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Unwarranted optimism in media portrayals of genetic research on addiction overshadows critical ethical and social concerns

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Abstract

The cost of addiction in the U.S., in combination with a host of new tools and techniques, has fueled an explosion of genetic research on addiction. Since the media has the capacity to reflect and influence public perception, there is a need to examine how treatments and preventive approaches projected to emerge from addiction genetic research are presented to the public. We conducted a textual analysis of 145 news articles reporting on genetic research on addiction from popular print media in the U.S., and from popular news and medical internet sites. In articles that report on *prevention*, the media emphasize vaccine development and identifying individuals at genetic risk through population screening. Articles that emphasize *treatment* often promote current pharmaceutical solutions and highlight the possibility of tailoring treatments to specific genetic variants. We raise concerns about the tendency of this coverage to focus on the benefits of pharmaceutical treatments and genetic-based approaches to prevention while neglecting or downplaying potential risks and ethical issues. Our analysis suggests a need for more balanced, evidence-based media reporting on the potential outcomes of genetic research.

Introduction

Addiction is a major public health problem with devastating consequences for individuals and their families, as well as our society, economy and health care system. The annual cost of substance abuse in the United States, including costs in health care, crime, and lost productivity is estimated at over \$600 billion dollars (National Institute on Drug Abuse, 2011). It is also a complex issue with a multitude of contributing biological and socio-environmental factors and a variety of proposed approaches for addressing the problem. The scope of the problem of addiction, the fact that addiction has proven resistant to quick fixes, and a broader explosion of genetic research has encouraged a vast expansion of inquiries into and publications about the genetics of addiction. This expansion has been stimulated by the National Institute on Drug Abuse (NIDA) and the National Institute on Alcohol Abuse

and Alcoholism (NIAAA) funding agendas (Dingel, Karkazis, & Koenig, 2011; Midanki, 2004).

Genomic research has been widely touted as potentially leading to improvements in human health and disease prevention and treatment (Collins, 1999; Collins, Green, Guttmacher, & Guyer, 2003). In the case of addiction, a substantial investment in biological research has coincided with a shift to the view that addiction is a “disease of the brain” and best prevented and treated through a biomedicalized approach (Courtwright, 2001; Dingel, Ostergren, Partridge, & Koenig, 2011). High expectations have been raised, for example, that pharmacogenomics will yield new treatment strategies that might allow physicians to tailor medications to the genetic profiles of individual patients (Roses, 2008; Sturgess, George, Kennedy, Heinz, & Muller, 2011), and that genetic research will transform how the public health field approaches disease prevention by shifting the emphasis toward genetic screening and subsequent modification of environmental risks (Coughlin, 1999; Khoury, McCabe, & McCabe, 2003).

Genetic research on addiction began with twin studies (Carmelli, Swan, Robinette, & Fabsitz, 1992; Heath & Martin, 1993), and has evolved with the advancement of research tools and techniques. Prominent biological theories of addiction implicate the brain “reward” system: the genes, neurotransmitters, transporters, and enzyme targets of the dopamine, serotonin, and glutamate systems of the brain (C.-s. R. Li & Sinha, 2008; Nestler, 2005; Schnoll, Johnson, & Lerman, 2007). The most recent studies include genome-wide association studies (GWAS) and meta-analyses of GWAS (Bierut et al., 2007; GENEVA Consortium, 2012; C.-Y. Li et al., 2011; Thorgeirsson et al., 2010), which have implicated a number of genes in predisposition to addiction, as well as difficulty remaining abstinent. Many scientists and other stakeholders hope this research will lead to advances in the treatment of addiction (Kalivas & Volkow, 2005; Liu et al., 2010).

The media play a critical role in informing the public about these types of new advances in science and technology, and the implications that these advances might hold for health and disease (Caulfield, 2004; Petersen, 2001). News stories serve as a source of public information on addiction research and prevention and treatment efforts, highlighting the latest scientific findings. The media, however, are not simply passive purveyors of news but engage in framing, which is “the process of culling a few elements of perceived reality and assembling a narrative that highlights connections among them to promote a particular interpretation” (Entman, 2007, p. 164). As such, media coverage both influences and is influenced by cultural conceptions and common knowledge (Edelman, 1988; S. Hall, [1980]1992; Siu, 2009). Analysis of the media therefore allows us to examine the public discourses used on addiction genetics and situate it within a wider lens (Fairclough, 1985).

