

**HOW COULD AN EFFECTIVE PODCAST ABOUT ALCOHOL USE BE DESIGNED
AND EVALUATED? A REVIEW OF THE LITERATURE**

by

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ABSTRACT

Nearly one quarter of Americans use alcohol in a risky manner. Most of the alcohol use interventions recommended by the CDC’s Community Guide are environmental; few evidence-based approaches attempt to address alcohol use on an individual or interpersonal level. Podcasting is a cost-effective communication tool whose potential impact for public health has been widely touted. The aim of this study was to answer the following research question: “How could an effective podcast about alcohol use be designed and evaluated?” Literature and guidelines related to health and science podcasts for popular consumption were reviewed. No literature specific to alcohol use and podcasts were located. According to peer-reviewed and gray literature, health podcasting is feasible and cost-effective, although it may be time-consuming. Of particular note is the importance of entertaining the target audience. Humor and the use of narrative can contribute to the entertainment value of a podcast. Podcasts can be evaluated for their impact at the individual or interpersonal level. Knowledge gain, attitude shift, and behavior change are all individual-level metrics, whereas information-sharing and the proliferation of “podologues” (conversation based the podcast) can indicate an interpersonal effect. Although the review concluded that there is insufficient formative research to design a podcast to reduce risky drinking, it identified a number of design and evaluation tools that may prove useful for podcasting about alcohol use and other health behaviors. It also outlined a rationale for

podcasting about alcohol use and a research agenda to guide the development of an efficacious podcast to address risky alcohol use. A quick guide to podcasting about alcohol use is included as an appendix. Statement of public health relevance: Alcohol use has a profound effect on health. It is responsible for one in 10 deaths among working age Americans and more than one in three Americans say alcohol has been a source of trouble in their family. A research-based approach to podcasting may create cost-effective alcohol use interventions that impact the individual and social level of the social ecological model.

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PREFACE

I wish to thank my academic advisors at the University of Pittsburgh Graduate School of Public Health and all of the excellent teachers and students from whom I've learned during my time in the Master's program here. I wish to thank the Executive Director of the Institute for Research, Education and Training in Addictions (IRETA), Dr. Peter Luongo, who has supported my completion of this program in many ways for several years now. I wish to thank all of the friends and family who have supported me personally and intellectually over the last few years, including (but not remotely limited to) Michael Pisano, Chris Mucci, Josh Park, Anya Weitzman, Daniel Menges, Jamie Williams, Kent Williams, Joan Kalhorn, Barb Kviz, Angry Bobby, Jeb Feldman, Hal B. Klein, and Sarah Schneider.

1.0 INTRODUCTION

Alcohol use is tightly intertwined with physical and mental health. Americans' rates of alcohol use have remained relatively steady in the last three decades (Newport, 2010), as has its profound effect on health. To illustrate, one in ten deaths among working age adults is attributable to risky alcohol use, primarily as the result of health conditions caused or exacerbated by drinking (Stahre, Roeber, Kanny, Brewer & Zhang, 2014). More than one in three Americans reports that alcohol has been a cause of trouble in their family, a proportion that is on the rise (Jones, 2014). And an estimated 21% of all hospital-admitted injuries are alcohol attributable, including 36% of assaults (Miller & Spicer, 2012).

Although federal low-risk drinking guidelines exist, research suggests that individuals do not heed federal drinking guidelines because they do not know the guidelines (Visser & Birch, 2012), don't find the information credible (Lovatt et al., 2014) and because some subpopulations are motivated to transgress the social norms implied by proscriptive messages from the government (Hackley et al., 2015).

Incorporating Health 2.0 principles into communication about alcohol use may improve public knowledge and attitudes toward low-risk drinking guidelines. Health 2.0 is a term that sprang from the concept of Web 2.0. According to Tim O'Reilly, who coined the term, "Web 2.0 is all about harnessing collective intelligence" (O'Reilly & Battelle, 2009, p.1). That is to say, users do not passively absorb Web 2.0; they build it. Wikipedia, Facebook, and a number of

other platforms are obvious examples of Web 2.0. Health 2.0, then, has its roots in those ideas. Health 2.0 is a developing concept whose definition has not been universally agreed upon, but a review of its use in both academic and gray literature (Van De Belt, Engelen, Berben, & Schoonhoven, 2010) found that:

1. Patients and professionals were seen to collaborate, with patients transforming their role in health care using social networks and access to health information; and
2. Web 2.0 is a facilitator for Health 2.0/Medicine 2.0, but not a necessity.

Collaboration between health professionals and non-professionals is a key concept in Health 2.0. In a Health 2.0 environment, the hierarchy between the professional and the patient is de-stabilized. Consumers may become “prosumers,” or active participants in their own healthcare, using such means as mobile technology to monitor personal health analytics or social networking sites to create, share and glean health information (Doherty, 2008). Public engagement with some health topics, such as nutrition, has flourished in this environment. Rather than a didactic information flow promoting federal nutrition guidelines, our media environment is a-twitter with blogs about Paleo diets, podcasts about veganism, and long comment threads about the virtues of superfoods. This begs the question of how alcohol use behavior would be impacted if public discussions about the relationship between alcohol use and health were as common as discussions about gluten.

Podcasting is a cost-effective communication tool in the Health 2.0 landscape (Doherty, 2008). Podcasts can empower listeners with health information and create social networks for information-sharing. They can be produced by amateurs with little technological expertise and distributed widely at minimal cost (Price, Gay, Searle, & Brissenden, 2006; Ha & Myers, 2013).

Although the science of podcasting to improve public health is not well-established, evidence is accumulating that podcasts can build knowledge, shift attitudes, and facilitate health behavior change. The aim of this study was to answer the following research question: “How could an effective podcast about alcohol use be designed and evaluated?”

The background section summarizes the significance costs associated with risky alcohol use and the prevalence of risky alcohol use among Americans ages 12 and over. It defines the term “podcast” and offers a brief history of podcasting. It suggests health communication and health behavior theories may be useful frameworks for evaluating the effects of health podcasting and lays out the case for continuing to study public health podcasting.

The methods section outlines the search strategy for this review of the literature on health- and science-focused podcasts. The results section presents 18 relevant studies deemed highly relevant to the research question. It describes the paucity of theory-based studies of podcast design or effectiveness and reviews the evidence for certain design elements and evaluation strategies. It also reviews pros and cons of several approaches to evaluation.

Following the results, the discussion section interprets the literature results as they apply to a podcast about alcohol use. A sample podcast episode and evaluation recommendations are presented. The study concludes that there is insufficient formative research to design a research-based podcast for alcohol use, but offers recommendations for further research that would advance the production of a podcast to address alcohol use.

2.0 BACKGROUND

Most Americans drink alcohol. In a nationally representative 2013 study, 52.2% of Americans age 12 and up had drunk alcohol within the last month (Substance Abuse Services and Mental Health Administration [SAMHSA], 2014). In part because of its prevalence, a 2010 analysis rated alcohol as the world's most harmful drug, followed by heroin and crack cocaine (Nutt, King, & Phillips, 2010). Americans' drinking patterns have remained relatively consistent over the last three decades (Newport, 2010). As result, alcohol-related harms have become endemic.

2.1 COSTS OF ALCOHOL USE

Although not straightforward to measure (Rehm, Gmel, Sempos & Trevisan, 2003), costs associated with alcohol use are substantial, both in terms of human lives and dollars spent. The health consequences may be acute (e.g. accidents, violence, poisoning) or chronic (e.g. the development or exacerbation of disease). They may be first- or secondhand in that they may harm the user or others. And costs change across the lifespan; alcohol use among adolescents is more likely to contribute to acute consequences like auto accidents and suicide whereas adult use contributes more frequently to cancers and heart disease (Schulte, 2014).

2.1.1 Mortality

Excessive alcohol consumption is the fourth leading preventable cause of death in the United States (Gonzales et al., 2014). Six people die daily of alcohol poisoning alone (Kanny et al., 2015). According to the Centers for Disease Control and Prevention (CDC), one in 10 deaths among working age adults is the result of risky alcohol consumption and these deaths often occur in the prime of someone's life: an alcohol-attributed death shortens a person's life by an average of 30 years (Stahre et al., 2014). Between 2006 and 2010, nearly 88,000 people died alcohol-related deaths per year (CDC, n.d.). More than half of these deaths were "acute," which includes injuries, drowning, child maltreatment, and suicide. The others were chronic, which includes alcoholic liver disease, stroke, and hypertension.

2.1.2 Morbidity

Alcohol use is interwoven with many aspects of physical and mental health, which complicates morbidity calculations. However, globally, alcohol use contributes more substantially to morbidity than mortality (Rehm et al., 2003).

Alcohol-specific diseases are those entirely attributable to alcohol consumption, such as liver cirrhosis and alcohol-induced chronic pancreatitis. There are 27 ICD-10 codes for alcohol-specific diseases (Shield, Parry & Rehm, 2013). However, over 200 diseases are sometimes caused by alcohol consumption: the CDC estimates that 40% of cases of portal hypertension, 15% of cases of epilepsy cases, and 3-6% of cases of hemorrhagic stroke among men the United States are attributable to excessive alcohol use (CDC, n.d.). These disease and injuries for which

risky alcohol consumption is a *component* contribute more to the global burden of disease than do alcohol-specific conditions (Rehm, 2011).

Risky alcohol use also contributes substantially to non-fatal injuries. According to the CDC, 32% of fall injuries, 42% of fire injuries, and 16% of cases of child maltreatment are alcohol-attributable (CDC, n.d.). The Alcohol Attributable Fraction for alcohol-related motor vehicle crashes is age- and gender-specific, ranging from 49% for males ages 25-34 to 8% for females ages 65 and over. An estimated 21% of all hospital-admitted injuries are alcohol attributable, including 36% of assaults (Miller & Spicer, 2012).

2.1.3 Harm to others

Like secondhand smoke, harmful alcohol use affects people other than the drinker (Navarro, Doran, & Shakeshaft, 2011). One of the most obvious cases of this “secondhand drinking” effect is maternal alcohol use that can cause fetal alcohol spectrum disorders (FASDs), which can consist of birth defects, neurodevelopmental problems, and a range of social/behavioral issues, some of which mimic ADHD (Coles et al., 1997). Estimates vary widely as to the prevalence of FASD in the United States; newer research indicates that it may be 50 per 1,000 live births (May et al., 2009; May et al., 2014).

Alcohol-related harms can affect social health and order. More than one in three Americans reports that alcohol has been a cause of trouble in their family (Jones, 2014) and more than 10% of U.S. children live with a parent with alcohol problems (Center for Behavioral Health Statistics and Quality, 2012). Second-hand drinking can lead to marital conflicts, intimate partner violence, financial strain and modeling unhealthy alcohol use for children (Gmel & Rehm, 2003). In a 2010 analysis of drug-related harms, alcohol was not deemed the most

harmful to the user, but exceeded all other drugs (including heroin and cocaine) in terms of harm to others (Nutt, King, & Phillips, 2010).

2.1.4 Economic Costs

The economic costs of risky alcohol use are considerable. The total economic burden of alcohol use in the United States was estimated at \$223.5 billion in 2006 (Bouchery, Harwood, Sacks, Simon & Brewer 2011). For context, alcohol use is more costly than diabetes: the economic impact of diabetes was \$174 billion in 2007 (American Diabetes Association, 2008). Alcohol-related costs are primarily incurred because of crime, lost work productivity, and healthcare utilization. An analysis of alcohol-related costs to states concluded that in 2006, the median state cost of excessive drinking was \$2.9 billion; a median of 42% of state costs were paid by government. Excessive drinking (not necessarily alcoholism) accounted for about three-quarters of those costs (Sacks et al., 2013).

