



Brief video intervention to teach firefighters the neurobiological basis of high risk alcohol use: A pilot study

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ABSTRACT

Introduction: Evidence-based information related to the neurobiological bases of alcohol use disorders has not been widely disseminated to individuals affected by alcohol use. The feasibility, acceptability, and effectiveness of the video, *Alcohol and the Brain* was assessed, guided by the three constructs of the transtheoretical model: processes of change, decisional balance, and self-efficacy.

Methods: This study examined the feasibility and acceptability of a brief video intervention and change in alcohol-related knowledge in a sample of urban firefighters ($n = 11$). The 20 min video was shown in a 45-min session of a Self-Management Wellness Program. A 10-item knowledge test was administered prior to and after the video and analyzed using a paired t -tests.

Results: This brief intervention was feasibly delivered with sufficient time for questions and answers in the firehouse. There was a high level of acceptability as reflected in the positive comments and the highly interactive discussion. There was a significant increase in knowledge from pre- to post-test ($t = 7.7$; $p < 0.001$).

Implications for practice: Complex neuroscience can be translated for patients in the form of a video that is feasible and acceptable with significant increase in knowledge. The efficacy of this brief video intervention on alcohol-related and treatment-related outcomes needs to be established.

Introduction

“Health care for general, mental, and substance-use problems and illnesses must be delivered with an understanding of the inherent interactions between the mind/brain and the rest of the body” (National Research Council, 2006). Despite this charge from the National Research Council as well as recognition that alcohol use disorders are brain-based disorders (Leshner, 2001), this evidence-based knowledge has not been widely disseminated to individuals affected by alcohol use. Bridging this gap is critical, since the majority of Americans who could benefit from treatment for problems related to alcohol or drug use report they neither received nor even perceived a need for treatment (Substance Abuse and Mental Health Services Administration Office of Applied Studies, 2018).

Common reasons for patients not seeking treatment include attitudinal factors such as minimizing the problem, fears about social stigma and pessimistic attitudes toward the effectiveness of treatment, (Mojtabai & Crum, 2012). Additionally, unsympathetic attitudes of health care professionals toward patients with substance use disorders

are common and contribute to less than optimal outcomes for these patients (van Boekel, Brouwers, van Weeghel, & Garretsen, 2013). Positive results, that is people who would otherwise not go for treatment, have been realized following the use of screening measures. For example, a screening rate of 95% has been reported when screening measures (i.e., the Single Alcohol Screening Question; SASQ and Alcohol Use Disorders Identification Test-Consumption; AUDIT-C) were adopted for use in a family medicine clinic (Johnson, Seale, Shellenberger, Harnack, & Lott, 2013). Likewise, high alcohol screening rates (93%) were identified after implementing the computerized AUDIT-C for annual screening for primary care in the Veterans Administration (Bradley et al., 2006). Similarly, high screening rates (96%) have been reported following integration of screening questions into the electronic triage tool used in the emergency department (Johnson, Woychek, Vaughan, & Seale, 2013). It is fair to conclude that high screening rates improve rates of seeking treatment.

Despite the movement toward universal screening for alcohol abuse, the use of brief educational interventions by healthcare providers is relatively limited (Kuehn, 2008) and has not been integrated into

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Table 1
Processes of change defined and corresponding active ingredients in the video.

TTM construct	Definition	Active ingredient in video
Processes of change		
Consciousness raising	Increasing information about self and problem	Describes the brain structures and functions. Shows the brain reward pathway.
Dramatic relief	Experiencing and expressing one's feelings about the problem and solution.	Actor tells story about consequences experienced when drinking.
Self-re-evaluation	Assessing how one feels and thinks about oneself with respect to a problem.	Actor reflects on how drinking negatively impacted his health and relationships.
Environmental re-evaluation	Assessing how one's problem affects the physical environment	Person shown sitting on ground next to her car that was in accident after DWI.
Social liberation	Increasing alternatives for non-problem behaviors in society.	Actor is walking dogs instead of isolating or drinking.
Stimulus control	Avoiding or countering stimuli that elicit problem behaviors	Actor shown refusing a drink. Actors shown enjoying television program in a casual setting.
Counterconditioning	Substituting alternatives for problem behaviors.	Mutual support group shown and described.
Reinforcement management	Rewarding one-self or being rewarded by others for making	Person shown looking at want ads to seek employment.
Self-liberation	Choosing and commitment to act or belief in ability to change.	Actor tells story about turning point in his decision to stop drinking.
Helping relationship	Being open and trusting about problems with someone who cares.	Mutual support group shows individuals sharing with one another.
Decisional balance		
Pros - alcohol consumption	The benefits of decreasing alcohol consumption	Actor discusses impact of alcohol on health
Cons -alcohol consumption	The consequences of decreasing alcohol consumption	Actor alludes to alcohol use as helpful when he returned from Vietnam
Pros -alcohol treatment	The benefits of accepting alcohol treatment	Actor describes working with healthcare provider to manage health
Cons - alcohol treatment	The consequences of accepting alcohol treatment	Actor discusses negative view of Alcoholics Anonymous and resistance to attend
Self-efficacy		
Confidence - decreasing alcohol consumption	Confidence in being able to cope with high-risk situations without relapsing	Actor relays that he would not be able to stop drinking on his own. Relays being determined to "make this work" after last treatment.
Temptation - consuming alcohol	The intensity of urges to consume alcohol when in the midst of difficult situations	Actor discusses being tempted to drink.

