Short Term Cravings, Long Term Effects

A Call for More Comprehensive Alcohol Education

By Madde Hyland
If you were watching television in the early 2010s, you likely saw commercials of people with breathing stomas and robotic sounding voices on nearly every channel. Many companies and non-profit organizations were hoping to use scare tactics in a desperate attempt to stop the devastating effects of a nationwide nicotine addiction. Other campaigns, mainly targeted at younger generations, focused on having a smoke free country and aimed to have the upcoming generation be the one to end smoking. Anti-smoking ads have been produced and consumed for decades. In fact, Britain’s Health Education Council created a Superman comic in which the superhero fights a new villain: Nick O’Teen (1). In the comic, Superman highlights the dangers of smoking, and encourages children to join the fight against Nick O’Teen by saying no to ever smoking cigarettes. The comic even featured a certificate for children who wished to sign on to fight Nick O’Teen with Superman.

Ads and campaigns like Britain’s Health Education Council Superman comic have become a norm in society because the negative effects of nicotine, tobacco, and cigarettes have become common knowledge to the general public. There are long term effects of smoking cigarettes not only on the person who decides to smoke, but also on those around them. Most people know that secondhand smoke is just as bad for a person as smoking cigarettes themselves, and policies have been put in place to prevent people from unwillingly experiencing secondhand smoke. Additionally, the individual long-term health effects of smoking, such as the development of high blood pressure and lung cancer, can pass on a genetic risk of disease to unborn children.

All of this information allows for consumers to become informed about the risks of smoking before they decide to pick up the addicting habit. Specifically, this information puts a sense of responsibility on both smokers and non-smokers to be mindful of the potentially devastating repercussions of smoking on themselves, those around them, and their future children. Because of all of this well-advertised and well-researched information, smoking is no longer seen as ‘the cool thing to do’. In fact, many people will get disgusted looks from others if they are smoking in a public space. This can even be seen in popular culture, where it is no longer common to see individuals smoking in movies, whereas that was the cultural norm several years ago.

Now imagine yourself in college on a weekend with your friends. You’re getting ready to go out and unwind after a stressful week of classes. What’s the first thing that you do? Your likely move is going to be drinking some alcohol to ‘loosen up’ before going out on the town. From getting drunk at parties, to having a few beers with your coworkers at a bar after work, social drinking is considered an acceptable way to spend time with friends, unwind, and meet new people. In fact, drinking is so ingrained into American societal norms that nearly 30% of young adults 18 and older in the United States reported binge drinking while about 7% reported heavy alcohol use in 2019 (2). While these numbers already seem large, they are very likely to be an underestimate.

According to the United States Department of Health, alcohol consumption is considered binge drinking when a person’s blood alcohol levels reaches 0.08%. A person is thought to have heavy alcohol use if this happens at least five times per month.
(3). Many college students go out to parties, bars, and other social events one or two times per weekend (roughly four times a month) and often become intoxicated beyond the requirements for binge drinking. Additionally, it is unlikely that most people will self-report binge drinking and heavy alcohol use for a multitude of reasons, all of which lead to the same result: underestimates of the true amount of people who frequently drink heavily. This means that almost certainly more than 30% of young adults have indulged in binge drinking. The individual long-term effects of alcohol are well-known: excessive alcohol use can lead to severe health effects such as high blood pressure, heart disease, learning and memory problems, risk of addiction, and mental health problems (4). 

Think back to the anti-tobacco campaigns that were mentioned earlier. Can you name an alcohol ad that is similar to any of those? The answer is likely no. It is currently not normal to talk about alcohol consumption in the way that we now talk about cigarettes, nicotine, and tobacco. Other than the occasional ‘Don’t Drink and Drive’ commercial or billboard as the holiday season approaches, there are very rarely discussions about the consequences of drinking alcohol in today’s society. We know the long-term effects of heavy alcohol consumption, so what is the major difference between alcohol and tobacco that allows for drinking to be socially acceptable while smoking is not? The answer is likely that the general public believes that they can partake in these activities without affecting others. As long as people are not drinking and driving, many people view drinking as a relatively harmless activity. To compare this to smoking, the general public understands—and has received an abundance of media teaching them—that anyone who smokes can negatively affect those around them, as well as risk the health of their unborn children. However, people seem to believe that when it comes to drinking, everyone is seemingly off the hook, making it socially acceptable to drink alcohol as much as they would like. That is, unless you are a pregnant woman.