2.2 RISKY ALCOHOL USE

2.2.1 Definition

Low-risk drinking guidelines in the United States include both daily and weekly limits. According to the National Institute on Alcoholism and Alcohol Abuse (NIAAA), low-risk drinking for men over 21 years old is four or fewer drinks per day and no more than 14 drinks per week. For women over 21 and all adults over 65, low-risk drinking is three or fewer drinks

per day and no more than seven drinks per week. Even staying within these guidelines, according to the NIAAA, does not eliminate risk associated with alcohol use. It is recommended that those who are taking medications that could interact with alcohol, are under 21, are pregnant or trying to become pregnant, or will be driving or operating machinery abstain altogether.

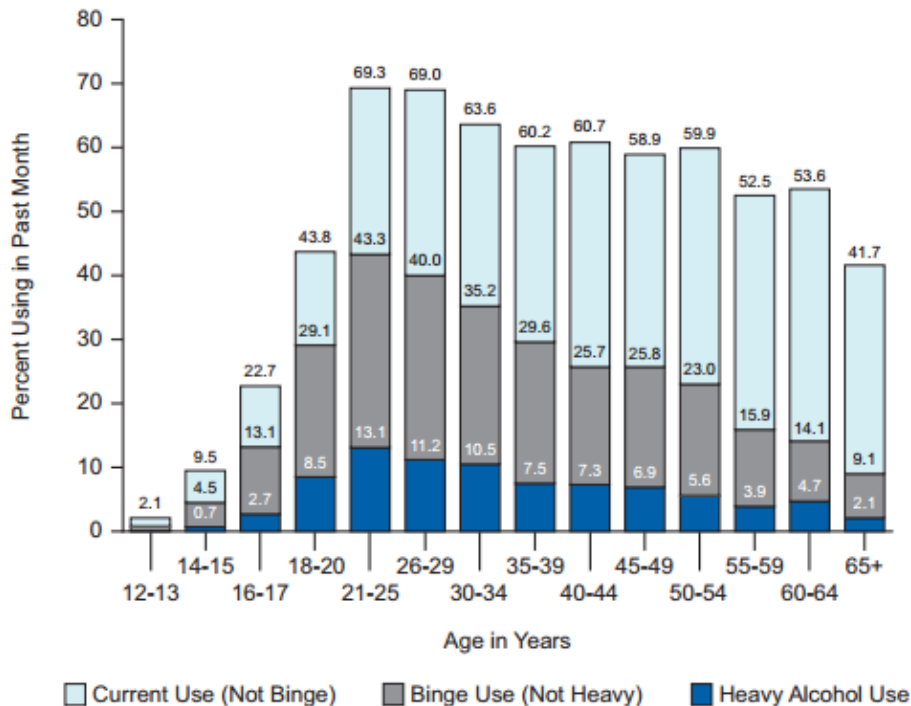
These guidelines, designed for broad public health use, simply apply to amount and frequency of consumption. Notably, they do not measure other, more personal dimensions of alcohol use, such as consequences as a result of use, difficulty reducing use, or the presence of cravings.

The Diagnostic and Statistical Manual (DSM)-5 provides diagnostic criteria to determine whether an individual has an alcohol use disorder (American Psychiatric Association, 2013). Risky alcohol use is not the same as an alcohol use disorder. The DSM-5 lists 11 criteria related to alcohol use; if an individual meets any two of them, he or she has a diagnosable mild alcohol use disorder. A moderate alcohol use disorder is defined as meeting four or five of the criteria and an alcohol use disorder is considered severe if an individual meets six or more criteria. Criteria include frequently drinking more than intended over longer lengths of time, persistent unsuccessful efforts to cut back, cravings, tolerance, withdrawal, and continued use despite persistent social or interpersonal problems caused or exacerbated by alcohol use. A qualified professional is required to diagnose an alcohol use disorder whereas any individual can assess his or her own alcohol use to determine whether it fits into the NIAAA low-risk drinking guidelines.

2.2.2 Prevalence of risky alcohol use

Based on the low-risk drinking guidelines, nearly one quarter of Americans use alcohol in a risky manner, although only 6.9 percent meet the criteria for a severe alcohol use disorder (SAMHSA, 2014).

Rates of risky use vary by age (*see Fig.1*). The 21-25 year old age group is most likely to engage in risky alcohol use. Over 43% of this age group reported exceeding the daily drinking limit within the last 30 days and over 11% reported heavy use that significantly exceeds the weekly drinking limit (five or more drinks on five or more days in the past 30 days). Rates of risky alcohol use gradually decline among older age groups, to 29.6% among 35-39 year olds and 23% among 50-54 year olds, but remain a significant proportion of the population.



Source: National Survey on Drug Use and Health, 2013

Figure 1: Current, Binge, and Heavy Alcohol Use (2013)

2.2.3 Change in risky alcohol use over the life course

Although many people's alcohol use changes over the course of a lifetime, the mechanisms of change are still not well understood. Observational studies of "self-changers" (e.g., Dawson et al., 2005; Witbrodt, Borkman, Stunz, & Subbaraman, 2015) who reduce their risky alcohol use without professional help suggest that such behavior change is common and success requires access to personal and community-level resources for change, often called "recovery capital" (Cloud & Granfield, 2008).

Risky alcohol users frequently "age out" of their behavior, a common trajectory whereby use peaks in an individual's twenties and declines afterward (Perkins, 1999; Marti, Stice, & Springer, 2010). Because "aging out" is so commonplace, the same type of alcohol use is viewed differently at different points in the life course. As psychiatrist George Vaillant (2005) observed, "At a homecoming party the sophomore who quaffs eight planned martinis, proudly punches a stranger and then vomits, is far more likely after graduation to resume 'social drinking' than the father who, against better judgment at his daughter's wedding, sneaks eight martinis, punches a stranger and then vomits" (p. 294).

Aging out fits into the larger rubric of "natural recovery," which has been defined as change in substance use behavior without professional help and (for some researchers) without help from mutual aid groups, such as Alcoholics Anonymous. Natural recovery--which may include not just abstention from substance use, but also moderation--is more common than "treatment-assisted recovery" (Witbrodt et al., 2015). One of the most powerful examples of the prevalence of natural recovery comes from the first wave of the National Epidemiological

Survey on Alcohol and Related Conditions (NESARC), conducted by the NIAAA between 2001 and 2002, which concluded that "there are substantial levels of recovery from alcohol dependence," (Grant & Dawson, 2006, p. 78) outside formal treatment. Researchers examined the drinking habits of 4,422 people who had met criteria for an Alcohol Use Disorder (using DSM-IV criteria) more than 1-2 years before. Only a quarter of respondents had ever received treatment, but at the time of the NESARC survey in 2001, only 25 percent remained dependent and more than a third of respondents were abstainers or low-risk drinkers. In short, even those individuals who might be termed "alcoholic" changed their drinking behavior over time, without treatment.

Despite the fact that behavior change around alcohol use happens all the time, interventions designed to initiate and sustain change have mixed success and limited implementation. Because of the massive costs associated with risky alcohol use and the fact that certain people do not age out or recover naturally, a number of interventions that target various levels of the social ecological model (McLeroy, Bibeau, Steckler, & Glanz, 1988) have been developed and implemented.

2.3 INTERVENTIONS TO REDUCE RISKY ALCOHOL USE AMONG ADULTS

According to the federal agency SAMHSA, which administers many prevention programs in the United States, interventions to prevent risky substance use fall into two categories, environment and individual (SAMHSA, n.d.). Environmental strategies consist of communication and education, policy adoption, enforcement, and strong collaboration. Individual approaches focus

on helping individuals build knowledge, attitudes, and skills to avoid or reduce risky use. Many individual approaches are classroom-based.

2.3.1 Environmental interventions

The Community Guide is a compilation of health interventions deemed evidence-based by the United States Preventative Services Task Force (USPSTF). With one exception, the alcohol use interventions recommended by the CDC's Community Guide are environmental. Its list of evidence-based interventions to reduce risky alcohol use includes limiting alcohol outlet density, increasing alcohol taxes, limiting hours of sale, and responsible beverage service training.

Although insufficiently evidence-based to meet the USPSTF standards, communication and education campaigns for adults have targeted particularly risky activities with some success, such as alcohol use before driving or during pregnancy (e.g., Lowe, Baxter, Hirokawa, Pearce, & Peterson, 2010; Perkins, Linkenbach, Lewis, & Neighbors, 2010). However, few communication and education efforts have attempted to address the range of risks associated with adults' alcohol use above certain daily and weekly levels (Ontario Agency for Health Protection and Promotion, 2015).

2.3.2 Individual interventions

Because any alcohol use by underage people is considered "risky" by the CDC, prevention of risky alcohol use among youth translates to abstinence-only messages delivered in classroom environments or via communication and education campaigns. An exception to this is the online education module AlcoholEdu, often used by colleges and universities to educate incoming

freshmen. AlcoholEdu encourages abstinence and also offers harm reduction strategies to address risky alcohol use. Its effectiveness is marginal: research shows that AlcoholEdu exposure reduces 30-day alcohol use during the fall semester (but not the following semester) and has no effect on binge-drinking (Paschall, Antin, Ringwalt, & Saltz, 2011).

Although addiction treatment services are available to individuals with severe alcohol use disorders, individual-level options to reduce risky alcohol use among adults consist of variations on one evidence-based practice: a brief intervention. Brief interventions are “practices that aim to investigate a potential problem and motivate an individual to begin to do something about his substance abuse” (Center for Substance Abuse Treatment, 1999). Unsurprisingly, brief interventions are a component of the only individual-level intervention recommended by the CDC’s Community Guide: electronic Screening, Brief Interventions and Referral to Treatment (SBIRT). The United States Preventative Services Task Force (USPSTF) has given SBIRT in primary care a B-level rating as cost-effective population-level strategy for reducing risky alcohol use (USPSTF, 2014). SBIRT carries with it the added benefit of educating healthcare consumers about low-risk drinking guidelines, even if their current use falls outside the criteria for risky use.

Although there is strong evidence supporting screening and brief interventions delivered in various settings, they rarely take place. Neither face-to-face nor electronic SBIRT have been widely implemented in primary care or other health and human service settings (Nilson, 2010). According to the CDC, only about one in six adults talks to his healthcare providers about alcohol use (McKnight-Eily et al., 2014).

2.3.3 Interventions that utilize Health 2.0 principles

Given the working definition of Health 2.0 as an environment where “patients and professionals were seen to collaborate, with patients transforming their role in health care using social networks and access to health information” and where “Web 2.0 is a facilitator...but not a necessity,” it is apparent that few research-based interventions for risky alcohol use utilize Health 2.0 principles.

Some interventions have offered moderate access to health information. E-SBIRT programs that use online screening instruments, provide personalized “brief interventions,” and offer hyperlinks for additional information have certain elements of Health 2.0. Brief interventions delivered via text message have also been developed to reduce risky alcohol use, primarily among young adults, and have shown moderate reductions in risky use (Suffoletto et al., 2014). Text messages can provide patients with useful health information about the consequences of risky alcohol use and utilize mobile technology. However, neither e-SBIRT nor text message interventions approaches the level of collaboration described in the working definition of Health 2.0.

Brief interventions delivered using the principles of Motivational Interviewing (MI) have collaborative elements. MI (Miller & Rollnick, 1991) is an evidence-based approach to helping people resolve their ambivalence and move towards healthy change. A practitioner who uses MI techniques to address risky alcohol use encourages the patient to articulate the personal benefits and drawbacks associated with alcohol use. The practitioner draws out the patient’s specific areas of ambivalence and, through conversation, builds on a patient’s own change talk to support movement through the stages of change (Prochaska & DiClemente, 1983). Elements of MI empower patients and encourage a collaborative approach to health, which fits the description of

Health 2.0. MI techniques form the basis for the brief intervention component of face-to-face SBIRT, which is promising. However, SBIRT has not been widely implemented (McKnight-Eily et al., 2014).