TTM = Transtheoretical Model.

routine practice (Tucker, Murphy, & Kertesz, 2010). Various provider and system-level barriers to the delivery of brief interventions have been identified. These barriers range from negative attitudes and perceptions (Broyles et al., 2012) to lack of institutional support (Johnson, Jackson, Guillaume, Meier, & Goyder, 2011; Nygaard & Aasland, 2011). Explaining the neuroscience behind alcohol disorders to individuals who are at risk could potentially increase acceptance of referral to alcohol treatment (Finnell & Nowzari, 2013). For example, patient education related to Hepatitis C was followed by a marked increase in their willingness to accept treatment (Gupta, Romney, Briggs, & Benker, 2007). Similar results may be possible for patient education related to alcohol use. While the content of brief interventions varies across research and demonstration projects, most are instructional and motivational (Babor & Higgins-Biddle, 2000). Ideally, a brief intervention is one that is low cost, low intensity and short in duration. A brief intervention is a non-confrontational, patient-centered approach designed to initiate a behavior change in an individual suffering from alcohol related problems by highlighting the consequences of alcohol related actions is to motivate an individual with an alcohol-related problem toward behavior change by (Sullivan & Fleming, 1997). The transtheoretical model (TTM) of intentional behavior change (Prochaska & DiClemente, 1984) provides the foundation for motivational interventions that can be tailored to an individual's readiness to change behavior, as conveyed in the Substance Abuse and Mental Health Service Administration' Treatment Improvement Protocol, *Enhancing Motivation for Change in Substance Abuse Treatment* (Miller & Brown, 1999). While professional education may improve clinicians' understanding of alcohol issues, it is unlikely to change behavior in clinical practice (Babor & Higgins-Biddle, 2000). Thus, the purpose of this study was to assess the feasibility, acceptability, and effectiveness of a brief neuroscience-based video intervention for career firefighters who we previously reported had a high rate of binge-drinking behavior (58%) (Carey, Al-Zaiti, Dean, Sessanna, & Finnell, 2012).

Research questions

The research questions were: Is it feasible to for firefighters to view and discuss a video while on duty at the firehouse? Do the firefighters find the content acceptable and will they gain knowledge?

Methods

To streamline the dissemination of evidence to patients, a 20-min video, *Alcohol and the Brain* (Finnell, 2012) was developed to provide information about the neurobiological basis of alcohol use. The video includes information about how alcohol impacts the brain and how the brain recovers in response to abstinence, behavioral and pharmacological treatments, and participation in mutual support groups. The hope was that in providing such information, the stigma attached to alcohol-related problems would be diminished enough to motivate the viewer into making alcohol-related behavior changes. These changes would hopefully come in the form of reduced alcohol consumption, and a willingness to engage in alcohol-specialty treatments (Finnell & Nowzari, 2013). In developing the script for the video, the each of the key points of the brief intervention was aligned to correspond with one of the three constructs of the TTM: processes of change (i.e., experiential and behavioral), decisional balance (i.e., pros and cons), and self-efficacy (i.e., confidence and temptations). The processes of change describe various strategies people use to change the way they think, feel, and behave while adopting a healthier behavior (Prochaska, Velicer, DiClemente, & Fava, 1998). Decisional balance reflects the weighing of pros and cons when considering a behavior change. As individuals engage in behavior change, they identify more benefits from changing their behavior and fewer reasons for not changing their behavior (Prochaska et al., 1994). Self-efficacy is important for beginning and then maintaining successful behavior change (Prochaska & DiClemente, 1992). Self-efficacy entails both confidence to enact the

behavior and temptation to return to the behavior (DiClemente, Carbonari, Montgomery, & Hughes, 1992), such as confidence or efficacy to abstain versus temptation to drink alcohol. Table 1 lists the 10 processes of change, pros and cons, confidence and temptation with corresponding definitions and examples of active ingredients in the video.