Researchers have expressed concern about inaccurate and overly-enthusiastic media representation of new medical treatments and a simplification of genetic research (Gilbert & Ovadia, 2011; Moynihan et al., 2000). Moynihan et al. (2000) examined U.S. news media coverage of the benefits and risks of new medical treatments for major diseases and found that the media often reported benefits in a way that could be potentially misleading, and that many articles failed to report any information about potential harms. Similarly, concerns that

media reproduce a biologically reductionist paradigm have been raised about news stories that report on advances in genetic science (Caulfield, 2004; C.M. Condit et al., 2001). The media often frame these stories in an aura of “genetic optimism,” which presents an overly enthusiastic view of the impact of genetic research findings with little to no consideration of negative consequences (Conrad, 2001). In this frame, the media report as if a gene exists, it will be found, and the results of finding the gene will be good. The media often uses language that resonates with larger cultural themes in order to present information that is both familiar and consistent with common sense (Gamson & Modigliani, 1989). The “genetic optimism” frame is consistent with familiar themes like faith in science, improvement in medical technologies and care, and reductionist explanations about health and illness. Negative frames present in other types of media coverage of technology include “runaway” technology (Gamson & Modigliani, 1989), where scientific advances become dangerously uncontrollable, and “the problem frame” (Altheide, 1997), which focuses on risk, danger, and fear (Petersen, 2001). However, in the past, those negative frames have been absent in coverage of medical genetics (Conrad, 2001).

Media frames potentially have the power to influence our perception of health care problems, and the solutions we perceive to be appropriate. For example, some scientists express the hope that detailing the biological bases of addiction will lead to improved pharmaceutical therapies (Kalivas & Volkow, 2005; Liu et al., 2010). Focusing only on the biological aspects of addiction may obscure the fact that public perception and discussion of addiction is a *cultural phenomenon*, which is located within a particular socio-historical context (Courtwright, 2001; Kushner, 2010)(Gladwell, 2010). These media and scientific frames have consequences for individuals: research with patients suggests that framing medical problems (like diabetes or high cholesterol) as genetic disorders results in patients focusing more on pharmaceutical therapies, and less on behavioral modifications (Bize, Burnand, Mueller, Walther, & Cornuz, 2009; Carpenter et al., 2007; Marteau et al., 2004; Marteau & Weinman, 2006; Wright, Weinman, & Marteau, 2003). In the case of addiction, best practices in addiction treatment include using behavioral therapies alone (K. M. Carroll & Onken, 2005) or in conjunction with pharmaceutical treatments (Potenza, Sofuoglu, Carroll, & Rounsaville, 2011). Focusing only on pharmaceutical treatments may limit awareness of the wide range of treatment options available.

In this paper we ask, when the U.S. media portray addiction through a genetic lens, what avenues for prevention and treatment do they present? We explore the kinds of prevention and treatment approaches the media report and how they portray these approaches. Our main conclusions are twofold: first, when addiction is portrayed through a genetic lens, the prevention and treatment options presented strongly favor pharmaceutical and genetic screening; and second, that the “genetic optimism” framing pervades the media’s portrayal of therapies and prevention strategies for addiction.

Methods

Data Collection and Sampling of Print Media Sources

In the electronic databases Lexus Nexus, ProQuest, and through publications’ official online archives, we searched for the terms “gene*” and “addiction.” We collected all media articles

on the genetics of addiction published between 1990 and 2010 from the 3 largest news weeklies in circulation (*Time*, *Newsweek*, and *U.S. News and World Report*), the country's 3 largest popular science journals in circulation (*Popular Science*, *Discover*, and *Scientific American*), and the 7 American newspapers with the largest circulation (*USA Today*, *The Wall Street Journal*, *The New York Times*, *Los Angeles Times*, *The Denver Post/Rocky Mountain News*, *The Washington Post*, and *Chicago Tribune*). The sample begins in 1990 because no articles covering addiction genetics appeared in the news weeklies, the popular science magazines, *The New York Times*, or *The Washington Post* over the decade prior to 1990. These articles devoted considerable space to either one specific or several genetic studies of addiction; human interest stories that did not discuss genetic research and editorials were excluded. We identified 120 articles that met our inclusion criteria.