2.4 PODCASTING

2.4.1 Definition

A podcast is an audio program in digital format available to download from the Internet and listen to any time on a personal computer or mobile device (Staff, 2009). The term, coined in 2004 by a journalist writing for *The Guardian* (Hammersley, 2004), was declared the 2005 word of the year by the New Oxford American Dictionary. Podcasting can be considered mobile technology (in that listeners can use portable MP3 players to hear podcasts) and social media (in that it allows for the creation and sharing of user-generated content). According to the Pew Research Center, the synergy between mobile connectivity and social networking is transforming the way Americans convey and consume information (Purcell, 2012). Podcasts sit at that intersection.

2.4.2 Trends in use

The percentage of Internet users that listens to podcasts has grown steadily in the last ten years. According to Pew, more than a quarter of Internet users downloaded a podcast in 2013, up from 21% in 2010 and 7% in 2006 (Zickuhr, 2013). Also in 2013, Apple announced that it had logged

the one billionth podcast subscription from its popular platform, iTunes (Mogg, 2013). Podcast data research firm RawVoice, which tracks 20,000 podcasts, said the number of unique monthly podcast listeners has tripled in five years from 25 million in 2009 to 75 million in 2014 (Kang, 2014). Demographically, podcast listeners are more likely to be male, in their twenties, upper middle class, college-educated, and urban (Zickuhr, 2013) (*see Fig 2.*) However, listeners cross all demographic categories; interestingly, 33% of adult podcast listeners identify as Hispanic. The adoption of podcasts seems to follow the Diffusion of Innovations theory (Everett, 1995), whereby podcast users in 2005 tended to fit demographically with typical “early adopters” of new technology and over the years became more diverse as the technology spread (Avila, 2009).

Demographics of Podcast Listeners			
Among internet users ages 18 and older, the percentage in each group who download or listen to podcasts			
<i>27% of internet users 18+ download or listen to podcasts</i>			
Men	30%	Less than high school	30%
Women	24%	High school grad	18%
		Some college	26%
18-29 year olds	33%	College +	37%
30-49 year olds	29%		
50-64 year olds	24%	Earns less than \$30K/year	20%
65+ year olds	15%	Earns \$30 - 49,999K/year	26%
		Earns \$50 - 74,999K/year	32%
White, Non-Hispanic	26%	Earns \$75K/year +	35%
Black, Non-Hispanic	24%		
Hispanic	33%	Urban	30%
		Suburban	26%
		Rural	24%

Adapted from Zickhur (2013)

Figure 2: Demographics of Podcast Listeners

2.4.3 Health podcasting

Existing health podcasts may be classified into two types, depending on their intended audience: those produced for student or professional education and those produced for popular consumption.

Educational

The majority of published research on podcasting looks at its utility in educational environments for students or professional development. Podcasts have been developed as stand-alone distance education technology (e.g., Bollinger, Supanakorn & Boggs, 2010) and as supplements to traditional classroom education (e.g., Whitney & Pessina, 2008) for medical students, dental students, pharmacy students, nursing students and other future health professionals. Because this thesis examines risky alcohol use among members of the general public, it reviews podcasts created for popular consumption rather than educational podcasts for a (relatively) captive audience.

Popular

The most widely-distributed health podcasts are intended for popular consumption. They are overwhelmingly focused on nutrition and fitness, although a significant number also address sexuality and mental health. To illustrate: in March 2015, the top five podcasts in the iTunes “Health” category were (in order): PODRUNNER: WORKOUT MUSIC, Savage Lovecast (sexual health), YOGAmazing, The Nutrition Diva’s Quick and Dirty Tips for Eating Well & Feeling Fabulous, and 20min Yoga Sessions from YogaDownload.com. The accuracy of many popular health podcasts is unknown, but analyses of health information on YouTube and other platforms that feature user-generated content suggest that a substantial portion of content is misleading and that users may find misleading or erroneous content more engaging (Kumar et

al., 2014; Garg et al., 2015). Popular health podcasts whose content is vetted by experts include podcasts released by government agencies like the CDC and the National Institutes of Health (NIH), podcasts released by academic journals like the *New England Journal of Medicine* and the *Journal of the American Medical Association*, and podcasts released by health centers to educate current and prospective patients (e.g. Moulton, Stephenson, Geddes & Webb, 2009).

2.4.4 What do we know about podcasts to improve health?

Best practices

In 2008, the CDC released Podcasting Best Practices, v. 1.0 for internal and external use. The guidelines are based on the CDC's experience with podcast creation, existing gray literature related to podcasts, and communication theory that guides CDC communication efforts on the whole. They are not necessarily based on scientific evidence from rigorous evaluations of podcast interventions. In summary, the CDC Podcasting guidelines suggest:

- Defining the purpose of the podcast
- Identifying the audience
- Creating audience-centered content
- Thinking carefully about whether to repurpose existing content
- Being brief
- High production quality
- Regular and frequent release
- Cross-marketing via the CDC website and third party sites
- Being complete...but limited

- Creating posting transcripts
- Tailoring content so as to connect with the audience
- Getting audience participation

Science of health podcasting

It is no accident that the CDC Podcasting Best Practices guide is based on so little evidence: there is no science of the use of podcasting to improve public health. Bock (2009) calls this fledgling field the “science of behavior informatics,” defined as “the study of the uses of information and communication technologies by individuals and healthcare providers and the design, implementation, and evaluation of behavior change interventions delivered through these technologies” (p. 377). The problem with an under-developed science of behavior informatics is that quite often the technology drives the intervention (Bock, 2009). An example of this dynamic is the thousands of health-related apps available for download, very few of which are theory-based or formally evaluated.

Theoretical frameworks

Podcasts are beholden to the same theoretical constraints and possibilities as other media for health communications (National Cancer Institute, 2008).

The Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1986) is frequently used to guide health communication strategies. It posits that information is considered by a consumer (i.e., elaborated upon) differently depending on whether it is processed centrally or peripherally. If a person deems a message to be personally relevant and she processes it centrally, she is more likely to evaluate the logic of a given message and if behavior change occurs, it is more likely to last. However, if a message is processed peripherally, a receiver is less likely to pay attention to the strengths and weaknesses of a given argument and more likely to rely on more superficial

“general impressions” of the message. Messages may be tailored toward central and peripheral processors. Moving a person from peripheral to central processing is more likely to lead to sustained behavior change, but this requires time and effort from the receiver. Most of us are peripheral information processors most of the time (Petty & Caccioppo, 1986).

Another theoretical guide to health communications is the communication-persuasion model (McGuire, 1984), which has frequently been applied to public health communication via mass media (*see Fig. 3*).

Steps that individuals must be persuaded to take for messages to have impact

- Exposure
- Attention
- Liking, interest
- Comprehension
- Generating related cognitions
- Acquiring relevant skills
- Agreeing with message position
- Storing change in memory
- Receiving relevant material from memory
- Decision-making using retrieved material
- Acting in accord with decision
- Post-action consolidation of new pattern

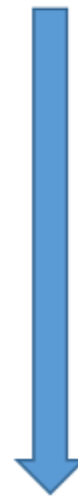
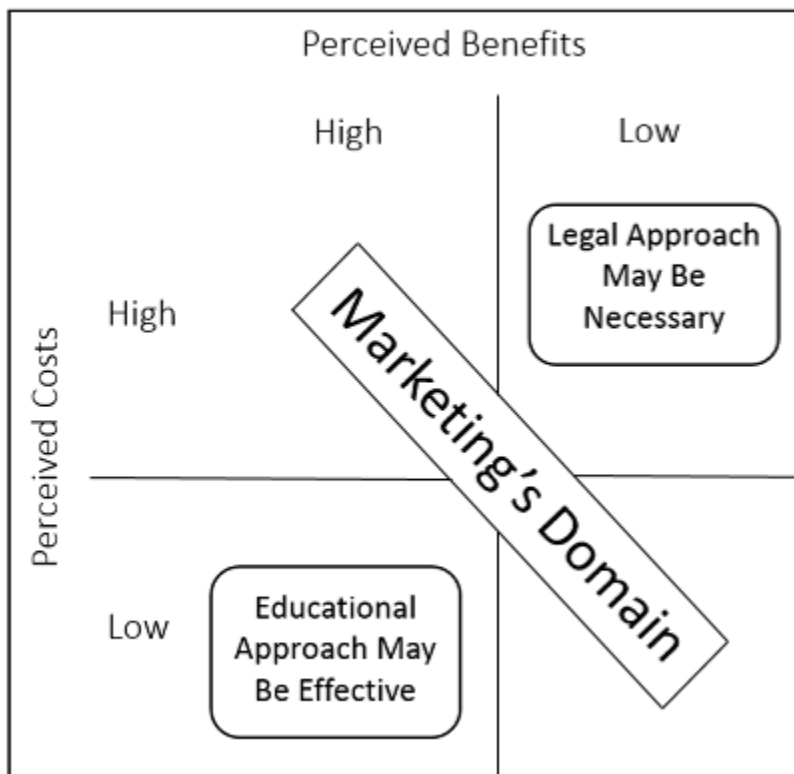


Figure 3: McGuire's Model of Persuasion

Both the ELM and the communication-persuasion model contend that information must be attractive and interesting before it is processed and acted upon, particularly for those recipients who are not aware of the issue or motivated to change behavior. This is especially germane for podcasting because audience members must first choose to listen (and perhaps subscribe to) to a podcast, unlike a Public Service Announcement (PSA) or a billboard.

In the sense that consumers need to be persuaded to “buy” the podcast, terms and strategies from social marketing may also inform the use of podcasts in public health efforts. Social marketing is “a process that applies marketing principles and techniques to create, communicate and deliver value in order to influence target audience behaviors that benefit society as well as the target audience” (Cheng, 2010, p. 2). Rothschild’s Behavior Management Model (*see Fig. 4*) is a rubric that shows when marketing may be particularly helpful in affecting behavior change.



Adapted from Parvanta, 2011

Figure 4: Rothschild's Behavior Management Model

Other theories may help guide the design and evaluation of podcasts for public health purposes. The social ecological model, which illustrates the micro and macro levels that impact

health and health behaviors, is a key consideration in the design of a podcast. The transtheoretical model (Prochaska & Diclemente, 1983) is a versatile model that maps onto various health behavior and health information processing theories (Slater, 2000), which can provide a basis for the choice of more specific theory selection. Social cognitive theory (Bandura, 1986) emphasizes the value of social learning; that is, changes in skill and expectation based on social observation. A communication effort can strive to facilitate social learning with its content (e.g. a soap opera in which a fictitious character negotiates condom usage with her partner, thus teaching audience members the same skill) and by influencing the social environment on the whole (e.g. a person who had seen the soap opera, who now knows more about negotiating condom usage, can share the knowledge with others, model the behavior for others, and lead to a change in social norms).

2.4.5 Reasons to podcast to improve public health, *prima facie*

The advantages of public health podcasting have been widely touted. In 2006, the CDC launched a podcast production and distribution initiative which has resulted in over 2,000 original podcasts (Ha & Myers, 2013). The rationale for podcasting, even in the early days of the technology, was that podcasts can be distributed efficiently at a low cost (Ha & Myers, 2013). In addition to their cost effectiveness, podcasts are uniquely accessible in a number of ways: they require less literacy than text-based resources (Gossey et al., 2011); they are easy to share via social media, websites, and email (Ha & Myers, 2013); and they can be accessed on mobile devices while driving, commuting, exercising, or doing other activities of daily life (Turner-McGrievy et al., 2009). Furthermore, certain features of podcasts align with larger media trends: for example, they are compatible with the public's increased expectation of content on-demand entertainment

(e.g. streaming television shows from Netflix as opposed to watching them at a particular time on a particular day of the week) and they are generally designed for niche audiences, which is a much larger trend in our increasingly fragmented media landscape (Birch, 2010; Tsagkias, Larson, & De Rijke, 2008).

3.0 METHODS

In order to identify publications related to podcasting about alcohol use, a literature search was conducted in January of 2015. Keywords used to search the PubMed database included alcohol, podcasts, substance use, webcasts as topic [MeSH terms], podcasts as topic [MeSH terms], and health literacy. Additional searches were conducted in the databases Google Scholar, Communications and Mass Media Complete, and Scopus. These keywords included podcast, alcohol, evaluation, and health.

