rules. After the app is finalized, the developer then uploads it back on to the website. Finally, the judges of the contest log on to the webpage to evaluate these apps (CDC 2011). Health knowledges then are refracted through the webpage between public health professionals and developers in both directions, inevitably

reconfiguring the messaging that ends up on the app. Policy in this sense, seems to stem from wanting to give a solution to a "problem out there" but as Bacchi argues, problems are created within the policy making process (ix) as "creative, not as reactive" to an existing problem (2009 p. 211)

The Impact of Apps as Mini-Policies

Recall in chapter 1, I introduced the concept of apps as a kind of mini-policy where norms and politics, already entrenched into public health policy, become further refracted and reframed in the app version. Findings in this thesis served to bring forward some of the unique ways that public health problems come to be represented on apps. In the case of the FASD app, the policy was translated into a form that allowed the user to click through the topics, for example, getting help with a drinking problem, in an interactive and personalized fashion. The concussion app was also interactive in the way it allowed the user to click through and pick the specific sport for the helmet fit, as well as also allowing the user to bypass topics that were not of interest. Further, some apps request permission to access the phone's camera, microphone or geolocation which brings in the possibility for surveillance and/or user data collecting (with potential privacy implications). Further, many apps encourage sharing through social media.

The text and framing of these mini-policies are chosen, perhaps through an app contest by the developer, but not necessarily by a public health professional. The question of how public health apps are created and by whom, thus suggests one important direction for future research.

The examples brought forth in this thesis help to inform future research on public health apps by imagining them as a mini-policy to differentiate and distinguish this object of study from others such as an online health website or health awareness poster. Apps are unique and have distinctive ways of coming into being, and in this way might embed the unintended politics of the app developer.

Limits and Further Directions

One limit of this study was that I only looked at national public health agency apps, and only those in the USA and Canada. Future research might also look at how local public health agencies and other organizations are promoting apps as public health tools.

Future research might also look into the terms of service policy such as those aimed at the terms and conditions of personal data collection. Further research might then examine how personal data is collected and stored on these apps.

While the number of apps available is increasing, there is also still a need for more research on how apps are actually integrated with people's everyday practices. Recent reports (non-peer reviewed) suggest that many users will download, but not use apps (O'Connell 2016; Perez 2016). Future research might interview end users to better understand how they might be using apps in everyday ways. Even if we know the framing and technology of the apps, this thesis cannot answer how the users are taking up the app in their daily lives.

Further, research might also delve into answering questions concerning how developers and public health professionals imagine how people are using public health apps. Are apps intended to monitor one's own behaviour? For public health agencies to track and collect user's data? Are apps used as a tool for spreading awareness? Or maybe used to seem accessible to "young people"? This is not to say that these would be negative reasons to create apps, on the contrary, increasing awareness of public health problems is an important part of the work that public health professionals and scholars do. Yet these apps are often touted as a way to save money, possibly replacing face-to-face services. We need to ask who benefits and who is overlooked if these mobile technologies supplant other public health services?

The digital revolution in both the health and public health sector presents digital technologies as an effective way for resource-constrained organizations to provide health services (CIHR, 2014). Future research might aim to render app users as visible in all their diversity: mapping and detailing who uses what apps and in what way these apps are incorporated into their everyday lives. Research could map out these interactions and relationships, to explore how the user might understand, integrate and transform these discourses.

The governmentality perspective doesn't (or hasn't traditionally) emphasized everyday practice, such as app users. From this perspective, one avenue of future research would be to look at different theoretical resources, for example Actor Network Theory (ANT), for instance Rutland and Aylett combined governmentality and ANT to examine climate change policy (2008). French et al. argue that an alternative approach, one that adopts a governmentality perspective, refracted through the lens ANT yields a perspective on social problems that "arcs

back to materiality and also brings attention to the actor-networks, processes, and practices that (imperfectly) translate these phenomena into social problems" (French et al. 2018, abstract). Governmentality and ANT can work well in concert with both being able to "address well-cited shortcomings of the other…" (Rutland & Aylett 2008, p. 627). Governmentality helps us to understand the ways that a policy might work to "produce self-governing citizens" and, in turn, "ANT links relevant discourses to their material conditions of possibility" (Rutland & Aylett 2008, p. 633).

Research might also take an alternative approach such as institutional ethnography, a method developed by Canadian sociologist Dorothy Smith and one that allows for an examination of the social and institutional dynamics that layer people's everyday experiences (Mykhalovskiy & McCoy, 2002), would allow researchers to examine mobile public health apps from a "bottom up" perspective, to understand the ways that these apps, specifically their discourses, and technical affordances, might become integrated and taken up in the daily lives of users (Smith 2006).

Taking this approach, future research might carry out in-depth interviews with public health professionals; epidemiologists, infectious disease experts, recruited through public health conferences. Further research might also look into interviewing app developers, recruited through health "app jams", where developers come together for a day or weekend to create apps for prizes. and ethnographic research at conferences (Gonzales-Santosa & Dimond 2015)

Final Conclusion

This thesis aimed to investigate the ways that public health apps form and frame public health problems. Key contributions included that public health apps can be understood as forms of governmentality. Apps, such as the FASD, constructed women's bodies as risky. The Heads Up app held the parent responsible for fitting and buying the correct helmet. It also inferred that helmets were implicated in the prevention of concussions. Studies of public health apps such as the FASD and Heads Up concussion can benefit by taking a critical public health perspective, which brings forth the different types of power, authority, and influences implicated within these sites of public health governance.

The purpose of this thesis was to bring forth the ways that apps might, inadvertently or not, serve to reinforce social norms or create subject positions such as that of the responsible

pregnant women or parent. This thesis set out to examine how public health apps represent problems and how these apps come to be fashioned in certain ways. These specific CDC apps have constructed public health problems in ways that explicitly hold some groups, parents and women of childbearing age accountable, while implicitly absolving others, sports bodies, helmet manufacturers, alcohol companies and men, of responsibility. Messages come to be framed through various means, many of which have shifted traditional public health knowledge networks. I have also argued that we can imagine apps as "mini-policies" where multiple actors, public health professionals, developers, a contest web page, participate in reducing, and therefore effacing the nuance of policy, re-framing certain selected points, and potentially omitting other perspectives from a larger policy on a given subject. Thus, public health problems come to be refracted and reconfigured, framing and instructing subjects in particular ways.

In this thesis I have illustrated that studies of public health apps can benefit by taking a critical public health perspective, which foregrounds the different types of authority, and different sites, implicated in public health governance. Bacchi's framework helped to critically interrogate these "mini-policies", those texts on the apps derived from main health policy, as it helps to make explicit the ways that problems are represented, and following this, the ways we are in turn governed through the policy as it is represented on these apps (2009, p. 1).

While research into public health governmentalities can be illuminating, this thesis also argued that more studies are necessary to understand how different publics use (or don't use) apps, and consequently how app users come to relate (or not) to these governmentalities.

This thesis addressed how apps formulate and construct public health problems, and how public health policies are transformed through apps. Public health policy information comes to be disseminated via various means, including more recently, through mobile phone apps. Problems come to be framed in particular ways that create responsible subjects, as well as prescribing how individuals are to become productive and healthy. Through the unique technical and personal nature of apps, these health discourses are then disseminated and circulated in novel and, to an extent, unexamined ways.

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