Data Collection and Sampling of Online Sources

Because online resources are also an important source of information, to supplement our print sample, we also gathered news articles from the most popular network and cable news websites. In order to identify the most popular news and medical news sites, we turned to search engines. Because search engines organize results based on number of hits, the use of common key phrases (e.g., “news,” “medical news,” “genetics and addiction”) provide a structured way of collecting the pages people have visited in the past (Judy Illes et al., 2003). Google and Yahoo searches identified CNN, MSNBC, ABC and FOX as the most popular news sites. CNET.com was excluded because it focuses on technology and not general or medical news. We also included the most popular sites that focus primarily on medical news and information: Google and Yahoo searches for “medical news” indicate that “Medical News Today” is the top medical news site, and “WebMD” is the top “medical information” site; both were therefore included in our sample. Searches were conducted within each of the sites above each week between April 9 and May 7 2010 for “genetics” and “addiction.” Articles that appeared in the top 5 search results for three or more of these weeks were included in the sample, which yielded 25 articles. This search strategy is warranted given that, when searching the web, the vast majority of people view only the first search results page (Jansen & Spink, 2006). In other words, though we could not obtain circulation data for internet pages that closely mirrors circulation for print sources, our search strategy sought to identify the most popular news and medical web sites, and, at a second level, the links that people are most likely to click. This sampling included internet articles originally published between 1996 and 2010, with most articles being fairly evenly distributed from 2000 to 2010. This even distribution across the previous ten years indicates that the articles emerging from these searches have remained popular over a long period of time, and therefore are not just articles that were popular during the sampling time period. In total our sample comprises 145 print and web articles (Table 1).

Analysis

Media reporting on addiction genetics forms a “class of texts” through which we can identify the public discourse of addiction genetics (Chalaby, 1996). By performing a critical discourse analysis of this class of texts, we are able to: identify common themes; uncover the ways in which seemingly neutral news stories embody a particular frame of the world; and elucidate “social determinations and effects of discourse which are characteristically

opaque to participants” (Fairclough, 1985, p. 739). Because themes in our sample are present in a variety of widely read media, we can conclude that they resonate with common cultural knowledge (Griswold, 1987), and are manifestations of cultural discourse (Fairclough, 1995; Phillips & Hardy, 2002).

All team members independently read four randomly selected articles. From these careful readings, a set of codes was developed from themes identified in the articles, which were continually revised and sharpened throughout coding. Each article in our sample was independently coded by two team members using NVivo 8 software. Though discrepancies in coding were infrequent, any discrepancies between members’ coding choices were discussed until consensus was reached. Though the articles were included on the basis of covering addiction genetics research, other topics like prevention and treatment strategies were coded, as well (See the codebook in Table 2). This paper focuses on the theme: *prevention and treatment*. We conducted a textual analysis of this theme, coding for types of treatment and prevention approaches discussed in our sample of articles. We carefully examined the coded text for messages of optimism and caution, and noted the inclusion of any discussion of social and ethical issues. We then constructed memos around code categories, which included a summary description of each treatment and prevention approach illustrated with references from the media articles. NVivo was used to calculate “coverage,” the percentage of characters in a document (news article) coded as a particular theme.

Results

Of the 145 print and online media articles, just over two-thirds (68%), about 99, mentioned either preventive strategies or treatment modalities for addiction. We identified three preventive approaches: 1) population screening and tests for genetic markers, 2) traditional public health prevention, and 3) development of vaccines. We identified four types of treatment modalities: 1) trial medications and the potential for new treatments, 2) products and medications on the market, 3) genetically-tailored treatment, and 4) behavioral treatment. Table 3 provides an overview of these themes by time period and by source type. Some, but not all of these approaches directly incorporate genetic advances. Preventive approaches that directly incorporate genetics include population screening, and, as we will see below, some instances where vaccines might be used following population genetic screening. Treatment approaches that directly include genetics include genetically-tailored treatment. In addition, discovering a genetic association for addiction may uncover a previously unknown mechanism of addiction; this knowledge then inspires the investigation of pharmaceuticals that work on that mechanism. However, all of the themes delineated in this paper, regardless of their direct dependence on genetic knowledge, illuminate the ways media present approaches as being consistent with, or, in some cases, at odds with, a genetic framing of addiction. The themes not directly dependent on genetic knowledge were at times, but not always, discussed in conjunction with strategies that directly utilized genetic knowledge.

Preventive Approaches to Addiction

References to prevention tended to focus on the integration of genetic knowledge into public health approaches, mainly by the identification of genetically at-risk individuals through population screening, or in a few cases through the development of substance-specific vaccines as preventive agents. In our sample, the media rarely addressed traditional public health preventive strategies, such as health education and policy initiatives.

Population screening and tests for genetic markers

Of the articles that mentioned the need for effective prevention strategies, most ($n = 23$) emphasized the potential utility of identifying genes associated with addiction as a form of targeted public health prevention. Nearly a third of the articles in this category referred directly to population screening as a future means of identifying those who are genetically vulnerable to addiction, although the time-frame claims made in these articles have since proven to be unrealistic:

The scientists estimated that it would take five years to perfect the blood test to detect the D2 receptor and other genes so that doctors and public health workers could use it to screen people to determine those who are susceptible to alcoholism (Altman, April 18, 1990).