Because a relatively small proportion of podcasts are produced for research purposes, the literature review utilized Internet search engines to locate “gray literature,” including reports and papers that were not peer-reviewed and proscriptive guidelines produced by individuals and organizations. Search terms included health, science, podcast, intervention, guidelines, and evaluation.

The publications were screened using the title and abstract of the studies identified during the preliminary review. Based on the abstract review, full text articles were retrieved for full valuation if the title and abstract met the selection criteria.

To meet the inclusion criteria, articles need to be in English, published between 2005 and 2015, and targeting a lay audience population (e.g., patients or the general public.) Articles that specifically described an intervention or evaluation were deemed more relevant and reviewed closely. Articles pertaining to podcasting were deemed more relevant, but those that addressed

other mobile health technology (such as apps and video-streaming) were not excluded. Articles pertaining to health were deemed more relevant, but those that addressed other scientific topics were not excluded.

Articles were excluded if they described podcasts for a student population or a specific professional population. Search results returned some actual podcasts or podcast transcripts, which were excluded. This resulted in 18 articles that met the inclusion criteria.

4.0 RESULTS

Although it would have been ideal to examine alcohol-related podcasts, the literature review yielded no studies particular to that topic. Therefore, abstracts related to health and science podcasts for popular consumption were reviewed for relevance. A total of 18 articles in the academic and gray literature were deemed highly relevant. See Table 1 for a full description of their subject matter and results.

Table 1: Summary of Literature Review Results

Title	Year	Authors	Participants	Comparison	Measured	Theories/ Frameworks	Results
A History and Informal Assessment of the Slacker Astronomy Podcast	2006	Price, A; Gay, P; Searle, T; Brissenden, G	1) 5 listeners for qualitative needs assessment interviews 2) 465 listeners (self-selected) for attitudinal survey 3) 197 listeners (self-selected) for knowledge survey	n/a	1) Attitude 2) Knowledge 3) Level of involvement in astronomy-related issues 4) E-mail responses to the show 5) Online discussions 6) # of downloaded episodes 7) # of subscribers 8) Ranking in Science category on iTunes	1) Bloom's taxonomy for affective goals	Users gained knowledge, had attitudinal shifts that contributed to a learning process.
Podcasting: Contemporary patient education	2007	Abreu, DV; Tamura, TK; Sipp, JA; Keamy Jr., DG; Eavey, RD	n/a	n/a	1) Feasibility of non-expert podcast creation 2) Amount of time to create a podcast 3) Costs of recording and editing equipment	n/a	Each podcast took 6-10 hours to create. Podcasting is an excellent platform for physicians to provide more info to patients. It is inexpensive and requires no formal computer training.

Table 1, continued

RenegadeCast: Evaluating Podcast Social Media as a Health Promotion Tool for Sex Workers & Adult Entertainers with Internet Access	2007	Akers, NM	Individuals who downloaded an episode the podcast, sampling frame was intended to be sex worker or friend of sex worker, n=27	n/a	1) Knowledge of advantages and challenges of collective sex work 2) Confidence in networking with peers	1) Community capacity building 2) Social marketing	Podcast increased knowledge of advantages and challenges in half of respondents. Most said they would be more confident in networking.
Astronomy Cast: Evaluation of a Podcast Audience's Content Needs and Listening Habits	2007	Gay, P; Bemrose-Fetter, R; Bracey, G; & Cain, F	2257 listeners; 23% of the audience during that time period	n/a	1) Listener personal characteristics 2) Attitude toward astronomy 3) Types of other podcasts the audience likes 4) Type of astronomy content interested in	Edutainment	Listeners move from passive to active interest in astronomy. Listeners like podcasts that are under an hour with two hosts and like access to transcripts.
PodCred: A Framework for Analyzing Podcast Preference	2008	Tsagkias, M; Larson, M; Weerkamp, W; de Rijke, M	n/a	n/a	1) Synthesized literature on blog and radio credibility, prescriptive literature on podcasting, and content of prize winning podcasts	n/a	A framework with seven elements that seem to be confirmed by these three data sources.
Pounds off digitally study: a randomized podcasting weight-loss intervention	2009	Turner-McGrievy, GM; Campbell, MK; Tate, DF; Truesdale, KP; Bowling, JM; Crosby, L	Overweight adults (n=78) in NC	Participants were randomly assigned to listen to a theory-based podcast on weight loss or an existing weight loss podcast	1) Weight 2) Food intake 3) Knowledge of weight loss topics 4) Elaboration, 5) User control 6) Cognitive load 7) social cognitive theory constructs 8) Perceptions of the intervention	1) Elaboration likelihood model 2) Social Cognitive Theory	Intervention group had significantly higher levels of weight loss, health food consumption, exercise, weight loss knowledge, elaboration, user control, cognitive load, intervention perception, and # of podcast episodes they listened to.
From pamphlets to podcasts: health information at Great Ormond Street Hospital for Children NHS trust	2009	Moult, B; Stephenson, P; Geddes, N; Webb, J	n/a	n/a	1) Feasibility of producing podcasts as patient education products 2) Cost of podcasting 3) Response to podcasts posted online and in hospital waiting rooms	n/a	One podcast in their series cost about 350 British pounds (\$540 us dollars now). Their "How to give medicines" podcast series won "Most innovative approach to medicines information" in Britain.
Podologues: conversations created by science podcasts	2010	Birch, H and Weitkamp, E	Commenters in discussion forums related to 5 podcasts and listeners of those 5 podcasts (n=10)	n/a	1) Interactivity and discussion among commenters 2) Listener feedback (qualitative)	n/a	Most listeners do not use the podcasts' blogs/forums/websites. Most listeners do have offline conversations about the podcasts with people they know. Listening on-the-go is a barrier to contributions to online forums

Table 1, continued

Caution, The Use of Humor May Lead to Confusion: Evaluation of a Video Podcast of the Midwest Teen Sex Show	2010	Campo, S; Askelson, NM; Spies, EL; Losch, M	Convenience sample (n=41) 18-22 females from college campuses in six focus groups	n/a	1) Response to existing Midwest Teen Sex Show content	1) Edutainment 2) intermedia theory	Humorous parts offended and confused some participants, but even those who were offended were very interested in the Midwest Teen Sex Show website and reported wanting to take action after watching the online video
Are podcasts effective at educating African American men about diabetes?	2012	Johnson J, Ross L, Iwanenko W, Schiffert J, Sen A.	30 inner city AA men	n/a	1) Knowledge based on pre- and post-test scores	n/a	Listeners increased knowledge by 40%
Messaging, music, and mailbags: How technical design and entertainment boost the performance of environmental organizations' podcasts	2012	Waters, RD; Amarkhil, A; Bruun, L; Mathisen, KS	67 environmental organizations' podcasts	n/a	1) Degree to which podcasts were designed according to principles of the PodCred framework 2) Whether adherence to those principles was correlated with popularity	1) Theory of entertainment persuasion 2) PodCred framework	Most of these podcasts were not designed according to the PodCred framework. Of the 7 dimensions in the PodCred framework, inclusion of 3 (content, provision of info about affiliation, and communication style) were correlated with higher popularity on iTunes.
Pilot intervention with adolescents to increase knowledge and consumption of folate-rich foods based on the Health Belief Model	2012	LaBrosse, I; Albrecht, JA	Youth under 18 (n=25) in 2 schools	Non-randomized control group (n=19) of youth under 18 in the same schools	1) Health belief model constructs 2) Knowledge	Health belief model	Post intervention, saw a change in knowledge, self-efficacy, and perceived susceptibility, but not in behavior.
Delivering Health Information via Podcast or Web: Media Effects on Psychosocial and Physiological Responses	2013	Turner-McGrievy, G; Kalyanaraman, S.; Campbell, MC	Undergraduate students 18+; n=40; nearly all white females	Compared listening to a brief podcast about weight loss with browsing a website about weight loss	1) Skin conductance (which indicates emotional response) 2) Perceived user control 3) Perceived novelty 4) Knowledge	User/information control theory	There was a significant relationship between the podcast modality and physiological arousal. Participants reported greater user control for the website and greater perceived novelty for the podcast. There was no difference in knowledge score.
The Sound of Science: An Evaluation of CDC's Podcast Initiative	2013	Ha, QC; Myers, BA	Convenience sample of 166 podcast subscribers and visitors to the podcast webpage	n/a	1) Knowledge gain 2) Intention to apply the knowledge 3) Intention to share the knowledge 4) Intention to share the podcast	n/a	Most respondents said they would use the knowledge to change/reinforce a personal behavior and to share the information they heard.
An Evaluation of a Triple P-Positive Parenting Program Podcast Series	2014	Morawska, A; Tometzki H; Sanders, MR	Parents of children 2-10 y.o. with concerns about children's behavior; n=139, in Australia	Waitlist comparison group (no intervention)	1) Parental perceptions of disruptive behavior in children 2) Parenting style 3) Parental self-efficacy and confidence 4) Participant satisfaction	n/a	Parents in the intervention group had significant reductions in child behavior problems, improvements in parenting styles & self-efficacy/confidence. 76.5 % of parents rated the podcast service as "good" or better on a 7-pt Likert

Table 1, continued

							scale.
The Impact of Grocery Store Podcasts in the Delivery of Nutrition Information to Improve Shopping Behaviors, Particularly the Purchase of Omega-3 Foods [Unpublished Dissertation]	2014	Bangia, D	Pilot had convenience sample at grocery store (n=56) full study had n=340, avg age 49, mostly white women on a grocery shopping trip	Pre-post and then 6-month followup	1) Knowledge of omega-3s 2) Subjective norms 3) Self-efficacy 4) Intention 5) Podcast satisfaction 6) Increased purchase of omega-3 products at 6-month followup	Theory of Reasoned Action	Pilot study (n=56) semi-structured interviews indicated that sound quality needed improvement, participants preferred female narrator and wanted background music. Full study participants showed significant increase in knowledge; liked the podcasts and found them easy to use; seniors enjoyed virtual "companionship" of podcasts. At 6-month followup (n=251), more than half had increased their purchase of omega-3 rich foods
Going Mental: Podcasting, Authenticity, and Artist-Fan Identification on Paul Gilmartin's Mental Illness Happy Hour	2014	Meresko, VM	n/a	n/a	n/a	Rhetorical analysis of three episodes	Gilmartin (and similar podcasters) use podcasts to convey an "authentic self" in direct contrast to the gulf they felt between themselves and the audience when doing standup comedy. Radio and podcasting both privilege intimacy, but podcasting reaches audiences that might evade mainstream radio. he podcast listener relates to the podcast producer on a more intimate level because the listener may feel that the producer is "one of them."
A randomized controlled trial of soap opera videos streamed to smartphones to reduce risk of sexually transmitted human immunodeficiency virus (HIV) in young urban African American women	2013	Jones, R; Hoover, DR; Lacrois, LJ	117 high risk, predominantly African American women living in urban areas of New Jersey	RCT comparing soap opera episodes delivered to mobile phones (weekly) with text messages to mobile phones (weekly)	1) High risk sex 2) Entertainment, personal identification, parasocial interaction and message relevance of the soap opera	1) Sex script theory 2) Entertainment-Education 3) Parasocial interaction	The difference between high risk sex behavior among the two groups was not significant. However, the intervention group evaluated the video as relevant, entertaining, and likely to appeal to their friends. Fewer than one percent missed any of the 12 episodes and the vast majority of the participants wanted the episodes to continue.

4.1 FEASIBILITY

The literature clearly indicates that people without previous experience creating podcasts can learn to create them (Abreu, Tamura, Sipp, Keamy, & Eavey, 2008; Akers, 2007; Meserko, 2014). And podcasts designed for purposes of patient education, for public education, and as specific health interventions have all proven to be cost-effective, as reported in the literature. As an example, the CDC reports that each podcast released costs less than \$600 (Ha & Myers, 2013). Of note is a likely cost increase as distribution broadens. Price et al. (2006) reported hosting and bandwidth costs for the podcast Slacker Astronomy at about \$150 monthly; its distribution at the time was 15,500 weekly listeners. However, compared to a radio spot on light rotation in a smaller market like Kansas City, MO which might cost \$6,000 a week (Ha & Myers, 2013), podcasting is clearly a cost effective option.

