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The media and behavioral genetics: Alternatives coexisting with addiction genetics

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Abstract

To understand public discourse in the U.S. on genetic causation of behavioral disorders, we analyzed media representations of genetic research on addiction published between 1990 and 2010. We conclude first that the media simplistically represent biological bases of addiction and willpower as being mutually exclusive: behaviors are either genetically determined, or they are a choice. Second, most articles provide only cursory or no treatment of the environmental contribution. A media focus on genetics directs attention away from environmental factors. Rhetorically, media neglect the complexity underlying of the etiology of addiction and direct focus back toward individual causation and responsibility.

Keywords

Addiction; behavioral genetics; genetics; media; discourse analysis; science and knowledge

Many prominent scientists have declared our current era, after the completion of the human genome project, as the “genome era” (Guttmacher and Collins 2005, Collins et al. 2003), and have predicted that genetic knowledge will have a “profound impact on scientific progress” and fuel a “revolution in human health” (Collins 2010). Despite modest gains so far, these scientists argue that the expanded role of genetics has created widespread changes in “the worlds of commerce, law, regulation, ethics, health insurance, and information technology” (Varmus 2010), and will likely continue to revolutionize medical research and practice (Guttmacher and Collins 2005). Scholars have also highlighted the prominence of a genetic paradigm not only for biological and medical research (Clarke et al. 2003, Keller 2000), but also, among others, in popular culture (Van Dijck 1998, Nelkin and Lindee 1995), in psychiatry (Kandel 1998), and for issues of power and identity (Rose 2007, Barnes and Dupre 2008).

With respect to power and identity, Nikolas Rose (2007) defines “biopower” as a perspective that “brings into view a whole range of more or less rationalized attempts by different authorities to intervene upon the vital characteristics of human existence...” (54). Biopower is tied to biopolitics, which are strategies “involving contestations over the ways in which human vitality, morbidity, and mortality should be problematized, over the desirable level and form of interventions required, over the knowledge, regimes of authority, and practices of intervention that are desirable, legitimate, and efficacious” (2007: 54). Scholars like Rose, along with numerous others (Courtwright 2012, Lock 2013, Midanik 2004) examine how the genetic paradigm has grown powerful and reshaped the types of research we fund, the way we define human similarity and difference, and the way we view and seek to treat human illness.

However, most diseases and disorders are the result of a complex set of factors. Psychiatric disorders like addiction provide a clear case study of this complexity, and some scholars have argued that too closely focusing on the biological aspects of addiction may cause us to overlook important social contributing factors (Midanik 2004, Cohen 1993). Kandel explicitly demonstrates this tendency when he outlines the central tenets that guide the alignment of psychiatry and modern biology: “All mental processes, even the most complex psychological processes, derive from operations of the brain....As a corollary, behavioral disorders that characterize psychiatric illness are disturbances of brain function, *even in those cases where the disturbances are clearly environmental in origin*” (Kandel 1998, p. 460, emphasis added). In other words, even when the environment plays a known contributing role, Kandel believes that psychiatric illnesses can still be characterized using neurogenetic criteria. This sentiment parallels efforts to define addiction as a “disease of the brain,” a paradigm that privileges neurobiological research showing that sustained, heavy drug use changes the structure and function of the brain (Leshner 1997).

In response to paradigms that privilege biology, many social science scholars have begun to advocate for more recognition of the intimate, constant connection and interaction between environments and bodies. Fox Keller (2010) argues that “From its very beginning, development depends on the complex orchestration of multiple courses of action that involve interactions among many different kinds of elements” (p. 6). Development, growth, and aging are more complex than suggested by the phrase “nature and nurture.” The “and,” to Fox Keller, suggests a false dichotomy by (incorrectly) implying that the two theoretically could be separated. In its place she suggests conceptualizing the “entanglement between genes and environment” (2010, p. 6). Margaret Lock (2013) suggests that this idea of “entanglement” could also describe the arguments of other social scientists who problematize the nature/nurture debate, and could encourage broader and deeper thinking about genetics, epigenetics, behaviors, health, addiction, and disease that takes into account socio-historical contexts as well as physical bodies and biology (Courtwright 2012, Lock 2013, Schüll 2012, Shostak, Conrad, and Horwitz 2008).