The media presented several different strategies on how addiction could be prevented once high risk individuals were identified. These ranged from prevention through abstinence to pharmaceutical intervention:

If a simple blood test could be developed to identify children who carry this and other troublesome genes, [researcher Kenneth Blum] reasons, those kids could be taught to handle intoxicants with special care. Future drugs might even let erstwhile substance abusers adjust their dopamine levels safely (Cowley, April 30, 1990).

The development of genetic engineering techniques that would prevent addiction by eliminating the causative gene appeared in three articles.

And in 30 to 40 years, this type of research may help scientists who are now conducting tests with animals to genetically rework humans, replacing such degenerative or “bad” genes with healthy, or “good” ones (Nazario, April 18, 1990).

Of the articles that directly mentioned population screening as a prevention strategy, only two cautioned against ethical or social consequences, including that screening should be “voluntary” and the results “kept private” (Borenstein, April 3, 2008). Another article, in the context of college binge drinking, raised the issue that knowledge of low genetic susceptibility could cause some people to drink more:

But screening can backfire: fraternity members, for example, might be more likely to go on a drinking binge if they knew their genetic risk for alcoholism was low (Humphreys & Satel, January 18, 2005).

As the vast majority of articles do not raise or provide discussion on ethical and social issues, these articles are notable exceptions.

Health education and policy

Reference to traditional public health approaches appeared in just nine of the 99 articles that mention prevention or treatment. Four emphasized the importance of education for the negative health effects of drug use and the effectiveness of the promotion of abstinence as a prevention strategy. For example, *The New York Times* quotes NIDA director Nora Volkow:

Providing access to knowledge definitely helps. A lot of people, and certainly adolescents, do not realize the consequences of being addicted to other things... When we look at the brains of young methamphetamine abusers, they look like the brains of people 40 to 50 years older. So what drugs are inducing in your brain is aging. Do you want to be a 20-year-old with the brain of a 70-year-old? I think that message is very, very powerful (Duenwald, August 19, 2003).

In contrast, two articles put a negative spin on traditional public health strategies, arguing that behavioral change efforts just don't work. One begins with: "Remember 'Just say no'? It was a slick motto, but a terrible remedy for drug and alcohol dependence" (Miller, December 19, 2005). The journalist goes on to remind us that addiction is still a huge problem despite the "Just Say No" advertising campaign of the 80s and 90s, and that the only way to deal effectively with addiction is through advances in science leading to new treatments. The other article, while including claims that support the abstinence strategy for the children of alcoholics, also acknowledges that this approach may not have worked in the past:

For three decades, public-health officials have been warning that alcoholism confers a powerful genetic predisposition. But those warnings have hardly kept the offspring of alcoholics from sinking into the same muck that trapped their parents. Knowledge of the danger, it turns out, isn't sufficient to avoid it. "Try willing yourself not to get cancer," says Mr. Irwin, a recovering alcoholic who hasn't touched a drop in 24 years (Helliker, October 21, 2006).

Of the handful of articles that mentioned traditional public health strategies, only one referred to policy approaches that would limit access to addictive substances, claiming some value in this approach if used in conjunction with increasing public knowledge about genetic susceptibility (Nurnberger & Bierut, April 2007). All others highlighted public health approaches that pertained to health education, public health programs, and messages of abstinence.

Development of vaccines

Six articles described current trials underway to develop vaccines against addiction; these articles focus mainly on vaccines for cocaine and nicotine, but also mention vaccines for heroin and methamphetamine. Populations could be screened for genetic markers before substance initiation (e.g. adolescents) and then vaccinated, or individuals in addiction treatment programs could be vaccinated as a form of medical intervention. Therefore, depending on the approach, the vaccine could be used as either a form of prevention or treatment (Interlandi, January 14, 2008).

Only one article expressed concerns about the feasibility of using vaccines to prevent addiction, raising concerns that not everyone's immune system would respond in the same way to the vaccine, and that a drug user could overwhelm the immune response by ingesting large quantities of the drug or could easily switch to another drug for which the vaccine would be ineffective (Interlandi, January 14, 2008). Another article suggested that ethical or civil liberties issues could arise with respect to preventative use of vaccines, but did not define these issues, and downplayed possible concerns by quoting a developer of a cocaine vaccine as saying, "but parent groups and pediatricians have been receptive to the idea" (Interlandi & Kelley, March 3, 2008).