Time is money. Despite their low overhead and production costs, podcasts do require time. The amount of time needed to design a podcast varies widely based on its design. Akers (2007) reported that producing a single 35-minute podcast episode for sex workers was “extremely time-consuming.” Her podcast, RenegadeCast, featured interviews and commentary from sex workers, and therefore required direction and coordination of multiple people. She also solicited input from the show’s interview subjects about all aspects of the podcast’s design, undoubtedly increasing the time investment in its production.

Abreu et al. (2007) created a podcast for patients of a pediatric ear and eye infirmary and reported that each episode required six to 10 hours to produce and “requires no formal computer training.” And Price et al. (2006) estimated that their weekly nine-minute scripted podcast on astronomy requires 15 combined person hours per week.

4.2 DESIGN

4.2.1 Theoretical frameworks

Most of the podcast interventions reviewed in the literature did not apply an information processing or health behavior theory to the design of the podcast itself. The strongest evidence for the effectiveness of theory-based podcast design is a relatively small randomized controlled trial (Turner-McGrievy et al., 2009) that tested a theory-based health podcast (Pounds Off Digitally) versus an existing podcast and demonstrated superior effectiveness of the theory-based podcast. Of 66 participants, the intervention group had significantly higher levels of weight loss, health food consumption, exercise, and weight loss knowledge. They also listened to more podcast episodes than the control group.

The information processing theories that the Pounds Off Digitally designers used were Cognitive Load Theory (Paas, Tuovinen, Tabbers, & Van Gerven, 2003), the Elaboration Likelihood Model (Petty & Cacioppo, 1986), and User Control Theory (Eveland & Dunwoody, 2001). The behavioral change theory that underlay the use of the Pounds Off Digitally podcast intervention was Social Cognitive Theory (Bandura, 1986). Specific components of the podcast design mapped onto specific theoretical constructs as follows:

- Cognitive load (Cognitive Load Theory): The use of a similar, predictable structure for each episode
- User control (User Control Theory): The use of podcasting technology in general, to allow for greater user mobility
- Elaboration Likelihood (Elaboration Likelihood Model): The use of personally relevant messages

- Expectation (Social Cognitive Theory): The use of a first-person audio diary of someone trying to lose weight
- Expectancies (Social Cognitive Theory): The use of information on nutrition and exercise to increase the value users place on weight loss
- Self-efficacy (Social Cognitive Theory): The end of the podcast included a goal to achieve; achievement was to increase confidence.
- Behavioral capability (Social Cognitive Theory): Knowledge about how to lose weight presented in multiple formats, including a recurring audio soap opera

A secondary analysis of the 2009 Pounds Off Digitally study (Ko, Turner-McGrievy & Campbell, 2014) looked at which theoretical constructs mediated weight loss among the intervention group. It concluded that Social Cognitive Theory constructs did not mediate behavior change (in the form of weight loss), but that elaboration was the key factor leading to behavior change.

Outside of the Pounds Off Digitally study, there is an absence of theory-based podcasts in the existing literature. And certainly, podcasts that enjoy the widest popularity are not theory based; even among podcasts evaluated in the research literature, the Slacker Astronomy podcast has the biggest audience (15,500 weekly) and was not designed with a basis in behavior change theory.

However, there is certainly value in using a theoretical framework to design a podcast (Ko et al., 2014; Tsagkias et al., 2008). As the makers of the popular Astronomy Cast write, “Because something works does not mean it cannot be improved. Additionally, our success is not necessarily something that can be replicated because we don’t know if the true reasons for our success in the rankings have been identified.” (p. 24)

Understanding the mechanisms and theoretical underpinnings of successful podcast design has the potential not only to improve future podcasts, but to inform the design of other media delivered via various technologies (Bock, 2009). In a commentary on *Pounds Off Digitally*, Bock discussed the value of using a theory-based approach to health communication using new media: "Their research highlights the importance of theory in the design, development, and study of behavioral health and healthcare technology interventions. The development of new technologies is changing the way healthcare can be delivered and received by individuals, but it would be a mistake to allow the technology to drive the science" (p. 78).

4.2.2 Conventions

Information about the conventions of effective public health podcast design is drawn from three types of sources. The first is called PodCred, which is an existing framework developed to gauge a podcast's public appeal (Tsagkias et al., 2008). The second is qualitative and quantitative data about listener preference and other seemingly successful aspects of design in the research literature on health and science podcasting. The third is the CDC Best Practices in Podcasting Guide, which is based on the CDC's experience creating podcasts and conducting public health communication campaigns (CDC, 2008).

The PodCred framework was created by triangulating three data sources: existing literature on credibility among bloggers, proscriptive documents on podcasting, and a content analysis of 19 podcasts who won in each category of the 2007 People's Choice Podcast Awards. The PodCred framework was designed to form a basis for subsequent research on podcast user preferences and intended to be honed to the point of predictive power, which is to say those podcasts that score well on the elements of the framework are likely to be well-liked by the

public. This has two potential benefits: 1) it can improve support for users who are seeking new podcasts (think of the way Netflix suggests movies to its users) and 2) it can mine the podosphere for podcasts which would appeal to users, but have not yet attracted much attention online. The PodCred framework is displayed in Table 2.

Table 2: The PodCred Framework

Podcast Content	Spoken Content	<ul style="list-style-type: none"> Podcast has a strong topical focus Appearance of (multiple) on-topic guests Participation of multiple hosts Use of field reports Contains encyclopedic/factual information Contains discussion/opinions Contains commentary/testimonial Contains recommendations/suggestions Podcaster cites sources
	Content Consistency	<ul style="list-style-type: none"> Podcast maintains its topical focus across episodes Consistency of episode structure Presence/reliability of inter-episode references Episodes are published regularly Episodes maintain a reasonable minimum length
Podcaster	Podcaster Speech	<ul style="list-style-type: none"> Fluency/lack of hesitations Speech rate Articulation/diction Accent
	Podcaster Style	<ul style="list-style-type: none"> Use of conversational style Use of simile Use of complex sentence structure Podcaster shares personal details Use of broad, creative vocabulary Presence of affect Use of invective Use of humor Episodes are succinct
	Podcaster Profile	<ul style="list-style-type: none"> Podcaster eponymous Podcaster credentials Podcaster affiliation Podcaster widely known outside the podosphere
Technical Execution	Production	<ul style="list-style-type: none"> Signature intro/opening jingle Background music (bed) Atmospheric sound/Sound effects Editing effects (e.g., fades, transitions) Studio quality recording/no unintended background noise
	Packaging	<ul style="list-style-type: none"> Feed-level metadata present/complete/accurate (e.g., title, description, copyright) Episode-level metadata present/complete/accurate (e.g., title, date, authors) ID3 tags used Audio available in high quality/multiple qualities Feed has a logo; logo links to homepage Episodes presented with images

Table 2, continued

	Distribution	Simple domain name Distributed via distribution platform Podcast has portal or homepage Reliable downloading
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The literature search identified only one subsequent evaluation of podcast preference using the PodCred framework that provides insight into the framework’s accuracy. A 2012 analysis of 67 environmental podcasts using the PodCred framework (Waters, Amarkhil, Bruun, & Mathisen, 2012) found that only three elements—podcast content, provision of information about organizational affiliation, and communication style—were correlated with podcasts’ higher popularity on iTunes. It is possible that dimensions of the PodCred framework that were not correlated with popularity on iTunes are not the result of the framework’s weakness; rather, that the 67 environmental podcasts in the study were popular despite not aligning with the criteria in the PodCred framework. This was the conclusion of the study authors, who asserted that the “organizations are only moderately incorporating elements of entertainment persuasion into their environmental podcasts, which limited their audiences’ ability to remember and recall key messages” (p. 67). Further research on the PodCred framework will illuminate its utility in podcast design and evaluation.

Although most podcast projects reported in the literature were not designed with a basis in health communication or health behavior theory, a number of researchers succeeded in gathering qualitative data about listener preference in the course of evaluating their podcasts.

Sound quality was critical to listeners (Bangia & Palmer-Keenan, 2014) (Akers, 2007). This is consistent with recommendations from the CDC best practices guide to podcasting: “Listeners simply will not continue listening to a poorly-recorded podcast” (CDC, 2008). Evidence also suggests that audience members prefer when podcasts incorporate music (Bangia, 2014; Akers, 2007; Tsagkias et al., 2008).

Price et al (2006) reported that their original episode *length*--five minutes--was judged to be too short by their audience; as a result, they lengthened each episode to around nine minutes. In a survey with a relatively high response rate (n=2,257) Astronomy Cast producers asked listeners about their content preferences for Astronomy Cast and their top 10 other favorite science podcasts. Results indicated that listeners preferred podcasts under one hour. More important than length may be the focus on one topic (Waters et al, 2012; Tsagkias et al, 2008), which prevents audience members from becoming confused by the message.

Based on a listener survey, Gay et al. (2007) postulated that the ideal astronomy podcast *structure* would be less than an hour, have two hosts, and incorporate five minutes of news, interviews with real scientists, and information about one celestial topic. Their listeners strongly preferred discussion and interviews to listener call-in formats. The Pounds Off Digitally podcast on diet and exercise was designed specifically with a formulaic structure to reduce cognitive load allow listeners to more easily absorb the podcast's message. This strategy was affirmed by a subsequent analysis by Ko et al. (2014) which showed that lower cognitive load mediated higher elaboration, which in turn mediated weight loss.

Including *transcripts* may be useful to listeners. The Slacker Astronomy podcast is designed to be casual and conversational, but the vast majority of its content is carefully scripted. These scripts are available on their website to complement the audio file. The CDC suggests that transcript production is "more than a Section 508 requirement" (2008); the CDC reports that more transcripts are downloaded than audio files, and by different users, suggesting that publishing a written transcript may widen a podcast's reach. People with limited English proficiency may prefer to read transcripts rather than listen to the podcast or they may use the transcript to supplement their audio experience (Gay et al., 2007). Making a transcript available

may also broaden access to individuals with low technological skill levels or unreliable Internet connections, for whom downloading digital audio files is challenging, but reading transcripts is possible (Gay et al., 2007).

Podcast producers may benefit from *cross-promotion within the podosphere*. The makers of the Slacker Astronomy podcast attribute its out-of-the-gate success to an unsolicited positive review from an established, well-known podcast host, which increased their listenership more than tenfold within a week. This strategy has been effective for comedian-turned-podcaster Paul Gilmartin, who hosts The Mental Illness Happy Hour. Gilmartin belongs to a community of podcasters that co-promote one another and appear as guests on each other's shows (Meserko, 2014).

Podcasts need to have an *entertainment component*. One of the advantages of podcasting to reach people is that users access podcasts on-demand, which means that you don't need to pay for advertising time and that you know more about who is exposed to the message (Ha & Myers, 2013). Because of their on-demand nature, podcasts need a certain amount of listener appeal (Tsigkias et al., 2008). In the Astronomy Cast podcast, creators Gay et al (2007) refer to seeking listener appeal as "extreme public outreach" or EPO, stating that "people working on extreme public outreach--EPO that is more 'edutainment' than education--must find out what is interesting to Joe Public, and use those interests to lure Joe into learning" (p. 24).

Tsigkias et al., who authored the PodCred framework (2008), researched the attributes of credible online voices, primarily bloggers, and determined that the key components for credibility are expertise and trustworthiness. In the case of podcasts, they argued, another factor should be included: "acceptability." They argue that "If podcasts are a pastime, concerns in addition to strict information reliability must enter into listener podcast choices...the desirability

or listener-appeal of a podcast arising from factors other than the believability of its propositional or declarative content.”