Addiction, with its wide variety of known contributing factors, provides a good case study for exploring issues of genetic reductionism. Scientists have long looked to the body and brain to characterize addiction, including the neurophysiology of addiction (Campbell 2010). The “disease of the brain” model for addiction includes a predictive component:

scientists estimate that 40–60% of individual vulnerability to addiction resides in our genes (National Institute on Drug Abuse 2007). Genetic explanations for addiction are connected intricately with the disease of the brain model of addiction because a large number of candidate genes that correlate with addiction are expressed in the brain; from this biological perspective, addiction may be conceived of as a neurogenetic phenomenon. Consistent with this focus on genetics, data gathered using novel biotechnologies and research methods support the disease of the brain, or neurogenetic, model of addiction. Prominent reductionist biological theories of addiction implicate the genes, neurotransmitters, transporters, and enzyme targets of the dopamine, serotonin, and glutamate systems of the brain, sometimes referred to as the brain “reward” system (Nestler 2005, Schnoll, Johnson, and Lerman 2007, Li and Sinha 2008). Studies using animal models (Barkley-Levenson and Crabbe 2012), classic twin studies (Agrawal and Lynskey 2008, Lachman 2006), genome-wide association studies (GWAS) (Bierut et al. 2007, GENEVA Consortium 2012) and meta-analyses of GWAS (Thorgeirsson et al. 2010, Li et al. 2011) also support the influence of genes on predispositions to smoking and alcoholism. Research continues to implicate a number of genes in the development of alcohol dependence and other substance use disorders (Olfton and Bierut 2012, Treutlein and Rietschel 2011, Cui et al. 2012, Gorwood et al. 2012, Wang, Kapoor, and Goate 2012).

While important, biology constitutes only part of the complex web of individual vulnerability to addiction. Structural factors, like poverty and unemployment, which are significant predictors of stress (Hill, Ross, and Angel 2005, McLoyd 1990), are also clearly contributing factors to addiction. Socio-economically disadvantaged individuals are more likely to be current smokers, as well as those who have less than a high-school education and those without health insurance (Flint and Novotny 1997, Centers for Disease Control 2011). Low socio-economic position is a major predictor of alcohol abuse, cannabis use and other illegal drug use (Redonnet et al. 2011). There is also evidence that family structure (single-parent vs. two-parent households) and friendship networks (relationships with risk-taking or deviant peers) may play a significant role in substance abuse and dependence in adolescence and early childhood (Barrett and Turner 2006), as well as neighborhood residential instability, family mobility, and lack of a supportive community (Buu et al. 2009). Together, these factors point to larger socio-historical conditions that leave certain populations and communities vulnerable to drug use and drug-related harm (Acker 2010, Draus 2009).

Scientists in the field recognize the centrality of environment to addictive disorders. For example, while in the United States the National Institute on Drug Abuse (NIDA), which “funds more than 85% of the world’s research on drug abuse” (The White House N.D.), embraces a disease of the brain model for addiction, NIDA also states that the “old saying ‘nature or nurture?’ might be better phrased ‘nature and nurture,’ because research shows that individual health is the result of dynamic interactions between genes and environmental conditions” (National Institute on Drug Abuse 2008). In addition, they have provided money for additional research at the intersection of genetics and environment (Department of Health and Human Services 2011), and, in its Strategic Plan, NIDA emphasizes the importance of understanding complex interplay of a variety of complex factors when treating addiction (National Institute on Drug Abuse 2010). The large number of widely

accepted contributing factors for addiction makes it an ideal case study for considering how the genetics of complex diseases are translated to lay audiences.

Media analysis allows us to examine the public discourses used to describe genetic research on addiction, and to situate these discourses within a wider social lens (Fairclough 1985). The media is an important site for discourse analysis both because the public learns about new scientific discoveries and advances through the media, and because the media reflect and reinforce discourses (Edelman 1988, Siu 2009, Hall 1992). The media act as an interface between scientific researchers and the public (Petersen 2001).