In summary, when articles covering the genetics of addiction address prevention, genetic screening of populations is the strategy most commonly mentioned. In our sample, the media generally do not include balance by addressing ethical or feasibility issues.

Treatment-based Approaches to Addiction

Most articles emphasized a medicalized approach to treating addiction, highlighting the utility of current pharmaceutical solutions as well as genetic-based alternative treatments and medications just on the horizon. One even included a quote comparing the development of pharmaceuticals to treat alcohol addiction with choosing food items on a restaurant menu: "We want a menu of medications for alcoholism," [Dr. Raye Litten, a treatment research leader at NIAA] said, similar to the variety of depression treatments now available. 'If one doesn't work, they can try another one'" (Associated Press, September 13, 2005).

Trial medications and new genetic treatments "on the horizon"

Of articles that mentioned treatment or prevention, over half referred to genetic and non-genetic treatments "on the horizon" or "under investigation." In our sample, this was the most common type of medical treatment mentioned. The typical statement indicated that genetic research would lead to new addiction treatments, but did not provide any other details. The implication was that identifying the genetic roots of addiction would soon yield a therapy:

Scientists are narrowing their hunt for genes that make people vulnerable to alcoholism, discoveries that promise to yield better medications (Neergaard & Press, April 10, 2001).

Fifteen articles explored the utility of new medications that, at the time of publication, had not yet reached the market—providing details about how research trials were being conducted and how the medications would work:

Addicts' brains are deficient in GABA, so researchers are investigating a drug called Vigabatrin, which stimulates its production. In December, the pill cleared its first double-blind, placebo-controlled trial; 30 percent of patients who took Vigabatrin stayed off cocaine during the nine-week study, compared with just 5 percent in a control group. "It's the best efficacy signal that we've seen in any clinical trial for cocaine treatment," says Frank Vocci, director of the pharmacotherapies division at NIDA. "And it's worked on what many have written

off as an intractable population-hard-core, long-term cocaine addicts” (Interlandi & Kelley, March 3, 2008).

Many of these articles make assertions about the assumed or expected effectiveness of potential new medications coming down the line, claiming that these trial medications are a substantial improvement over what is currently available.

Products and medications on the market

Twenty-three articles specifically identified pharmaceuticals and other products, such as nicotine gums and patches, already being used to treat addicted individuals. Detailed information on how these medications work was often provided in an upbeat advertisement-like fashion:

Campral can help alcoholics remain sober by easing withdrawal symptoms and reversing drinking-induced imbalances in brain chemistry. The drug costs \$3.70 for an average daily dose of six tablets (Associated Press, September 13, 2005).

Two articles made a direct connection between genetic research on addiction and the effectiveness of pharmaceuticals in treating addiction.

After determining that severe alcoholism was associated with a mutation of the gene that doles out DR2s, Dr. Noble and his colleagues tried treating alcoholics with bromocriptine, a medicine that boosts the amount of dopamine available to the brain. The medication quieted craving and ultimately helped alcoholics fight their addiction, Dr. Noble said (L. Carroll, November 14, 2000).

Only three articles cautioned the reader about potential negative effects of medications on the market, or criticized the ineffectiveness of currently available medications for most patients.

For example, methadone, a medication used to treat heroin addicts, has itself been associated with addiction and overdose, because in addition to blocking heroin’s entrance to brain cells, methadone also mimics the narcotic, producing its own, milder high. Drugs that treat alcohol and nicotine addiction have been effective only in small subsets of patients and have produced severe side effects in some cases (Interlandi, January 14, 2008).

The fact that only three of the twenty-three articles pointed out negative aspects of pharmaceuticals reflects a positive bias toward currently available pharmaceutical treatments for addiction. Table 3 indicates an upward trend in the average percent coverage of products and medications on the market between the time periods of 1990-2001 and 2001-2010.

Genetically-tailored treatments

Twenty articles explored the possibility of identifying genes involved in addiction and tailoring pharmaceutical treatment to particular genetic variants. In 1999, one article enthusiastically reported: “As soon as three years from now, physicians and stop-smoking programs will rely on DNA tests to help tailor their treatments to the genetic profiles of smokers, predicts a top National Cancer Institute scientist” (Elias, January 25, 1999). Over ten years later, this prediction has not come to pass. The media demonstrated extreme

optimism for a tailored-treatment approach to addiction without addressing issues having to do with cost, negative aspects of medications, or ethics.

Behavioral treatment

Behavioral treatment, which includes counseling and a variety of drug treatment programs, appeared in twenty-four articles. Nineteen of these emphasized a two-pronged approach to addiction treatment focused on counseling and medications.