The next step was to assess the feasibility and acceptability of the video prior to conducting an efficacy study. This pre- post-test designed study also sought to assess change in knowledge among a sample of urban firefighter prior to and after receiving the information with the video format.

This was a pre-post-test study design conducted with career firefighters in their urban firehouse located in Western New York. This sample of professional firefighters was selected because a previous study among this population found more than half (58%) reported binge drinking and 14% reported hazardous drinking (Carey et al., 2012). Hazardous alcohol use was one risk factor identified among this population that informed the development by one of the authors (MGC) of a 12-week Self-Management Program for professional firefighters.

Human subjects protection and setting

The research protocol was reviewed and approved by the Health Sciences Institutional Review Board, State University of New York, University at Buffalo. The firehouse was one of the more active firehouse with three emergency rigs (eg, Ladder, Pumper, etc). Two of the rigs has four fighters assigned and the third rig has five firefighters for a total of 13 firefighters in the firehouse per shift. Firefighters gathered in the firehouse kitchen where the investigator distributed an IRB approved information sheet and then subsequently verbally explained the research protocol and answered all questions to the assembled group, most ($n = 11$, 85%) volunteered to complete the protocol.

Procedures

The video, *Alcohol and the Brain* (Finnell, 2012) was shown in the 11th week of the 12 week Self-Management Program. A knowledge test was administered immediately before and after participants viewed the 20-min video. A question and answer period followed. Participants were then asked to comment on the content and quality of the video. Importantly, because the readability index for the script was high (10.4 Flesch-Kincaid) due to the scientific terminology, a glossary of terms used in the video was provided to each participant (Table 2).

Measures

A 10-item test (nine multiple-choice, one true/false) included items related to the structures and function of the brain reward pathway, neurochemicals, definition of a standard drink, low risk drinking levels, medications and behavioral interventions, and mutual support groups. Scores could range from 0 to 100%.

Feasibility was assessed by monitoring the additional time that participants engaged in discussion beyond the 20-min video. Given the uncertainty of emergency calls coming into the firehouse, it was important to assess if the video could be shown without interruption. Additionally, since the efficacy study is planned to be conducted in primary care clinics, it was important to assess the amount of time these participants engaged in discussion as well as the type of questions asked. Acceptability was assessed by asking open-ended questions. These questions focused on the participants' overall reaction to the video and their opinions about the content and the quality of the video.

Data analysis

To assess acceptability, qualitative data was obtained from responses to the open-ended questions and comments during the

discussion period. Feasibility was assessed by the ability to provide the intervention within the allotted time and within a high intensity setting. To assess effectiveness of the intervention, descriptive analyses were used to calculate the knowledge test scores. A paired *t*-test was used to analyze differences between the pre- and post-test knowledge scores. Statistical significance was set at $p < 0.05$.

Results

A convenient sample of professional on-duty firefighters ($n = 11$) was recruited from one firehouse. All firefighters (100% men, 44 ± 12 years old, 82% white, 9% African American, 9% Hispanic) completed the knowledge test before and after watching the video. The sample's demographics were close to that of the fire department as a whole, except that women who represent 4% of the department were not on duty the day of the research study.

Feasibility

The 45-min session provided sufficient time for administration of the knowledge test, delivery of the 20-min video, and discussion. All firefighters remained for the duration of the testing, viewing of the video and open discussion. For their privacy, the discussion was not audio recorded but investigators took field notes.

Acceptability

The positive comments about the video content and quality, along with the interactive discussion of the participants affirmed the acceptability of the video. The video included three vignettes portraying a Vietnam Veteran telling his story about his reluctance to seek treatment, his decision to stop drinking and how he became engaged with AA. One firefighter commented how true one of the scenarios depicted his situation. Others commented on what they learned about the medications used for alcohol treatment. Several acknowledged awareness of disulfiram, but the majority had not heard of naltrexone and acamprostate. As a group, they affirmed the high quality of the production, specifically the graphic material and motion of the images.