Not merely passive conveyers of news, the media 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). This framing often includes a “conflict” lens, in which journalists present scientific debates as having two “sides,” one of which is more valid than the other (Lehrman 2008). While this conflict frame is consistent with basic journalistic conventions, dichotomization oversimplifies causation and omits the complex and multivariate nature of problems like addiction. Indeed, addiction exists as a complex problem both because of the web of contributing factors, but also because of the socially-created divides among those who we stigmatize for drug use, and those who escape such stigmatization (Keane 2010).

Research by Peter Conrad, published the same year that the Human Genome was mapped, confirmed a simplification of genetic research. When covering genetic research, Conrad (2001) found that the American media commonly used an “optimistic” frame. 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. In the media it is considered good practice to utilize language that resonates with larger cultural themes to present information that is both familiar and in accord with common sense (Gamson and Modigliani 1989). In this case, the “optimistic” frame resonates with a larger cultural narrative about faith in science, progress of medical care, and reductionist explanations about health and illness. Conrad’s (2001) research indicated that frames seen in other case studies of health and technology are largely absent. These absent themes include “runaway” technology, where new scientific advances takes on a dangerously uncontrollable life of their own (Gamson and Modigliani 1989), and “the problem frame” (Altheide 1997) that privileges danger and risk, and encourages fear (Petersen 2001).

These frames are not benign, but may influence our perceptions of appropriate responses and, in the case of health problems, therapies. The hope that understanding biologically-based conceptions of addiction will lead to improved pharmaceutical therapies is made explicit by scientists (c.f. Liu et al. 2010, Kalivas and Volkow 2005). Though better pharmaceutical therapies undeniably would be welcomed by both clinicians who treat addiction and those negatively affected by addiction, current research supports the effectiveness of behavioral therapies alone (Carroll and Onken 2005) or in conjunction with pharmaceutical treatments (Potenza et al. 2011). Despite the importance of behavioral therapies, alone or in combination with pharmaceutical treatments, research with patients suggests that understanding addiction as a genetic disorder or as a disease that results from a

behavior (like diabetes or high cholesterol) leads patients to focus on pharmaceutical therapies, and away from behavioral modifications (Bize et al. 2009, Carpenter et al. 2007, Marteau et al. 2004, Marteau and Weinman 2006, Wright, Weinman, and Marteau 2003). Elsewhere we show that media articles covering biological causes of addiction are more likely to propose pharmaceuticals than behavioral treatment as therapies (Ostergren, Dingel, McCormick, and Koenig, forthcoming).

Because the epistemological models, discourses, and framing devices we use to understand and explain a problem implicitly shape the solutions, they have implications for policy and research funding. In the United States, funding for policy-level interventions for tobacco addiction is already at risk. For example, the American Lung Association called 2011 “an abysmal year for tobacco control” at the state level both because of states’ failure to continue to enact new control measures, and because some states have weakened existing laws or have cut funding for tobacco control and prevention programs (American Lung Association 2012).

Given the prominence of genetics, and given that emphasizing genetic bases of diseases can influence not only our perception of therapies but also where we allocate funding, we explore how the American media portray biological research on addiction, asking what the reporting on addiction genetics tells us about how the media frame *genetic causation*. This question is of particular importance for behavioral genetics because of the complex and necessarily contingent nature of both the etiology and phenotype of behaviors. We explore the conflicts within articles, asking how and to what degree alternate frames invade the space. When genetic causation is covered, do media resort to simple dichotomies that obscure the complex nature of addiction? Do media include themes of skepticism and criticism?

Based on our analysis, we argue two points: first, media articles create conflict by placing biology and willpower as two opposing and mutually exclusive explanations for addiction. Second, other frames invade the articles in only minor ways. A focus on biological etiology draws our attention away from larger social and structural forces that influence drug addiction, thus directing attention back down the reductionist spiral toward individual causation and individual responsibility—either to take pharmaceutical aids or to exercise willpower.