We now know that treatments combining medication and psychotherapy work better than either strategy does by itself. Next year, an eight-year study called COMBINE (Combining Medications and Behavioral Interventions) will provide the best evidence yet on how to weave drugs and therapy into a comprehensive treatment plan (Miller, December 19, 2005).

In two cases the importance of behavioral treatment was downplayed, making it clear that counseling and behavioral treatments will always play second fiddle to more powerful pharmaceuticals.

Brookhaven researchers are certain that, though counseling and behavioral adjustments will always play a role in treating addiction, biochemistry-changing medications are the key. "Alter a protein here or there," says Volkow, "and you turn a philanderer into a monogamist" (Skloot, April 2002).

Five articles emphasized the importance of behavioral therapy:

Realistically, no one believes better medications alone will solve the drug problem. In fact, one of the most hopeful messages coming out of current research is that the biochemical abnormalities associated with addiction can be reversed through learning. For that reason, all sorts of psychosocial interventions, ranging from psychotherapy to 12-step programs, can and do help (Nash & Park, May 5, 1997).

The message of most of these statements is that pharmaceuticals and behavioral therapy work best in combination. At the same time, a few articles still argued for the effectiveness of one over the other. In our sample, pharmaceutical intervention received more attention than behavioral treatment.

Discussion

Our analysis reveals that, in our sample, media coverage of genetic research on addiction contains overly optimistic claims and misrepresentations of the potential public health benefits of recent scientific findings; there did not appear to be major differences between internet and print media sites. Indeed, we found messages about forthcoming prevention and treatment approaches to be invariably positive, and to contain little reflection on risks or on ethical or social consequences. We also found that media reporting tended to emphasize pharmaceutical and genetic screening approaches to addiction over social, behavioral and legislative public health initiatives, such as smoking bans or prohibition of sales to minors. There seems to be an implicit connection made by the media between genetic bases of addiction and pharmaceutical therapies, despite the fact that an important connection exists

between genes and environments, and despite the fact that addiction is an extremely complex biopsychosocial issue.

Even when genetics are determinative for a specific disorder, a variety of strategies may be used, including pharmaceutical therapy or changes to an individual's environment. For example, if a genetic test indicates that an infant has Phenylketonuria, the response is to exclude phenylalanine from that's child's diet (MedlinePlus, 2013). In the context of addiction, evidence supports the use of public health policies (Guide to Community Preventive Services, 2011; U.S. Department of Health and Human Services & National Institutes of Health, 2000; West, 2006), behavioral therapies (K. M. Carroll & Onken, 2005), and pharmacotherapies in conjunction with behavioral therapies (Potenza et al., 2011). Indeed, it would be surprising if such a complex phenomenon as addiction could be solved by a singular solution. Yet public health policies and programs may be losing support in many states in the U.S. (American Lung Association, 2012), and "personalized" genetically-tailored treatments have been proposed as a more effective way to deal with addiction (Heilig, Goldman, Berrettini, & O'Brien, 2011).

In addition, many ethical, legal and social issues surround the use of genetic information to prevent or treat addiction. These include fears that genetic information may inadvertently stigmatize some patients, inadvertently direct drug company (and other) resources away from patients who have rarer or "unfavorable" genotypes (Brice & Sanderson, 2006; Caron, Karkazis, Raffin, Swan, & Koenig, 2005), or create additional barriers to treatment for impoverished patients (Brice & Sanderson, 2006). Other scholars express concerns about how such information would be stored and protected, and who would have access to it (W. D. Hall, Gartner, & Carter, 2008) (Brice & Sanderson, 2006). Genetic test results can also create ethical quandaries for individuals, in terms of how and when to share that information with relatives, including children (Klitzman, 2012). Further, there is a need for genetic information to be rigorously evaluated, with demonstrated and cost effective health benefits, before it is used in a clinical setting (Burke & Psaty, 2007). From a cost-benefit standpoint, many scholars have questioned whether preventative screening or personalized genetic information for addiction will ever be more effective than more traditional approaches (Carlsten & Burke, 2006; W. D. Hall et al., 2008; Merikangas & Risch, 2003), like taking a simple family history (Gartner, Barendregt, & Hall, 2009).