Narrative elements can contribute to the entertainment value of a podcast. An evaluation of a podcast called Love, Sex and Choices (Jones, Hoover & Lacroix, 2013) that used soap operas to reduce HIV-risk behaviors among urban women of color showed that listeners found the stories entertaining, identified with the characters, thought their friends would like the podcast, and wanted the stories to continue. The Pounds Off Digitally podcast also used a soap opera component based on Social Learning Theory, which contributed to greater participant recall (Turner-McGrievy et al, 2009).

Humor is a well-known approach to increasing listener appeal in health messages. In Tsagkias et al.’s 2008 analysis of the 19 winning podcasts at the 2007 People’s Choice Podcast Awards, 10 had a humorous component. In a series of focus groups with representatives from the target audience, Campo et al. (2010) found that humor in a podcast about sexual health made messages more memorable, provoked a desire to take action and seek more information and, for some women, made uncomfortable topics less uncomfortable. Although some focus group participants found the humorous parts offensive, most still expressed eagerness to visit the podcast’s website and to share information with their peers. Price et al. (2006) postulated that Slacker Astronomy’s levity is balanced by a respect for the audience’s intelligence and curiosity, which they described as ”heavy on the cheese, heavy on the science.”

Podcasts may be particularly good vehicles for *emotional intimacy and disclosure*. Podcasts provoke more emotional responses than written information on a website, as revealed by sensors measuring physiological arousal on research subjects who listened to a podcast on weight loss compared to those who read a website with the same information posted (Turner-

McGrievy, Kalyanaraman, & Campbell, 2013). The use of headphones, in particular, may more deeply submerge the listener into the media, including its emotionality (Kallinen & Ravaja, 2007). A handful of popular podcasts by standup comedians illustrates the nature of podcasting as intimate, authentic, and revealing. The Mental Illness Happy Hour, which has over a million listeners (Meresko, 2014), is hosted by comedian Paul Gilmartin, who drops his “stage persona” and enacts his “true self,” encouraging guests and listeners to engage in self-disclosure about mental health, compulsive behaviors, and other private topics. Podcasts have a particularly authentic quality because they retain certain aspects of radio (private consumption, intimacy), but defy the traditional logic of “top down” broadcasting, whereby large media companies produce and members of the public consume. The community of comedians who produce personally-themed podcasts (e.g., Marc Maron, Paul Gilmartin, Pete Holmes) tend to produce them with free software out of their homes or offices, making them, even more so than radio personalities, “one of us” (Meresko, 2014).

4.3 EVALUATION STRATEGIES

4.3.1 Theoretical frameworks

As with podcast design, most of the podcast interventions reported in the literature did not include a theory-based evaluation, even if there was an evaluation component to the project. And although podcast exposure did lead to behavior change in some cases, theoretical frameworks to evaluate a podcast’s ability to effect behavior change have not fit very well. A number of factors contribute to any study’s choice of theoretical framework, including the

behavior change itself, characteristics of the target population such as their readiness to change, and the nature of the intervention (Green, 2000). Therefore, theories that have been used in the past to evaluate podcast interventions should not necessarily dictate the theoretical underpinnings of future evaluations of podcast interventions.

The evaluation of the weight-loss podcast *Pounds Off Digitally* podcast (Turner-McGrievy et al., 2009) measured constructs of several information processing theories but ultimately presumed that behavior change would occur according to the principles of the Social Cognitive Theory. In fact, although participants did lose weight, behavior change was primarily mediated by elaboration, i.e., the degree to which a user thought about the information in the podcast (Ko et al., 2014). Information-processing theories are primarily about learning rather than behavior change, and the finding that elaboration mediated weight loss led researchers to postulate that there may be more to learn about the relationship between information processing and Social Cognitive Theory. It is also possible that the elements of the *Pounds Off Digitally* podcast intended to address the Social Cognitive Theory constructs were not effective or that the evaluation of their effects (assessed with one question per construct) were not sufficiently sensitive (Turner-McGrievy et al., 2009).

Bangia (2014) designed an evaluation of his podcast about the importance of omega-3 fatty acid consumption using the constructs of the Theory of Reasoned Action (TRA) (Ajzen, 1988). The TRA states that an individual's intentions predict behavior change, in addition to the individual's perceived behavioral control (including self-efficacy), perception of social norms, and motivation based on his perceived importance of the behavior change. Although Bangia (2014) documented behavior change among study subjects after podcast exposure and at six month follow-up, measurement of the TRA's constructs using survey questions did not indicate

that the mechanisms of behavior change fit the TRA. One reason that the TRA did not describe the podcast's effect on participants' omega-3 fatty acid consumption may be that the TRA tends to be more useful when an individual perceives costs and benefits associated with a particular behavior change rather than measuring the effects of gains in knowledge among participants in the precontemplation stage (Slater, 2000).

4.3.2 Evaluation measures and instruments

Knowledge, attitudes, and information-processing

Published evaluations of podcasts frequently measured changes in knowledge. Knowledge gain was typically measured using written responses to survey or quiz instruments.

To evaluate what they called “retainment of facts,” the makers of Slacker Astronomy created four-question surveys about a particular show that had aired within the last month. Three of the questions were multiple choice “science facts” questions; the fourth was a free response question that asked respondents to describe a particular idea or phenomenon from a past episode. To evaluate the podcast's impact on knowledge, survey respondents were organized into two groups—members of their podcast audience who had listened to the particular episode (the intervention group) and members of their podcast audience who had not (the control group)—and their quiz scores were compared. Similarly, to evaluate an intervention where high schoolers produced and listened to peers' podcasts on the benefits of folate consumption, LaBrosse and Albrecht (2013) measured folate knowledge using a folate knowledge quiz posted on the CDC website before the intervention and then 12 weeks later, at the conclusion of the intervention. To evaluate a 14-minute CDC-produced podcast's impact on a sample (n=30) of African American

men's knowledge of diabetes, Johnson et al. (2012) conducted pre- and post-tests with a 15-item knowledge index.

The approach to measuring knowledge gain from the Slacker Astronomy and folate podcasts has the benefit of measuring delayed recall (participants could have heard the show up to a month before completing the quiz), while the evaluation of the CDC diabetes podcast tested only knowledge gained immediately after exposure to the intervention. However, respondents to the Slacker Astronomy survey could “cheat” by referring to an outside resource while taking the quiz, whereas participants in the diabetes study were restricted from seeking information elsewhere. Students in the folate consumption intervention could not cheat, as the quizzes were administered using paper and pencil in their classrooms. Using an online survey, Akers (2007) evaluated knowledge gain by asking respondents a single open-ended question what they learned from the podcast that is useful to them in their work.

Researchers also measured attitudinal changes associated with podcast exposure. A key attitudinal construct in a number of behavior change theories is self-efficacy, which Morawska, Tometzki, and Sanders (2014) measured among 100 parents (45 who were exposed to a podcast on parenting children with disruptive behavior and 55 members of a waitlisted group serving as a control) using the Child Adjustment and Parent Efficacy Scale (CAPES). Price et al., (2006) designed one portion of their evaluation of Slacker Astronomy according to Bloom's Taxonomy for Affective Goals (Bloom, 1956), a scale used primarily in the field of education to categorize an individual's emotional investment in the subject he or she is learning (*see Fig. 5*).

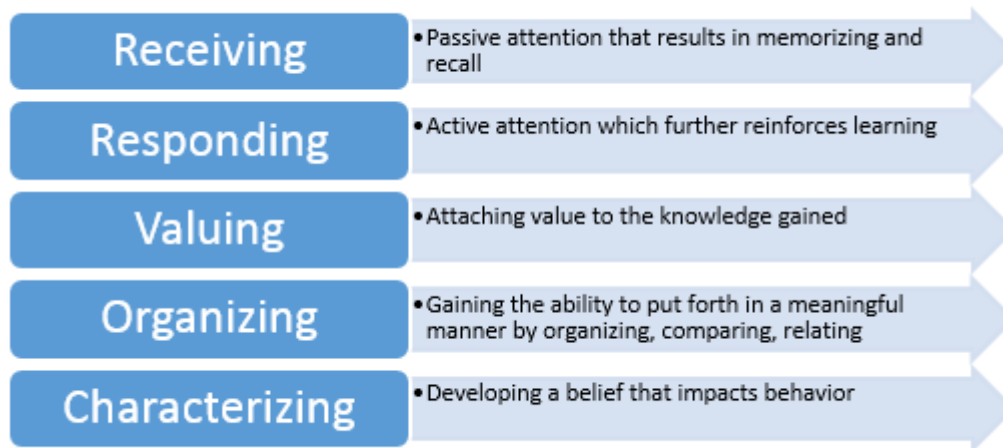


Figure 5: Bloom's Taxonomy for Affective Goals

Overall, Price et al. (2006) concluded that the Slacker Astronomy podcast was impacting the lower three domains of the taxonomy (receiving, responding and valuing) and that the future focus for the podcast would be on the deepest levels of affective learning, which are organization and characterization of value set. They did not use a validated survey instrument, but constructed their survey questions according to the principles of Bloom's Taxonomy for Affective Goals, which in turn yielded an average response score for each level of the model. For example, the question "The scripts are easy to understand" addressed the first level of Bloom's Taxonomy for Affective Goals (receiving), whereas the question, "I invest more time in astronomy activities than I did before listening to the Slacker Astronomer" applied to the fifth level of the Taxonomy, characterization of value set.

Some evaluations measured not only changes in knowledge and attitudes, but also constructs of various models of information-processing. That is to say, some podcast evaluations were concerned not only with whether these changes occurred, but also with *how* they occurred.

Turner-McGrievy et al. (2009) measured participants' change in knowledge about weight loss strategies, but also measured their cognitive load (the amount of mental effort required to listen to the podcast) and elaboration (the amount participants considered the information) as it related to knowledge gain and behavior change. These domains were measured with several survey instruments that used a 7-point Likert scale. The intervention group (exposed to a theory-based podcast about weight-loss) reported higher levels of elaboration and lower cognitive load, which in turn was correlated with weight loss. In a more recent study, Turner-McGrievy et al. (2013) measured emotional arousal among participants who listened to a podcast about weight loss compared with a control group that looked at a website with the same information. Participants gained the same level of knowledge, but podcasts generated a greater degree of emotional arousal, as indicated by sensors placed on their skin to measure conductance. This objective biomarker suggests indicates that the mechanism by which podcasts contribute to knowledge acquisition may operate more on an emotional level than other health communication modalities.

Behavior change

Evaluations of the effects of podcast exposure have also measured behavior change. This literature review showed that podcast exposure may be associated with self-reported changes in diet (Turner-McGrievy, 2009; Bangia, 2014), exercise (Turner-McGrievy, 2009), and parenting practices (Morawska et al., 2014). However, not only have researchers measured changes in specific health behaviors, they have also measured the extent to which podcast listeners are driven to engage in conversation, share information, and seek more information as the result of podcast exposure.

In the only published evaluation of the CDC’s podcast initiative, Ha and Myers (2013) aimed to determine what consumers do with information from podcasts. Several portions of their survey evaluation addressed sharing information with others. This included questions about changing personal behavior, helping someone else adopt a positive health behavior, sharing information from a CDC podcast, or forwarding the podcast link to another person. In an evaluation of the Teen Midwest Sex Show podcast, Campo, Askelson, Spies, and Losch (2010) found that most participants in a focus group who had been exposed to the podcast reported an intention to talk to others about the overall message of the program.

To assess the role of science podcasts in stimulating discussions (which they term “podologues”), Birch and Weitkamp (2010) analyzed the amount, type, and content of integrated online discussion forums, which included the podcasts’ associated website and other online forums where the podcasts of interest were discussed.