Methods

Data Collection and Sampling of Print Media Sources

We collected all media articles on the genetics of addiction published between 1990 and 2010 from the three U.S.-based news weeklies with the largest circulation (*Time*, *Newsweek*, and *U.S. News and World Report*), the three popular science journals with the largest circulation (*Popular Science*, *Discover*, and *Scientific American*), and the seven U.S. 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*). These publications comprise a national sample, and the newspapers cover a variety of regions in the United States. We accessed media print publications

through the electronic databases Lexus Nexus, ProQuest, and through publications' official online archives. We performed full article searches using the terms "addict* AND genet*." We found no news articles on the genetics of addiction published in the news weeklies, the popular science magazines, *The New York Times*, or *The Washington Post* between 1980 and 1990, indicating that beginning our search in 1990 is sufficient. Articles sampled devote considerable space to specific genetic studies of addiction; human interest stories that do not discuss genetic research and editorials have been excluded from the sample. Our sample comprised 120 articles from these print sources.

Data Collection and Sampling of Online Sources

Online resources are also an important source of information, so we gathered news articles from internet network and cable news websites, including CNN, MSNBC, ABC and FOX. These sites were chosen because both a Google and Yahoo search for "news" indicates these are the 4 most popular news web 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. Because search engines organize results based on number of hits, the use of common key phrases (e.g., "genetics and addiction") provided a structured way of collecting the pages people have visited in the past (Illes et al. 2003). Searches were conducted each week between April 9 and May 7, 2010 using the search terms "genetics and addiction." 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. To ensure that the articles in our sample were the ones most likely to be seen by people searching the web, only articles that appeared in the top 5 search results for three or more weeks were included in the sample, yielding 25 articles. In total we have 145 print and web articles in our sample.

Analyses

Public perception and discussion of addiction is a *cultural phenomenon* which is located within a particular socio-historical context (Courtwright 2001, Gladwell 2010, Kushner 2010). As such, media reporting on genetics of addiction research presents a "class of texts" through which we may identify the public discourse on this topic (Chalaby 1996). We performed a critical discourse analysis of this class of texts, in which we: sought to identify common themes or "storylines" that appear; 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). In this discourse analysis, we wanted to understand both the linguistic characteristics of the texts and also their meanings within a wider socio-historical context. For example, themes in our sample are apparent in a variety of widely read media; as a result, we can conclude that they resonate with common American cultural knowledge

(Griswold 1987). We therefore treat themes in these texts as the material manifestation of cultural discourse in the U.S. (Fairclough 1995, Phillips and Hardy 2002).

Team members independently read four randomly selected articles. From these careful readings, we deliberated on and developed an initial set of codes from themes we identified in the articles. We continued to revise and sharpen codes throughout the coding process. Table 1 shows a complete list of the codes, with a brief description of each. Each article was independently coded by two team members using the qualitative software package NVivo (QSR International 2009). Though there was very high inter-coder agreement, any disagreements were discussed until consensus was reached. We then wrote memos for codes, through which we further analyzed the content of the text that fell within the code, and identified variation in how the topic of the code was presented in the articles. For this paper, we analyzed the code “Theory of Addiction,” which contained any mention of underlying contributing factors of addiction. Subsequent analysis, including the creation of detailed memos summarizing key codes, helped us identify three contributing factors for addiction commonly portrayed in media accounts: biological, willpower, and social/environmental. Below in the analysis, we provide specific media quotes to illustrate each contributing factor, but briefly, the biological contributing factor was defined as any mention of a biological basis of addiction, including genetic predisposition and neurological influences. “Willpower” included will, self-control, or morality, concepts that the articles used interchangeably. Finally, social/environment included elements like family structure, social inequality, or policy. Using NVivo software, which is designed to aid qualitative data analysis, we tracked articles by theme and “coverage,” the latter of which is calculated by NVivo, and is the percentage of the *characters* in the document coded to that theme.