Fetal Alcohol Spectrum Disorders and the Weight of Drinking for Two

In Ancient Greek and Roman cultures, the risks of drinking during pregnancy were constantly acknowledged. In fact, women were told to not drink on their wedding night in order to avoid birthing children with developmental defects (5). Although this cautionary tale was passed on through generations, it somehow found its way into the world of mythology. Therefore, many people took it as just that: a myth. The identification of the relationship between alcohol and severe birth defects was widely ignored until the late 20th century. For many years it was believed that low levels of drinking were acceptable during certain stages of pregnancy without causing any harm to the unborn child. However, doctors continued to see babies born with severe birth defects, and began to suspect that alcohol may be involved.
As more scientific research was done on the effects of gestational alcohol consumption, it became apparent that there was no safe amount of alcohol that a woman could drink while pregnant. It appeared that all levels of alcohol consumption could risk leaving a developing fetus with serious health defects. As knowledge of this phenomenon grew, the terms ‘Fetal Alcohol Syndrome’ and ‘Fetal Alcohol Spectrum Disorder’ became buzz words as scientists uncovered all of the potential effects of drinking alcohol during pregnancy (6).

Fetal Alcohol Spectrum Disorders, which may occur when an expecting mother consumes alcohol during pregnancy, result in a multitude of physical, behavioral, and learning problems throughout development, many of which can persist into adulthood (6). Symptoms associated with Fetal Alcohol Spectrum Disorders include the following: low body weight, poor memory, intellectual disability, vision problems, heart problems, shorter than normal height, small head size, and abnormal facial features (6). These symptoms are often striking and devastating to new parents. Because many of these symptoms do not go unnoticed, babies are able to be diagnosed with Fetal Alcohol Spectrum Disorders at birth or in early stages of childhood. The growing prevalence of these disorders after their discovery required some sort of action on behalf of public health officials. The public needed to be informed of the dangers of drinking alcohol during pregnancy. Beginning in 1988, the Surgeon General required that every alcoholic beverage must have the following warning on the outside of the container (7):

“GOVERNMENT WARNING: (1) According to the Surgeon General, women should not drink alcoholic beverages during pregnancy because of the risk of birth defects.”

As people became more aware of the risks of drinking alcohol while pregnant, the pressure was placed on pregnant women to avoid alcohol at all costs. Unborn fetuses live in a mother’s womb and survive using the nutrients that they get from their mother. It seems logical that, since the fetus and mother share blood (and therefore blood alcohol content), this is how the negative effects of alcohol are passed down through generations. Pregnant women were — and still are — advised to break societal norms and stop drinking with their friends or unwinding with a glass of wine at night after a long day at work. This responsibility was placed on them alone to make sure that their children were not negatively impacted by alcohol. However, is it really only up to pregnant women?

Changing the Narrative: Everyone’s Drinking Habits Affect Everyone

For a long time, it seemed unlikely that there were any risks to someone’s future children posed by alcohol outside of gestational alcohol consumption given that moms are the only people who have contact with a fetus before it enters the world. However, this frame of thinking ignores the developmental biology of a growing fetus, specifically where it gets the basic genetic information necessary to create human life. DNA from both the mother and father are passed onto the fetus, and therefore mom and dad both have the ability to pass traits on to their children. This leads to a very pressing question: does alcohol affect our DNA? If so, how?

Drinking while pregnant can cause severe developmental effects for new babies. Original image by Madde Hyland. Created in BioRender
In the last 20 years, research has been done to investigate these exact questions. When a question is asked about how a certain behavior affects our DNA, the field of epigenetics is often a topic of discussion. Epigenetics involve changes to the DNA that, although they do not affect the genetic code itself, can affect the way the certain genes are expressed throughout the body (8). Epigenetic changes can do several things, including turning genes on and off at points when they would usually not be. This can potentially lead to an imbalance of proteins and hormones that regulate bodily functions and behaviors. Researchers have found that certain behaviors lead to specific epigenetic changes to the DNA. Since epigenetic research seeks to explore how a person’s behavior can impact their genetic makeup, scientists set off to explore the impacts of heavy drinking on the expression of specific genes related to learning and memory, as well as addiction. Mouse models are often used to study epigenetics because epigenetics work similarly in humans and mice. Therefore, researchers used mouse models of binge drinking and chronic alcohol consumption to investigate how this can affect gene expression and epigenetics. Studies have shown that alcohol consumption can actually epigenetically modify a person’s DNA. These changes can result in a multitude of behavioral changes, including making an individual more susceptible to the rewarding effects of alcohol and therefore more likely to develop a dependence or addiction (9). Scientists have also demonstrated that high levels of alcohol consumption in mice, similar to heavy alcohol use in humans, can lead to an increased preference for alcohol, and a decrease in working memory – the capability to remember things. Heavy drinking can lead to heritable epigenetic changes to the DNA. Me3 is a type of epigenetic change to the DNA. Original image by Mad-de Hyland. Created in BioRender.

Increased risk of addiction, potential learning and memory deficits.
to remember information for small amounts of time (10).