Effectiveness

The *Alcohol and the Brain* pre-posttest included 10 questions. For example the last question was "Alcohol treatment is a waste of time and money". Mean knowledge scores increased significantly after the brief video intervention from pre- to posttest scores of 43% to 84%, respectively ($t = 7.72$, $p < 0.001$).

Discussion

It has been 60 years since the discovery of the brain reward system by Olds (DeHaan, 2010) with a substantial body of evidence related to how alcohol and other drugs of abuse contribute to the understanding of intense pleasure that accompanies alcohol consumption and attributing value to predicted negative outcomes associated with alcohol use (Urban & Martinez, 2012). Yet, this knowledge has not been widely disseminated to individuals affected by alcohol use. Until that gap is addressed, the stigma that acts as a barrier to treatment will likely persist. Having demonstrated that this complex neuroscience can be explained to patients in the form of a video and that it feasible and acceptable, it is time to test the efficacy of this brief intervention on alcohol-related and treatment-related outcomes.

While limited by the small sample size, there was a significant increase in knowledge after watching the 20-min video. These promising findings suggest that a brief intervention can be used to educate individuals about the neurobiology of alcohol use, treatments, and mutual support groups. Hinyard and Kreuter (2007) assert that narrative

Table 2
Glossary of terms used in the video (ASAM, 2011).

Term	Definition
Acamprosate	A medication usually taken three times a day by mouth. This medication has a direct action in the brain acting on neurotransmitters, glutamate and gamma-amino-butyric acid, resulting in decreased craving.
Addiction	An inability to consistently abstain from alcohol accompanied by impaired behavioral control. Addiction is a primary, chronic disease of brain reward, motivation, memory, and related circuitry. ¹
Alcoholics Anonymous	An international mutual aid fellowship founded in 1935 for the purpose of helping its members to stay sober and help others achieve sobriety.
Amygdala	Two small almond-shaped bodies in the limbic brain that detect fear and threat.
Behavioral interventions	Approaches used to help engage people in treatment and support their abstinence, modify their attitudes and behaviors related to alcohol use, and increase their skills to handle stressful circumstances and cues that may trigger return to alcohol use.
Brain reward pathway	An area of the brain activated by a rewarding stimulus, such as alcohol. The brain reward pathway includes the ventral tegmental area, the nucleus accumbens, and the prefrontal cortex
Cells	The basic structural unit of all organisms
Cerebellum	Located in the lower area of the brain, it is important for activities done with purpose and intent, such as walking.
Cortex	The cortex is the outer layer of the brain that is responsible for thought processes including speech and decision making. Four lobes of the cortex (frontal, parietal, temporal, occipital) are each responsible for processing different types of sensory information.
Detoxification	The process of removing toxic substances, such as alcohol from the body
Disulfiram	Inhibits the enzyme, acetaldehyde dehydrogenase which breaks down alcohol in the stomach and gut. When alcohol is consumed, nausea, vomiting, headaches, skin flushing (redness), and other symptoms may occur. A severe reaction requires emergency treatment as death may occur.
Dopamine	A chemical released by neurons to send signals to other nerve cells - also called a neurotransmitter. Dopamine plays a major role in motivation and pleasure.
Gamma aminobutyric acid (GABA)	GABA is a neurotransmitter that helps reduce the activity of neurons, or otherwise inhibit them from being overly active. If nerves fire too often and too easily then anxiety is experienced.
Glutamate	Glutamate is a neurotransmitter that promotes other neurons to send signals between nerve cells. Glutamate has an important role in learning and memory.
Hippocampus	An area of the limbic brain, the hippocampus has an important role in memory.
Initial recovery	A period of time when sustained motivation is needed to tolerate distressful symptoms of longer abstinence from alcohol
Limbic brain	An area that is deep in the center of the brain. The limbic brain includes the amygdala, hippocampus, and thalamus. This limbic system is involved in motivation, emotion, learning, and memory.