Results

As expected given our search criteria, the articles in our sample focus largely on the biological underpinnings of addiction (See Table 2), with 86% of the articles describing addiction as a genetic or biological condition¹ or disorder. Using this as our starting point, we will show below that few alternate frames significantly invaded the biological frame of addiction. “Willpower” and “moral character,” which are used interchangeably, are present in about 20% of these articles, and are framed in opposition to and as mutually exclusive with biological etiology. These articles imply that the resulting knowledge about a biological underpinning of addiction will be positive because it will depose the outmoded idea that addiction is a problem of willpower. Environmental variables are not often mentioned and, when they are, tend to receive only cursory attention, undermining the notion that addiction results from a complex web of interacting factors.

Dichotomizing Biology and Willpower

Many articles in our sample differentiated “biology” from “willpower” or “moral character,” portraying the two as opposites. In some cases, articles offered no alternate reasons for addiction:

¹Since many of the articles expanded their focus to include other biological variables that influence addiction (e.g., neurology), our use of “biology” throughout reflects this wider lens.

Americans tend to think of drug addiction as a failure of character. But this stereotype is beginning to give way to the recognition that drug dependence has a clear biological basis. “Addiction,” declares Brookhaven’s Volkow, “is a disorder of the brain no different from other forms of mental illness” (Nash and Park 1997).

Although the American Medical Association declared alcoholism a “disease” in 1956, the topic has been hotly debated. Some contend it is a matter of willpower and moral backbone, while others cite the genetic propensity (Kotulak 2002).

The contributing factors dichotomized in these articles (willpower/morality or biology) are located in the individual. However, individuals exist within a complex network of social and cultural settings and relationships; locating drug consumption behaviors solely within the individual detracts from the complex interplay between genetics and the social environment (e.g., drinking with friends, smoking out-of-doors with coworkers, psychosocial stress, or peer influence).

Willpower as a Straw Figure

Though the willpower-disease dichotomy is apparent in many of these articles, the media usually do *not* present the two as equally valid contributing factors. Instead, the notion that addiction is the result of a lack of willpower or moral code is generally constructed as a straw figure. The clear message in these articles is that defining addiction as a problem of willpower is neither logical nor supported by the evidence. They seem to say that, in the past, the dominant social understanding of addiction was as a problem of willpower, but now, thanks to modern science, we hold a more accurate biological understanding.

Once thought of as weak-willed people who lacked the moral strength to just say no to drugs, addicts are now viewed as victims of genes that make them susceptible to the powerful pull of mind-altering substances (Carroll 2000).

In years past, people debated whether alcoholism was a disease or a moral failing. Today, it is abundantly clear that not only is it a disease, but also one with a strong genetic component (Foreman 2004).

In other words, the storyline embedded in these articles first sets up a tension between the probable contributing factors (biology and willpower), and then resolves the tension by discrediting the latter. This storyline inherently conforms to the genetic optimism frame by conveying faith in the benefits of scientific progress and genetic knowledge.

Challenging the Dichotomy

Only a few articles challenge the dichotomy between the biological and moral model of addiction. Some of these articles quote scientists who are trying to interweave the supposedly dichotomous disease and willpower.

“High levels of dopamine receptors seem to make us more sensitive to natural reinforcers,” such as our codes of moral, social or personal behavior, says Volkow. That means it’s easier for us to balance our desire for pleasure with our desire to achieve social closeness, career success or other positive life goals. Low levels throw off that balance (Wingert 2006).

In this passage, Volkow, the current Director of NIDA, creates an elegant explanation that ties what we might conceptualize as “willpower” directly to the human body. This explanation directly connects our ability to follow the codes of morality or personal conduct to our physiological sensitivity to pleasure. Low sensitivity to pleasure makes it harder to balance desire with social norms, morality, and expectations. Volkow makes a similar argument in another article in our sample, stating:

People say that addicts take drugs because the drug is pleasurable. And that is where the whole stigmatization of the drug-addicted person as being morally weak comes across. I don’t like the whole concept of pleasure because it gets oversimplified. It’s motivation and drive (Deunwald 2003).

Other scientists make similar points, often emphasizing the NIDA-endorsed “disease of the brain” model of addiction:

“People are not just making lifestyle choices, or heritability wouldn’t be so high,” Goldman said. “I don’t know why people have a problem calling [alcoholism] a disease. Clogged arteries exist because of choices made about eating Twinkies. No one says it isn’t heart disease” (Talan 2001).