Among the three preventive approaches that received attention in our sample, the most commonly addressed was "population screening and tests for genetic markers." The tendency of the media to promote population screening as a preventive strategy for addiction occurred despite serious concerns that many researchers have raised about utility, feasibility, and negative ethical consequences (Ball, 2008; Gartner et al., 2009; W. D. Hall, 2007; W. D. Hall et al., 2008; W.D. Hall, Madden, & Lynskey, 2002). A further complication is that there are currently no effective, evidence-based medical interventions to prevent substance use dependence once at-risk individuals are identified (W. D. Hall, 2007; W.D. Hall et al., 2002). While few articles referred to vaccine development, it was the main focus of those that did and the coverage was overwhelmingly positive. Consistent with a framing of "genetic optimism" (Conrad, 2001), in our sample media reporting did not provide substantial commentary on safety and privacy concerns or raise the issue of vaccinating

genetically at risk minors (W. Hall & Carter, 2004). Further, in hindsight this optimism appears unwarranted, since multiple clinical trials showed one nicotine vaccine (NicVAX from Nabi Pharmaceuticals) no more effective than placebo (AP News, 2012), and another nicotine vaccine has been abandoned by Novartis in the wake of its own disappointing clinical trials (Genetic Engineering & Biotechnology News, 2013). Cocaine and heroin vaccines have yet to be tested in humans.

Among the treatments covered in our sample, pharmaceuticals on the market and in development or “on the horizon” received the most coverage. This emphasis likely reflects the newsworthiness of new pharmaceutical treatments—and possibly also the influence of product promotion. Although some articles did touch upon medication risks, most highlighted the benefits while omitting or downplaying any harms. An aura of hope pervades most media statements about potential new genetic and pharmaceutical treatments. In our sample, new therapies were often represented by the media as close to “magic bullets”—the potential cure to addiction. Unrealistic claims about how fast the new therapies would appear on the market were also common. Contrary to media claims, a personalized medical approach to addiction in which treatments are tailored to a patients’ genetic profile may be of limited value given the enormous costs involved in developing pharmaceuticals that are aimed at a small number of patients and the cheaper alternatives that are currently available (Dean, 2009). Behavioral treatment was typically under-emphasized in these articles in comparison with pharmaceutical approaches.

The media’s emphasis on pharmaceuticals and population screening for genetic markers over traditional public health approaches and behavioral treatment could have negative consequences. For instance, in the case of nicotine addiction, focusing on the genetics of addiction locates responsibility for addiction within individual bodies, instead of on wider social influences, like a tobacco industry that has intentionally manipulated and aggressively promoted cigarettes (Brandt, 2007; Gundle, Dingel, & Koenig, 2010). Unwarranted media claims about future applications of genetic findings may shift attention away from tobacco control efforts, such as exerting pressure on the tobacco industry, restricting tobacco promotion and sales, and implementing smoking restrictions and tax increases on products, and toward the idea that we soon may be able to prevent substance use by screening for genetic markers, vaccinating the public or eliminating harmful genes through direct manipulation of the human genome. The detailed and promising information provided by the media on various pharmaceuticals and products may also influence how individuals approach treatment for addiction. Rather than seeking out counseling or programs that focus on behavior change, it is conceivable that the information presented may contribute to a public perception that a medical “quick fix” for addiction soon will be available, or that pharmaceuticals are currently the most effective option (c.f., Carpenter et al., 2007; Marteau & Weinman, 2006).

Our findings mirror earlier research on media reporting on genetics and medicine, including Conrad’s (2001) findings of “genetic optimism.” Similarly, in their examination of newspaper stories on genetic research, Bubela and Caulfield (2004) conclude that though relatively few articles contain moderately or highly exaggerated claims, very few article discuss costs or risks, while nearly all discuss the potential benefits of the research. Some

researchers have reported a similar phenomenon in other areas of medicine; in an analysis of 500 media stories about medical treatments, tests, products, and procedures, Schwitzer reports that journalists “usually fail to discuss costs, the quality of the evidence, the existence of alternative options, and the absolute magnitude of potential benefits and harms” (Schwitzer, 2008). However, other research indicates that this optimism does not extend to all areas of medicine. Hallin, Brandt, and Briggs (2013) report that in the 1960s, reporting on medicine and medical advances was strongly positive, with little mention of controversy or critique. By the 2000s, reporting on medicine, and specifically biomedicine, focused more on controversy, with more mixed and negative portrayals of “biomedical actors.” Reporting in some areas of medicine, like vaccines, has been more mixed than some other types of medical advances, like cancer treatments or advances in genetic knowledge (Hallin et al., 2013).