Scientists have used mouse models of alcohol consumption to show that these behavioral changes are linked to the differential regulation of particular genes, and that this differential genetic regulation can be passed down to the next generation of mice (10). One specific study investigated the role of alcohol consumption on working memory in the next generation.11 This study found that the offspring of mice who were subjected to heavy alcohol consumption had a downregulation in dopamine transporter proteins, which are crucial for memory and the formation of new neurons in the brain.12 These molecular changes in the brain resulted in a deficit in spatial memory, and the mice whose parents had consumed large amounts of alcohol were unable to remember locations that they had previously visited (11). A separate study showed that heavy alcohol consumption can lead to the upregulation of the SIRT1 gene, which plays a role in the rewarding effects of alcohol (9, 13). An increase in the rewarding effects of a drug of abuse can result in a higher risk of developing an addiction to the drug. Therefore, the upregulation of the SIRT1 gene is a potentially dangerous result of long term alcohol use. Unfortunately, it has been suggested that the upregulation of this gene may be passed onto future generations, which can increase the risk of offspring developing addiction later in life (13). Studies have demonstrated that some of these epigenetic changes can even persist into a second generation of offspring (13). This means that your alcohol consumption can not only affect you, but your children and grandchildren as well. Put simply, anyone who drinks heavily can pass down negative traits to their future children, and can even increase their susceptibility to addiction.

While these studies uncover the impacts that alcohol consumption can have on your children even prior to conception, it also highlights that both sexes are capable of passing these negative traits on to the next generation (10, 11, 14). These research findings, while grim, may be seen as somewhat of a relief for expecting mothers: the idea that they are the only ones responsible for the health of their unborn children has now been debunked. The responsibility is no longer only on them, but rather on everyone to drink responsibly.

It’s About Access to Information

The research papers discussed in this article are often hard to read for an undergraduate science student, let alone someone with little to no scientific background. Many forms of scientific research are inaccessible to the general public due to the heavy use of scientific jargon. This leads to a delay in the spread of new and important information and can often lead to a disconnect between the scientific community.
and the rest of the world. New commercials, advertisements, campaigns, and warning labels all do one thing: they give the general public access to information that allows them to make an informed decision before partaking in potentially harmful activities. As information about the harmful effects of smoking became public knowledge, less people made the decision to smoke. Once people learned that secondhand smoke could affect other people, policies were enacted to give people the choice to be smoke-free. Now that it is known that heavy alcohol consumption can affect people’s future children, it is likely that the incidence of heavy drinking, along with its negative effects, will decrease if this knowledge is transferred from the scientific community to the rest of the world.

Taking Action: Changes in Policy

It has now been established that heavy alcohol consumption and binge drinking can in fact affect those around you, specifically when thinking about your future children. Now that we know this, what is the next step? We can actually use the lessons learned from cigarette and tobacco prevention strategies and apply similar tactics to heavy drinking. The very first step is to educate the general public about the long-lasting and hereditary effects of drinking to an unhealthy extent. This can be done by commercials that target all generations. A short commercial using a simple split-screen to demonstrate the difference between the life of a heavy drinker and their family compared to a responsible drinker could prove to be an effective way to portray this information to older audiences. For younger audiences such as school-age children, education on the long-term effects of heavy drinking can be implemented into preexisting “Don’t Drink and Drive” education campaigns. Additionally, a spin-off of the Nick O’Teen character in the Superman comic could spread awareness to yet another audience. The main focus of these proposed campaigns is simple: make the long term negative effects of alcohol public knowledge, just like we’ve done with tobacco.

While educating the general public will be a long and tedious process, there are also immediate changes that can be made to the way that alcohol is advertised and distributed across the country. As mentioned earlier, the only warnings currently displayed on alcohol bottles are ones that warn of gestational alcohol consumption and a warning to not drink and drive. Alcohol companies are not required to warn consumers about the risk of addiction or any other potential effects of alcohol consumption (7).

This has been a very recent point of discussion in the tobacco industry, and in March of 2020 the FDA officially required cigarette companies to add warning labels to their packaging and in their advertisements (15). These new warning labels are required to demonstrate some of the less well-known, but still devastating health risks of smoking cigarettes in vivid detail, including imagery of lung disease, cancer, and even a small child on oxygen. These regulations are set to take effect in October of 2022 (15). These now complex and informative labels on cigarette packs are meant to inform consumers about the dangers of their purchase and the potential choice to smoke cigarettes. Given that alcohol also has widely unknown long-term effects, it is of the utmost importance that the warning labels on alcohol containers also change. The addition of a simple image and text box explaining how alcohol can not only affect the consumer, but also their future children, would help to diminish the risk of alcohol addiction and cognitive defects in future generations. It is important to note that the overall goal of this proposed alcohol education is not to scare people away from drinking. Alcohol consumption is ingrained in our society. People enjoy wine with their meal and cracking open a beer while watching football, and these norms will likely remain for the foreseeable future. Rather, the purpose of more comprehensive alcohol education is to inform the public of the potential long term dangers of misusing alcohol, and to encourage them to think before they drink.
References