These explanations contrast with those that present biology and lack of willpower as mutually exclusive causes of addiction. Volkow and others seek to break down the perceived dichotomy between “biology” and “choice,” a dichotomy that arises in much behavioral genetics research (Dingel 2005, Easter 2010, Wilcox 2003). While these more complex explanations attempt to illuminate the intimate relationship between our bodies, our will, and our actions, they still privilege a reductionist framework for addiction (Bradburd 2012) and omit the cultural and social context within which individuals make decisions and weigh options. It is a framework that holds the “environment” constant and explains variation by looking to the neurological – a framework consistent with that held by the National Institute on Drug Abuse (Courtwright 2012), for which Volkow sits as director. By focusing only on genetics without understanding the local cultures of norms, morals, and economic and social avenues for positive experiences, and without understanding how the avenues for the above vary between groups of individuals, our conception of why and how people begin and continue to abuse substances will never be complete (Courtwright 2012).

Though our qualitative study does not allow us to draw statistically reliable conclusions, our analysis indicates a general trend where the space devoted to describing biological bases of addiction has decreased over time (Table 2). There does not appear to be a corresponding increase in “coverage” of environmental factors or willpower, suggesting that the focus of these articles has shifted from etiology and onto other topics, like potential therapies for addiction. There is not a clear trend in the number of media articles on addiction genetics published, despite the steady increase of addiction genetics journal articles published (Table 3).

Environment

Fewer than half of the articles in our sample mention environmental factors, and about half of the articles that do describe the environment in a cursory manner. This singular focus on

the biological with only scant attention to environmental exposures and other social factors is evidence that the complex variables involved in drug use do not comfortably sit together in a common rhetorical frame. Once biology is introduced, other frames do not invade the space. Examples of the cursory nature of references to environment include mentions of “environmental factors” or triggers, without any additional detail:

The genetic variations, which encode nicotine receptors on cells, could eventually help explain some of the mysteries of chain smoking, nicotine addiction and lung cancer that cannot be chalked up to environmental factors, brain biology and statistics, experts said (Associated Press 2008).

But genes hardly tell the full story. In about 25% of identical twin pairs, one twin smokes and the other doesn't, though they share all genes. Environment and willpower clearly play a role, too, [Dean] Hamer says (Elias 1999).

When the media describe the biological underpinnings of addiction in detail but the environmental influences are either absent or addressed sparingly, readers are pushed to focus on one at the expense of the other. Even though there is no contradiction between understanding addiction as a complex biopsychosocial problem, over-simplifying the problem to one chief complaint—the biology—takes attention away from the other important factors, like stress, poverty, and cultural expectations.

Only about one-fifth of the articles in our sample provide some detail about environmental, cultural, and structural underpinnings of drug use and addiction. While many of these quotes are brief, they provide more descriptive information.

Such environmental factors as the stress of financial or other personal problems are thought to play a significant role in the disease, and researchers note that those without any genetic disposition can become alcoholics. The environmental argument is bolstered by the few alcohol-abuse problems experienced among groups, including the Amish and Mormons, whose upbringing discourages alcohol use. Others note that alcoholism is five to six times more common in men than women, which suggests environment-related factors in a society that has been more tolerant of men drinking (Nazario 1990).

Genetics is never destiny, however. Genes may interact with specific toxic environments, such as abuse or neglect, to result in problems for some gene carriers but not for others. And if half of alcoholism risk is heritable, the other half must derive from other sources. Nobody gets to be alcohol dependent without making some poor choices, but clearly some people are more sensitive to alcohol than others in the same set of circumstances, and scientists are working to identify the sources of that vulnerability (Numberger and Bierut 2007).