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Table 2 (continued)

Lower risk alcohol consumption	Men: no more than 4 standard drinks on any single day and no more than 14 standard drinks per week Women: no more than 3 standard drinks on any single day and no more than 7 standard drinks per week Pregnancy or considering being pregnant: No amount of alcohol is considered safe Over age 65 (men and women): : no more than 3 standard drinks on any single day and no more than 7 standard drinks per week
Mutual support groups	Forum in which to share experiences, strength and hope as way for support when trying to stop drinking and maintain recovery
Naltrexone	A medication taken daily by mouth that decreases the amount of dopamine released from the nucleus accumbens. Taking naltrexone is known to decrease craving and decrease the amount of alcohol if consumed;
Neural circuits	A group of neurons that are connected and interconnected to carry out a specific function when activated
Neural pathways	Neural pathways are connections formed by a single neuron to make a series of connected nerves along which impulses can travel in the brain.
Neurons	A specialized cell that transmits nerve impulses
Neurobiology	The organization of the nerve cells in the brain
Nucleus accumbens	This area integrates motivation and goal-directed behavior. The nucleus accumbens helps make the association between alcohol and pleasure, and in turn the continued use of alcohol.
Prefrontal cortex	At the front of the brain, this area is involved in planning, decision making, and judgement.
Relapse prevention	A time when new behaviors are maintained, and internal and external stresses are being managed
Standard drink	In the United States, one standard drink contains about 14 grams of pure alcohol. This amount corresponds to 12 ounces of regular beer (about 5% alcohol), 5 ounces of wine (about 12% alcohol), or 1.5 ounces of distilled spirits (about 40% alcohol). <div data-bbox="821 1017 1251 1293" data-label="Image"> <p>What Is a Standard Drink?</p> <p>12 oz of regular beer (about 5% alcohol) = 5 oz of wine (about 12% alcohol) = 1.5 oz of distilled spirits (about 40% alcohol)</p> <p>Each beverage per 14g of pure alcohol represents one standard drink for one alcoholic drink equivalent (defined in the United States as any beverage containing 14 g or 0.5 oz of pure alcohol). The percentage of pure alcohol is expressed here as alcohol by volume (ABV), varies within and across beverage types. Although these standard drink amounts are helpful for following health guidelines, they may not reflect customary serving sizes.</p> </div>
Thalamus	The thalamus is described as the brain’s relay station because it forwards information about all senses, except smell, to the higher area of the brain, the cortex for processing.
Ventral tegmental area (VTA)	A structure in the midbrain that contains many dopamine neurons. This area is best known for its role in reward processing, such as experienced when alcohol is consumed.
Vivitrol	A form of naltrexone that is injected and administered monthly.
Withdrawal	Distressful symptoms that may occur from 2 hours to 4 days after stopping alcohol. Symptoms may include headaches, nausea, tremors, anxiety, hallucinations, and seizures. The symptoms can range from mild to serious and life-threatening.

communication may be a promising tool for motivating and supporting health-behavior change. The video included three interviews with an individual (actor) describing his experiences of first coming to realize the consequences associated with his alcohol use, his initial resistance to treatment and Alcoholics Anonymous, and eventually how he overcame that barrier with help from healthcare providers and others in his support network. Future studies should examine the potency of the personal stories as an active ingredient in effecting behavior change.

Admittedly, the terminology related to the neuroscience posed a concern about the difficulty patients may have in comprehending the

information provided in the video. The accompanying glossary of terms was an important addition to the video. In fact, the participants of this feasibility study began using some of the scientific terms during the discussion period after watching the video. The glossary of terms also included the definition of a standard drink with the illustration from the National Institute on Alcohol Abuse and Alcoholism (NIAAA) booklet, *Rethinking Drinking* (US Department of Health and Human Services National Institutes of Health, 2010). Our previous study related to alcohol consumption among firefighters utilized the same graphic with the definition of a standard drink in collecting self-report data on

alcohol consumption in the month prior. Including this in the glossary of terms served as a reinforcement of drink size information, important given the high rates of binge drinking identified among the firefighters (Carey et al., 2012).

Implications for practice

This brief neuroscience-based alcohol intervention may help shift the current paradigm of shame and blame to one that is consistent with other chronic health disorders (i.e., biologically-based) and otherwise help diminish the stigma that prevents individuals from engaging in alcohol-specialty treatment. This brief intervention is ready to be applied to individuals who are at high risk because of alcohol consumption and who may benefit from referral to substance use treatment. Anticipated intended outcomes will include reduction in alcohol consumption, acceptance of referral to treatment, engagement in treatment, and completion of specialty treatment.

Conflicts of interest

None.

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Author contributions

DSF developed the content for the DVD and led the activities for the feasibility study, including development of the knowledge test and glossary of terms. SN assisted in the production of the DVD, provided input on the knowledge test and glossary of terms, and developed Table 1. The Self-Management Program was led by MGC. All authors contributed to conduct of the pilot study, data collection and analyses and writing of the report.

Disclosures

The work was conducted when MGC, SN, and DSF were at the University at Buffalo.

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