In an evaluation of the Astronomy Cast podcast, Gay et al. (2007) took an interest in the movement from “passive content acquisition” to “active content acquisition” associated with podcast exposure. To assess this change, they asked current listeners to respond to the following statements about their content acquisition before and after they began tuning in to Astronomy Cast:

- I knew how to spell astronomy
- I thought it was neat when I was a kid
- I will pay attention if it crops up in something I already read/watch/listen to
- I actively seek and read/watch/listen to stories about astronomy
- I am an amateur astronomer and/or go to local astronomy club meetings
- I am a professional astronomer or astronomy major in college

The first three items were designed to assess passive content acquisition and the last three, active content acquisition.

Listener preference and satisfaction

Finally, podcast evaluations commonly measured listener preference and satisfaction. Although rarely were these the sole metric for podcast evaluation, it lent insight both into audience members level of satisfaction with particular podcasts and into their general preferences with regards to topic and design. Evaluation took the form of survey questions about customer satisfaction (Morawska et al., 2014; Price et al., 2006; Akers, 2007), interviews about how the podcast could be improved (Bangia, 2014), requests for lists of other podcasts listeners regularly seek out (Gay et al., 2007), questions about how easy the podcast's website was to navigate (Ha & Myers, 2013), and quantitative analytics such as how often the podcast had been downloaded (Price et al., 2006).

4.3.3 Evaluation methods: Pros, cons, lessons learned

Effectiveness versus efficacy

Peer-reviewed articles and gray literature in this review rarely distinguished between efficacy and effectiveness evaluation. An efficacy study is designed to evaluate the intervention under optimum conditions, whereas an effectiveness study evaluates the effects of the intervention under real-world conditions (Evans, Uhrig, Davis & McCormack, 2009). Efficacy studies are particularly helpful for the process of message development. Importantly, without knowledge of a message's efficacy, the results of effectiveness studies in the real world may be difficult to interpret. The 2009 randomized controlled trial of Pounds Off Digitally was an efficacy study: its

participants were randomized and researchers had a high level of control over message exposure. The 2006 evaluation of the Slacker Astronomy podcast was an effectiveness study: its participants were selected non-randomly from its existing audience and the researchers had little control over the audience's exposure to the intervention. As is often the case, the effectiveness evaluation of the Slacker Astronomy podcast relied more heavily on self-report than the efficacy evaluation of Pounds Off Digitally (Evans et al., 2009).

There are strengths and weaknesses to evaluating an intervention's efficacy and its effectiveness. Efficacy evaluations often have higher internal validity, but are less generalizable. Effectiveness interventions have lower internal validity but enable researchers to measure a message's success in a real-world environment and estimate campaign awareness and exposure. As Evans et al. (2009) point out, these two types of evaluation are not absolutely delineated; there may be overlap between them.

Different measures and instruments are more or less conducive to efficacy and effectiveness evaluations. Some of these measures and instruments are detailed below. Note that online surveys, for example, may be administered in both efficacy and effectiveness studies. Podcast exposure's influence on skin conductance (which requires a special instrument for measurement) is likely to be a measure of efficacy. Finally, the extent to which podcast exposure births online discussion is likely to be a measure of effectiveness.

Online surveys

Online surveys were the most common strategy for evaluating podcasts. However, the reviewed literature shows that response rates to online surveys were notoriously low and far from representative. As an example, although the makers of Slacker Astronomy had around 15,500

weekly listeners, they received only 465 responses to an online survey posted for a month (Price et al., 2006). This suggests that reaching a critical mass of listeners may be important before undergoing a survey-based evaluation.

Several researchers proposed ideas for improving online survey response rates. Compellingly, the Astronomy Cast was able to get 23% of its weekly listeners to respond to an online survey using the incentive of “hidden content.” Study authors strongly recommended the use of hidden content to incentivize survey participation, with the caveat that respondents should be given the option of “prefer not to respond” to all questions. The lure of “hidden content,” they reported, accounted for their much higher response rate than the evaluation of Slacker Astronomy, which used the opportunity to win a gift certificate as an incentive. Akers (2007) speculated that her survey response rate might have been improved by offering incentives, shortening the survey, or lengthening the evaluation period (her online survey was posted for three weeks). Ha and Myers (2013) distributed two surveys, one longer and one abbreviated, to gauge the effect of the survey length on response rate. The abbreviated survey received nearly twice as many responses.

Skin conductance

Measuring skin conductance to gauge physiological arousal is a unique approach to podcast evaluation, with built-in advantages and limitations. As Turner-McGrievy et al. (2013) note, skin conductance is an objective measure that can be used continuously during a user’s information processing experience, as opposed to a simple pre- and post-test, which measure discrete moments. However, skin conductance does not indicate how the person feels, just *that* he feels. Additionally, the relationship between skin conductance and information-processing is not firmly established in the research literature. And there is certainly very limited evidence of

the relationship between skin conductance and behavior change. Furthermore, skin conductance cannot be measured in an observational study of remote users; it requires participants to listen to the podcast in a contrived laboratory setting.

Online podologue content

A number of podcast evaluations opted to measure information-sharing and conversation generation among listeners. Some relied on self-reported intentions, e.g., survey questions asking whether the participant expected to share content from the podcast. Measuring information sharing and conversations generated as the result of podcast exposure is simpler and more objective for online conversations than for offline conversations. However, due to the mobile nature of podcast listening, many users do not even visit the website or associated online forum of a podcast, which means that measurement of public online conversations shows a partial story (Birch & Weitkamp, 2010). Furthermore, Waters et al. (2012) found that few popular podcasts explicitly try to build online conversations among listeners and particularly between the podcast producers and its audience. This further suggests that an analysis of online conversations will yield limited information, as listeners are rarely informed about or encouraged to post in forums. In qualitative interviews with ten scientist podcast listeners, all respondents claimed that the podcasts led to offline conversations “in the real world,” whereas half never contributed to an online forum and only half only occasionally did (Birch & Weitkamp, 2010).

5.0 DISCUSSION

5.1 WHY DOES PRODUCING EFFECTIVE PODCASTS MATTER?

Podcasts present fruitful opportunities for improving public health because the production technology is so simple and so cheap. But although the feasibility of producing podcasts to address public health issues has been confirmed, the question is how to make them good. And furthermore, the question is, what does it mean for them to be “good”?

There are two primary components of a “good” podcast, which is that it is a) potentially efficacious, which is to say, based on formative research and b) satisfying to the listener. Podcasts do not reach a captive audience. They have to sell themselves. Popular podcasts will continue to provide ongoing examples of new, interesting ways of engaging an audience. The podosphere is a rich, ever-expanding media environment from which public health practitioners can continue to learn entertainment strategies.

There is an ethical imperative to learning how to produce good podcasts. For one, podcasts require a modest financial investment and a sometimes-significant investment of time. In an environment with limited resources, public health practitioners are responsible for creating ever-more effective interventions. Many have noted that the business of public health is to constantly redefine the unacceptable—we no longer tolerate the number of deaths from infectious disease that we did 100 years ago, for example. The development of public health

interventions, specifically in the area of health communications, should adhere to that same standard. As the media environment changes and as marketing research evolves, public health communications must deem what-has-always-been-done to be hereto forth unacceptable.

Another reason to improve the quality of public health podcasts is encapsulated by Claudia Parvanta's (2011) contention "If McDonalds has a Facebook profile page, public health campaigns should have a page too" (p. 205). A 2015 analysis of the 70 most popular YouTube videos featuring alcohol revealed that those videos that are most widely viewed and "liked" by online audiences associate alcohol with humor and attractiveness and "infrequently depict negative clinical outcomes" (Primack, Colditz, Pang, & Jackson, 2015, p. 496). In short: health-related topics are being discussed on new media. Alcohol companies advertise using both traditional and new media. Peers share information using new media. Producing good public health podcasts is one important and certainly feasible way of connecting with audiences and sharing accurate information in a Health 2.0 environment.

5.2 DESIGNING AN EFFECTIVE PODCAST ABOUT ALCOHOL USE

The PodCred framework, although developed several years ago, is the most research-based guide to podcast creation that this literature review unearthed. Furthermore, consistent with principles of social marketing and the nature of podcasts (which people must choose to access), the PodCred framework is derived from podcasts that received "People's Choice Awards," which means their structure and content appealed to listeners. Using the PodCred framework to design a podcast is simple because it takes the form of a checklist.

Another feature of podcast design is the use of entertainment, particularly narrative. This literature review included two podcast evaluations that suggested the narrative element was appreciated by audiences, even if it did not lead immediately to behavior change. The Sex, Love, and Choices podcast, (Jones et al., 2013) which was delivered to women at high risk of contracting HIV, consisted of a soap opera with weekly installments. Even though the podcast did not lead directly to a reduction in high risk sex behavior, 115 out of 117 participants watched every episode of the podcast and almost 100% of them reported that they wanted the stories to continue. Even more compelling is the response of the focus group participants to the Midwest Teen Sex Show (Campo et al., 2010), which also included narrative elements. Even those focus group respondents who found the podcast content to be offensive said they would be likely to recommend it to their friends. These results are testament to the power of narrative in health podcasting.

The DSM-5 criteria for alcohol use disorders may provide a jumping-off point for creating alcohol-related narratives. Although the goal of a podcast about alcohol use may be to affect knowledge, attitudes and behavior related to risky alcohol use (i.e., drinking outside the NIAAA daily and weekly drinking limits) as opposed to alcohol use disorders, the DSM criteria are clearly a much richer source of stories than the low-risk drinking limits. The DSM criteria include personally-relevant details such as alcohol's effect on relationships and whether an individual has made continued unsuccessful attempts to cut back. The Pounds Off Digitally study on podcasting for weight loss specifically used personally relevant details to promote users' elaboration. Study results showed that elaboration was the single factor that led most often to weight loss behavior. Therefore, choosing narratives that encourage listeners to identify similar

issues in their own lives is likely to improve a podcast about alcohol use. The DSM-V criteria may be a place to start.

Finally, a podcast about alcohol use can capitalize on the way podcasts privilege intimacy and disclosure. Discussions about personal substance use tend to be stigmatized (Room, 2005), so an effective podcast about alcohol use may be able to broach issues that are not well-suited for billboards or waiting room brochures.

On a more technical level, an effective podcast about alcohol will also have high sound quality and produce transcripts to accompany the audio file.

5.2.1 A sample podcast episode designed to address alcohol use

Although the literature review did not yield information on efficacious messages delivered by podcast to address risky alcohol use, it did yield information other specific podcast design elements with a basis in research. Based on the literature review, below is a description of a sample podcast episode about alcohol use.

In accordance with the PodCred Framework, the episode would have a similar structure to the episodes that preceded it. As in previous episodes, it would begin with predictable theme music and one or two hosts who possess exceptional verbal acumen would discuss factual information and express opinions related to alcohol use and health. From there, the hosts would cut to a series of stories based on one criterion of the DSM-V alcohol use disorder.

One criterion is “persistent, unsuccessful attempts to cut back.” Many Americans have health conditions that are exacerbated by alcohol use, such as diabetes or hypertension. Other Americans find that consuming alcohol sabotages smoking cessation attempts. A collection of first-person stories would examine the ambivalence that produces “persistent, unsuccessful

attempts to cut back.” Storytellers with health conditions that are worsened by alcohol use would share intimate details about their difficulty untangling alcohol from their lives. For example, storytellers would address alcohol use in their families, alcohol use among their friends, alcohol use and its relationship to sexuality, and the ways that alcohol use affects physiological functions. Throughout, the podcast would acknowledge that alcohol use is a personal choice that is heavily influenced by social and physical environments. Particularly through the use of humor, it would acknowledge the benefits that the storytellers perceive from their alcohol use, not just the harms.

These narratives would naturally include examples of barriers and facilitators to reducing alcohol use. In the conclusion of the episode, the hosts would briefly reinforce these tips, offering the audience health information that may increase the listeners’ sense of health empowerment, in accordance with the principles of Health 2.0.

5.3 EFFECTIVE EVALUATION OF A PODCAST ABOUT ALCOHOL USE

Evaluation of any public health intervention should be an integral part of the project rather than an afterthought. Evaluation of an intervention involving podcasting should be tied to the podcast’s intended impact on the social ecological model. Does it aim to impact the individual or does it aim to make change at the interpersonal and social level? This goal will define whether the evaluation measures individual knowledge gain, attitude shift, and behavior change, or whether it will focus on information-sharing and conversation generation.