Just three articles (2% of our sample), all about tobacco, emphasize the importance of public policy on decreasing smoking rates at the population level: “Taxing cigarettes, banning smoking in bars and not glamorizing it in movies is far more likely to lower smoking rates than drugs tailored to certain genotypes, these critics say” (Associated Press 1992). Only one of these (Humphreys and Satel 2005) focuses significant attention on family and environmental variables. Three articles include significant information about a study done

with monkeys, suggesting that the stress resulting from early separation from mothers increases the occurrence of risky behaviors, including drinking. One of these also includes data indicating that “living in a culture where heavy drinking is endemic” was also a contributing factor (Foreman 2004).

Most scientists doing research in genetics and addiction are quick to acknowledge the importance of environmental factors, including stress, family, and larger social and cultural issues (Hammer et al. 2012). However, both scientific publications and media articles describing genetic research often marginalize these issues.

Discussion

Examining American media representations of scientific research on the biological underpinnings of addiction allows us to situate conceptions of behavioral genetic research within American popular culture. Addiction is a case study that reveals the tensions between environmental and individual explanations for problematic behaviors; these explanations have consequences for how Americans organize responses to these behaviors personally and through health care and policy. In our sample, media representations privilege new biological explanations for addiction, dichotomize these with individualistic notions of willpower, and marginalize or omit the role of environment, which includes culture and social structure. This evidence suggests that though biological and environmental explanations are theoretically compatible, in practice focusing on biology directs attention, if unintentionally, away from the environment and the necessarily complex and messy etiology of addiction. This redirection is particularly problematic given that the epidemiological evidence surrounding drug use and addiction undermines the strongest form of the disease of the brain model that *all* addiction is a chronic and relapsing brain disorder: a majority of people who at some point in their life qualify as “addicted” quit without treatment or relapse (Hall and Carter 2013).

The dearth of alternate frames that invade the nearly singular focus on genetics reflects, in part, the difficulty researchers face in integrating knowledge of environmental, socio-structural, and genetic predictors of addiction. Though there is wide scientific acceptance that understanding interactions between genes and environment is essential for understanding complex behaviors like addiction (Goldman, Oroszi, and Ducci 2005, Crabbe 2002), exploring these interactions remains a challenge. First, because of specialized disciplinary training, both social scientists, who study environmental and structural causes of behavior, and geneticists, who interrogate biological causes of behavior, have long resisted both interdisciplinary collaborations and integrating alternative explanations into their models (Dick 2011, Seabrook and Avison 2010). Further, the “environment” is composed of a virtually infinite number of variables that interact, change over time, are often dependent upon the meaning of the environment to individuals, and modulate in influence depending on when they occur in the lifecourse (Seabrook and Avison 2010). Within this context, a genetic study with clearly defined parameters is seductive.

Another challenge for researchers is communicating their findings to the media. Conveying accurate information to the public about the promise of genetic-based therapies for nicotine

and alcohol addiction, alongside the ethical and social implications is a challenge that could be more effectively met by the scientific community through increased engagement with the public on the part of researchers, greater media savvy, and the deployment of communication specialists (Condit 2007, Caron et al. 2005, Illes et al. 2010). Condit (2007) urges scientists to temper the promotion of their own work, being particularly sensitive to reducing hype and avoiding determinism.

Though media coverage of addiction genetics research reflects the biological focus of much federally-funded research on addiction, as well as the building excitement among scientists and the public over the potential application of these new biomedical advances to health care, media portrayals of addiction genetics have been viewed by some as largely deterministic and overly simplified (Hall, Gartner, and Carter 2008, Brechman, Lee, and Cappella 2009, Khoury et al. 2000). There has been a tendency for the popular press to represent genetics in a Mendelian sense, suggesting that having a particular gene—an “addiction gene”—will likely lead to developing nicotine or alcohol dependence (Conrad 2001). Such thinking reflects early discoveries of single-gene disorders, such as Huntington disease and Tay-Sachs, but does not reflect the current scientific understandings of nicotine and alcohol dependence, with a broadened understanding of etiology including epigenetics and environmental factors (Hall and Carter 2013, Hall, Gartner, and Carter 2008). Journalist and scholar Sally Lehrman argues that journalists 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” (2008, p. 297). Including more of the social, historical, and economic context into the story, she argues, will make the story more interesting as well as more accurate, especially in the context of covering complex disorders like addiction.