We see a need for high-quality, evidence-based media reporting with tempered predictions about future applications. This requires improved communication between scientists and the media about the implications of research findings (C. M. Condit, 2007; J. Illes et al., 2010). Journalist Sally Lehrman argues that the media must “venture further than simplistic dichotomies,” including bringing skepticism into their reporting, “making uncertainties clear, exploring what is missing, and dissecting the assumptions behind the interpretations” (Lehrman, 2008, p. 297). Such a task will require including more economic, social, and historical contextual information, and will in turn make reporting more interesting, as well as more accurate. Our message is not that optimism or enthusiasm about the future applications of scientific discoveries should be avoided, nor do we endorse a fear framework in which potential risks and consequences are over-emphasized or presented in a threatening way. We believe that “unwarranted” optimism can be misleading, and that the media should strive to provide an effective balance between optimism and caution. Scientific discoveries and their clinical application are unpredictable; there is always the possibility that research findings will not be replicated or that potential treatment and prevention applications, which at one time seemed promising, may prove to be unattainable.

It has been a decade since scientists mapped the human genome, and while genomics has been influential in advancing basic scientific understanding, many of the applications for human health and disease that were promised have not yet been delivered (Hamburg & Collins, 2010; Hudson, 2008; Munafo, Shields, Berrettini, Patterson, & Lerman, 2005). In order to contribute to greater public knowledge and understanding, the media must take care to avoid representing future applications of genetic research in a way that exaggerates or misleads. Sufficient attention should be paid to social and ethical implications of the potential uses of genetic information.

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Table 1
Frequency of Print and Online Media Sources in Sample (N=145)

	n	(%)
Print Media (N=120)		
Time	8	(5.5)
Newsweek	10	(6.9)
U.S. News and World Report	6	(4.1)
Popular Science	2	(1.4)
Discover	2	(1.4)
Scientific American	2	(1.4)
USA Today	11	(7.6)
The Wall Street Journal	11	(7.6)
The New York Times	23	(15.9)
Los Angeles Times	11	(7.6)
The Denver Post/Rocky Mountain News	7	(4.8)
The Washington Post	14	(9.7)
Chicago Tribune	13	(9)
Online Media (N=25)		
CNN	3	(2.1)
MSNBC	4	(2.8)
ABC	5	(3.4)
FOX	4	(2.8)
Medical News Today	4	(2.8)
WebMD	5	(3.4)

Table 2
Codebook for Addiction Genetics Media Study

Code	Description of Code
Genes	Descriptions of what genes are and what they do. How deterministic are they?
Gene-environment interactions	Includes discussion of epigenetics
Theory of Addiction	Any description of the underlying cause of addiction: A disease of the brain? A chemical abnormality? The result of environmental influence? A bad habit? ETIOLOGY.
Addiction Effects	What does addiction or drug abuse do to individuals? More of a focus on bodies. This does not include descriptions of what drug <i>use</i> does, only <i>addiction or abuse</i> .
Drugs	Description of what drugs are and what they do. This category includes only “addictive” drugs. Therapeutic drugs should be coded under “treatments and prevention.” What happens to anybody when they use drugs, including first time or light users?
Treatments and Prevention	Descriptions of the preventative or treatment possibilities that stem from this research.
Uncertainty	Descriptions of the certainty/uncertainty of findings. Calls for replication, doubts about the validity of the findings, etc. Burden of Proof. Trust in science.
Hype	Statements that we might recognize as not supported by data that may raise people hopes or misrepresent the science on addiction.
Addict Portrayal	How are addicts portrayed? How much agency are they given? Not neurobiological effects, but characteristics of addicts. This code is more about a personal perceptions; social and moral implications of addiction. Embodies a sort of “whole person” element.
Animal Models	Any mention of pertinent research on animals or animal models being implicitly or explicitly tied to human responses/addiction.
Brain	Explicit mentions of brain or neuroscientific bases of addiction/treatment.
Social Effects of drug use	Not individual effects, but drug use effects at a population level. Also includes mentions of drug use effects on families.
Interesting quotes not coded elsewhere	

Table 3

Average Percent Coverage by Topic

Topic	Sources (N)	Average % Coverage (1990-2001)	Average % Coverage (2001-2010)	Average % Coverage Internet sources	Average % coverage print sources	Average % Coverage * Coverage (all articles)
Prevention	38					
Health education and policy	9	0.24	1.50	0.88	0.83	0.84
Population screening and tests for genetic markers	23	2.05	1.16	1.95	1.56	1.62
Development of vaccines	6	0.00	2.35	0.00	1.35	1.12
Treatment	80					
Products and medications on the market	21	0.79	4.80	2.35	2.77	2.70
Trial medications and new genetic treatments "on the horizon"	52	3.93	5.20	5.53	4.33	4.53
Genetically-tailored treatment	20	0.70	2.02	2.82	1.02	1.33
Behavioral treatment	24	0.84	3.49	1.82	2.16	2.10

* "Coverage" is the percentage of characters in a document (news article) coded as a particular theme.