Specific outcomes that might be measured are a) the movement from passive to active information-acquisition, and b) the generation of online and offline “podologues,” i.e.,

conversations generated by the podcast. Measurement of passive and active information-seeking might take the lead of the Astronomy Cast evaluation (2007), which devised a series of questions to determine audience members' interest in astronomy before and after they began listening to the podcast. And measuring "podologues" could be informed by the strategies that Ha and Myers (2013) took in their evaluation of the CDC's Podcast Initiative, which is to ask respondents about their intention to share information gleaned from the podcasts with others. Birch and Weitkamp (2010) used another research method to evaluate podologues, which was to measure dialogue generated in forums and websites. Any evaluation of podologues should be mindful of the limitations of measuring online conversation because research shows that many podcast listeners do not venture online to participate in dialogue there.

In the realm of podcasting, customer satisfaction is an integral, make-or-break aspect of the effectiveness of the intervention and should be evaluated on an ongoing basis. In McGuire's model of persuasion (McGuire, 1984), the first step is called "tuning in," and any subsequent change in knowledge, attitude and behavior relies on an audience member having tuned in. For each podcast to have any chance of improving public health, the audience must choose to tune in. An evaluation should therefore include an aspect of the user's satisfaction with the podcast itself and may be accompanied by questions about other podcasts that the users enjoy or suggestions to improve the podcast, which may inform the design of future episodes.

Another way to measure customer satisfaction is by measuring the podcast's number of subscribers and downloads. These metrics are particularly important at the outset of the podcast's launch. Without a community of listeners, it will be very difficult to conduct any additional evaluation of the effectiveness of the podcast. Even among podcasts with thousands of weekly downloads, coaxing listeners to respond to online surveys can be difficult.

There are limitations to evaluating the effectiveness of podcasts. It may seem easier to determine whether an individual has been exposed to a podcast than a radio PSA because analytics reveal whether a podcast was downloaded, but many podcasts are downloaded and not listened to (Avila, 2009). Most approaches to podcast evaluation in this literature review have incorporated the use of online surveys. The most effective strategy for increasing response rate that was reported in the literature was the tack taken by Gay et al. (2007): using access to hidden content as an incentive to respond to the online survey. This strategy is worth trying, although it reinforces the importance of building a satisfied customer base that finds the podcast entertaining and engaging. To determine the extent that the length of the survey is a barrier to a decent response rate, podcast evaluators could follow the lead of Ha and Myers (2013), who designed an abbreviated survey in addition to a longer one. Their response rate to the abbreviated survey (which skipped questions about demographics) was twice as high as the longer one.

Finally, an evaluation of a podcast about alcohol use can also incorporate an evaluation of the PodCred framework itself. For example, an evaluation could look at whichever elements of the PodCred framework were incorporated into the podcast's design and report survey respondents' satisfaction with those elements in the podcast. The authors of the PodCred framework hoped that it would one day have predictive value and help locate high-quality podcasts in the ever-growing podosphere. This makes sense. Most people in the podosphere are amateurs, which makes the quality of podcasts uneven on the whole (Tsagkias et al., 2008). It is worthwhile to contribute to a body of research that could someday help guide users through the saturated online media environment to locate new, high-quality podcasts on issues that pique their interest and may improve their health.

6.0 CONCLUSION

Alcohol-related harms are significant and costly. This thesis reviewed existing literature about podcasting to determine what the design and evaluation of an effective podcast about alcohol use would look like.

Background research revealed that most of the alcohol use interventions recommended by the CDC's Community Guide are environmental; few evidence-based approaches attempt to address alcohol use on an individual or interpersonal level. New media may offer opportunities for alcohol use interventions that impact the individual and social level of the social ecological model. As Health 2.0 becomes more culturally ingrained, members of the public will expect access to information about alcohol use, desire more empowerment with regard to alcohol use behavior, and seek a collaborative relationship with their healthcare providers in addressing personal choices around alcohol. Although taxes and outlet regulation are powerful public health interventions, individual and interpersonal interventions are less paternalistic approaches to reducing the public health impact of alcohol use. The use of brief interventions is an evidence-based approach to alcohol use with Health 2.0 components, but brief interventions are not widely implemented.

Podcasts' popularity has steadily grown in the decade since their invention; now, over one quarter of Internet users downloads or listens to podcasts. Podcasts are feasible for non-specialists to produce and cost-effective when compared to traditional media channels. There are

no geographic limits to their reach: they can be distributed and shared to anyone who has access to the Internet. Although the *prima facie* advantages to podcasting about alcohol use are clear, there is still much to learn about doing it well.

This literature review concluded that there is an absence of formative research about efficacious design for a podcast focused on alcohol use. Some lessons have been learned in the course of creating health- and science-focused podcasts. For example, we know that podcasts privilege intimate disclosure and storytelling; customer satisfaction is a key ingredient to an effective podcast; and evaluation of podcast effectiveness can focus on the individual or interpersonal level (or both).

Without formative research about messaging and efficacy, a successful podcast about alcohol use will, at best, leave its designers with the same questions that the makers of the Astronomy Cast podcast had: “Our success is not necessarily something that can be replicated because we don’t know if the true reasons for our success in the rankings have been identified” (Gay et al., 2007, p. 24). Once research on efficacious messaging for a target population has been conducted, a podcast about alcohol use can be distributed widely and, in the course of distribution, its effectiveness measured. This literature review offers a number of strategies for the initial design of an efficacious podcast and a number of evaluation strategies to measure both its efficacy and its effectiveness in the real world.

6.1 RECOMMENDATIONS FOR FUTURE WORK

Design of an efficacious podcast about alcohol use would be well-served by formative research about Americans’ attitudes toward the existing low-risk drinking guidelines proscribed by the

NIAAA, CDC, and USDA, among others. A better understanding of perceived barriers to adherence to low risk drinking guidelines could inform the development of a podcast about alcohol use. For example, is one barrier knowledge? Among which groups is knowledge a significant barrier to adherence to the low-risk drinking guidelines? Is another barrier credibility? Which types of respondents question the credibility of the low risk drinking guidelines and which aspects of the guidelines seem improbable? Do Americans perceive more individual-level barriers or interpersonal-level barriers? That is, do they see risky drinking as a matter of individual choice or a product of one's social environment? A more nuanced understanding of Americans' attitudes toward low-risk guidelines would inform the design of an efficacious podcast that addresses risky alcohol use.

Overall, the continued study of so-called "natural recovery" can improve the design and evaluation of a podcast about alcohol use. Alcohol use behavior change without formal intervention happens every day; a better understanding of what initiates and sustains it will pinpoint aspects of alcohol use that a well-designed podcast may address. A deeper study of "recovery capital" may also indicate a specific place for podcasts (and other media) among recovery capital elements like social support and spirituality (Laudet, Morgan & White, 2006).

6.2 LIMITATIONS

There are several methodological limitations to this literature review. The first is that there was an element of subjectivity to the application of the selection criteria. Some studies were deemed more relevant than others based on the author's judgment. Moreover, the evidence was not

weighed using a rigorous or consistent criteria based on the quality of the research. Like the selection process, the synthesis of the evidence had a degree of subjectivity.

The search turned up a number of documents that were not peer-reviewed, but they were included in the results. There are clear advantages to using gray literature because so much of the work being done on podcasts is outside the academic sphere. However, the accuracy of gray literature is less reliable than studies published in peer-reviewed journals. And there are methodological limitations to using popular search engines (e.g., Google) to locate relevant articles. Searches in search engines are not consistent; they turn up different results based on opaque algorithms that depend on the individual's search history and the particular date that the search was conducted.

Another significant limitation is that none of the literature in this review pertained directly to podcasting about alcohol use, which meant that research about health and science podcasting had to be extrapolated to apply to alcohol use. As podcasting is a relatively new technology, research on its application to alcohol use may emerge in the future, but the present literature review did not locate any peer-reviewed or gray literature specific to this topic.

6.3 PUBLIC HEALTH SIGNIFICANCE

This thesis examined existing literature on health- and science-focused podcasts to gather information about the design and evaluation of an effective podcast about alcohol use. Although the review concluded that there is insufficient formative research design a podcast as part of a campaign to reduce risky drinking, it identified a number of design and evaluation tools that may prove useful for podcasting about alcohol use and a number of other health behaviors.

The literature reviewed identified several proscriptive guides to podcasting, the most research-based of which was the PodCred Framework (2008), which is based on three data sources and functions as an easy checklist for a potential podcast designer. The review also identified a number of evaluation strategies that might be used to measure various individual- and interpersonal-level effects. For example, using Bloom's Taxonomy of Affective Goals to design an evaluation instrument, measuring skin conductance to gauge listeners' emotional response, and multiple strategies for measuring on- and offline "podologues," or conversations generated by a podcast.

Although the literature review revealed that online surveys can be challenging evaluation instruments because of low response rates, two innovative strategies for improving response rate emerged: a) promising listeners "hidden" podcast content in exchange for responding and b) offering two surveys, one longer and one truncated. This thesis also pinpointed one particularly innovative approach to gauging listeners' podcast preferences: asking listeners not just what they think about the podcast in question, but to list other podcasts that they enjoy. Analyses of these other podcasts' design may improve the quality of the podcast intervention.

Finally, this thesis outlined a rationale for podcasting about alcohol use and a research agenda to inform the development of an efficacious podcast to address risky alcohol use. A quick guide to designing and evaluating an effective podcast about alcohol use, based on available evidence, is included as a resource.

APPENDIX: QUICK GUIDE TO DESIGNING AND EVALUATING AN EFFECTIVE PODCAST ABOUT ALCOHOL USE

This guide is based on a 2015 review of literature pertaining to health- and science-focused podcasts. As such, it may be a useful resource for podcasting on a variety of health topics.

Design

1. Check out the PodCred framework. It's a research-based checklist that can guide your podcast content, your podcaster(s), and your technical execution. While it may not be appropriate to adhere to the PodCred framework perfectly, it will provide a good jumping off point.
2. Establish a predictable structure for each episode.
3. Be entertaining. Narrative can be particularly appealing. Your audience has to *choose* to listen to your podcast. The DSM-5 criteria may provide guidance for stories related to alcohol use that are relatable.
4. Produce podcasts with excellent sound quality.
5. Podcasts may be uniquely suited to establishing personal relationships with audience members and disclosing intimate details. Consider capitalizing on this benefit of podcast media.

6. Other podcasters can be strong allies. Build links with them. Consider promoting their content on your show or inviting them to be interviewed on your show. Podcasters create communities of listeners. Other podcasters may be able to help you gain access to their communities.
7. Produce transcripts and post them with the podcast. Some people will read the transcripts who do not listen to the podcast.

Evaluation

1. Work from the beginning—and continually—to build an audience for your podcast. Without an audience, you cannot evaluate the effectiveness of the podcast intervention.
2. Include listener satisfaction as one metric of podcast evaluation.
3. Consider evaluating knowledge gain, attitude change, and information processing among audience members.
4. Consider evaluating behavior change among audience members. This can—but does not have to—include behavior change directly related to alcohol use. It can also include a change in alcohol information-seeking behavior (from passive to active), a change in alcohol information-sharing behavior, and a change in participation in online discussions related to alcohol use.
5. Online surveys are the most common way to evaluate health podcasts, but low response rates can be a problem. To increase your response rate, consider a)

- incentivizing survey participation with hidden podcast content and b) releasing two surveys in succession; a short and a longer one.
6. Do not rely strictly on online surveys to evaluate the podcast. Complement survey data with other data sources, such as online metrics, qualitative interviews, discussion in online forums, and other approaches, as feasible.
 7. Consider using the PodCred framework as part of the structure of your podcast evaluation. This can contribute to the existing body of literature about the PodCred as a guide for high-quality podcast design.

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