Common media framings of addiction genetics that dismiss individual agency, couched simplistically as “willpower,” and undermine the logic and importance of environmental and structural variables, leave the only logical contributing factor as genetic or biological. This, in turn, has implications for what individuals perceive to be logical therapies (Dingel, Karkazis, and Koenig 2011, Hall and Carter 2013). The news media have tended to make overly optimistic claims about the amount of time it will take to translate genetic research into practice, as well as to emphasize the benefits of new treatments over the risks. For example, one article published in 1990 claimed that “It could take at least five more years of research to understand better the gene’s role in alcoholism and to design a screening test for it and other genes, the researchers said” (Scott 1990). This quote illustrates both determinism about the influence of genetics on addiction and unfounded optimism about the development of diagnostic technologies. Media messages could thus play a key role in contributing to a shift from social interventions to a reliance on genomic medicine (Hall, Gartner, and Carter 2008). Other research indicates that providing individuals with genetic information about smoking and cholesterol encourages people to utilize pharmaceuticals, and rely less on behavioral interventions (Carpenter et al. 2007, Marteau et al. 2004, Marteau and Weinman 2006, Wright, Weinman, and Marteau 2003, Bize et al. 2009).

Of particular concern is that funding for research, prevention, and treatment programs is sensitive to how we conceptualize the root cause of a public health problem. Maintaining

funding remains a concern both for scientists engaging in biological research and for public health and social programs (Givel and Glantz 2000, LaPelle, Zapka, and Ockene 2006, American Lung Association 2012). Some researchers have argued that public health measures that focus on population-level solutions will always be more effective for substance use, like smoking, than genetic therapies (Hall and Carter 2013, Carlsten and Burke 2006, Merikangas and Risch 2003). Yet others argue that the current public health programs are experiencing a leveling-off of success, and that new pharmaceutical treatments are needed to help the approximately 20% of people who continue to smoke in the face of otherwise successful public health policies and programs (Warner and Mendez 2010).

A number of researchers have emphasized the importance of public education to counter media misrepresentations of genetic research on addiction and to ensure that genetic information and applications are well understood by the public (Hall, Gartner, and Carter 2008, Khoury et al. 2000). Ultimately, scientists and journalists must work together to craft media messages that illuminate the complex nature of human behaviors, and resist temptation to dichotomize contributing explanations for these behaviors in ways that privilege simplistic and deterministic genetic explanations.

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Table 1

Code	Description
Genes	Descriptions of what genes are and what they do.
Gene-environment interaction	Descriptions of gxe interactions (including epigenetics).
Theory of addiction	Description of the underlying cause of addiction. 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</i> or <i>abuse</i> .
Drugs	Description of what drugs are and what they do.
Treatment 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.
Hype	Statements that we might recognize as not supported by data that may raise people's 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.
Animal model	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.

Table 2

	Percentage of articles containing the theme:			Percentage of average coverage* within articles		
	Environmental Factors	Willpower	Biological bases	Environmental Factors	Willpower	Biological Bases
All Articles	40%	19%	86%	3.0%	0.9%	16.9%
All articles, 1990–2000	42%	14%	91%	2.8%	0.6%	20.5%
All articles 2001–2010	39%	24%	79%	3.3%	1.2%	12.8%
Internet articles	46%	9%	87%	3.6%	0.5%	16.5%
Print articles	40%	21%	87%	2.9%	0.9%	17.0%

*“Coverage” is the percent of *characters* in the document coded to each theme.

Table 3

Year	# of media articles in sample	# of scientific articles published*
1990	15	5
1991	8	35
1992	12	21
1993	5	20
1994	2	73
1995	1	85
1996	5	116
1997	4	134
1998	18	136
1999	7	161
2000	6	219
2001	10	200
2002	5	228
2003	6	270
2004	9	324
2005	6	384
2006	6	425
2007	6	431
2008	13	610
2009	5	587
2010	4	704

* These numbers were obtained using a Web of Science search. All articles with topic “(gene* OR genom*) AND addiction” were included.