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Drug Abuse Warning Network

The DAWN Report

January 10, 2013

Update on Emergency Department Visits Involving Energy Drinks: A Continuing Public Health Concern

Energy drinks are flavored beverages containing high amounts of caffeine and typically other additives, such as vitamins, taurine, herbal supplements, creatine, sugars, and guarana, a plant product containing concentrated caffeine. These drinks are sold in cans and bottles and are readily available in grocery stores, vending machines, convenience stores, and bars and other venues where alcohol is sold. These beverages provide high doses of caffeine that stimulate the central nervous system and cardiovascular system. The total amount of caffeine in a can or bottle of an energy drink varies from about 80 to more than 500 milligrams (mg), compared with about 100 mg in a 5-ounce cup of coffee or 50 mg in a 12-ounce cola.[1] Research suggests that certain additives may compound the stimulant effects of caffeine. Some types of energy drinks may also contain alcohol, producing a hazardous combination; however, this report focuses only on the dangerous effects of energy drinks that do not have alcohol.

Although consumed by a range of age groups, energy drinks were originally marketed to appeal to youths and were reported to have been consumed by 30 to 50 percent of children, adolescents, and young adults.[2] Marketing suggests benefits such as increased energy and stamina, weight loss, and enhanced physical and mental performance.[2] More concentrated forms of energy drinks, known as energy shots, have become increasingly popular among a wider range of age groups, including older adults.[3] Marketing analysts reported increasing sales of energy shots in 2011 that were expected to continue through 2012.[3] The concentrated amount of caffeine and other ingredients in these drinks has come under scrutiny as the Food and Drug Administration disclosed reports of adverse events with mention of the popular energy shot 5-Hour Energy.[4]

Consumption of energy drinks is a rising public health problem because medical and behavioral consequences can result from excessive caffeine intake. A growing body of scientific evidence documents harmful health effects of energy drinks, particularly for children,

IN BRIEF

- The number of emergency department (ED) visits involving energy drinks doubled from 10,068 visits in 2007 to 20,783 visits in 2011
- Among energy drink-related ED visits, there were more male patients than female patients; visits doubled from 2007 to 2011 for both male and female patients
- In each year from 2007 to 2011, there were more patients aged 18 to 39 than patients in other age groups involved in energy drink-related visits; however, the largest increase was seen among patients aged 40 or older, for whom visits increased 279 percent from 1,382 visits in 2007 to 5,233 visits in 2011
- In 2011, more than half of energy drink-related ED visits involved energy drinks only (58 percent), and the remaining 42 percent involved other drugs

adolescents, and young adults.[2] Research has established that, among college students, there are associations between energy drink consumption and problematic behaviors such as marijuana use, sexual risk taking, fighting, smoking, drinking, and prescription drug misuse.[5,6] In one study, bar patrons who consumed alcohol mixed with energy drinks were 3 times more likely to leave a bar highly intoxicated and were 4 times more likely to intend to drive while intoxicated than those who did not consume alcohol mixed with energy drinks.[6] This latter finding may be because the high levels of caffeine found in energy drinks can mask the symptoms associated with being intoxicated (e.g., feeling lethargic). Individuals, especially young drinkers, may incorrectly believe that consumption of caffeine can "undo" the effects of alcohol intake and make it safe to drive after drinking. Because of the popularity of energy drinks and the burgeoning literature suggesting the risks involved with their use, gaining additional information about these beverages is important.

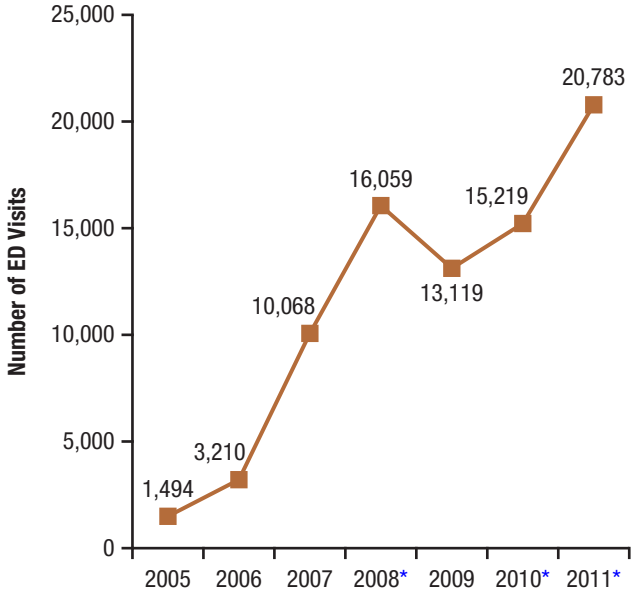
The Drug Abuse Warning Network (DAWN) is a public health surveillance system that monitors drug-related emergency department (ED) visits in the United States and can be used as a source of information for assessing the more negative medical consequences associated with consuming energy drinks. To be a DAWN case, the ED visit must involve a drug, either as the direct cause of the visit or as a contributing factor. Such a visit is referred to as a "drug-related visit." Drugs include alcohol; illegal drugs, such as cocaine, heroin, and marijuana; pharmaceuticals (e.g., over-the-counter medicines and prescription medications); and nutraceuticals, such as nutritional supplements, vitamins, and caffeine products. A previous report addressing ED visits involving energy drinks was published using 2009 data[7]; this issue of *The DAWN Report* highlights trend data for energy drinks from 2007 to 2011, as well as drug combinations found in 2011.

Trends in ED Visits

In years prior to 2007, ED visits involving energy drinks were either not shown due to low statistical precision (in 2004) or because they occurred in very low numbers (in 2005 and 2006). Figure 1 shows the trend in ED visits beginning in 2005; however, statistical tests were not used until 2007, when the number of ED visits exceeded 10,000. The number of ED visits involving energy drinks doubled from 10,068 visits in 2007 to 20,783 visits in 2011. From 2007 to 2011, increases did not always occur annually, but an overall upward trend was evident.

The majority of energy drink-related ED visits involved either adverse reactions[8] or misuse or abuse of drugs[9]; other reasons are not presented because they represent less than 5 percent of visits. In each year from 2007 to 2011, visits involving adverse reactions were about twice as commonly reported as visits involving misuse or abuse. Energy drink-related ED visits involving adverse reactions doubled from 6,996 visits in 2007 to 14,042 visits in 2011 (Figure 2). The most noticeable increases occurred in 2008 (54 percent increase from 2007) and 2011 (101 percent increase from 2007). Energy drink-related ED visits involving misuse or abuse of drugs nearly doubled from 3,060 visits in 2007 to 6,090 visits in 2011.

Figure 1. Energy Drink-Related Emergency Department (ED) Visits, by Year: 2005 to 2011



* Compared with the number of visits in 2007, the difference was statistically significant at the .05 level. The number of visits in years prior to 2007 were not used in statistical tests because of low numbers; the number of visits in 2004 was not shown because of low statistical precision.

Source: 2011 SAMHSA Drug Abuse Warning Network (DAWN).

Trends in ED Visits by Demographic Groups

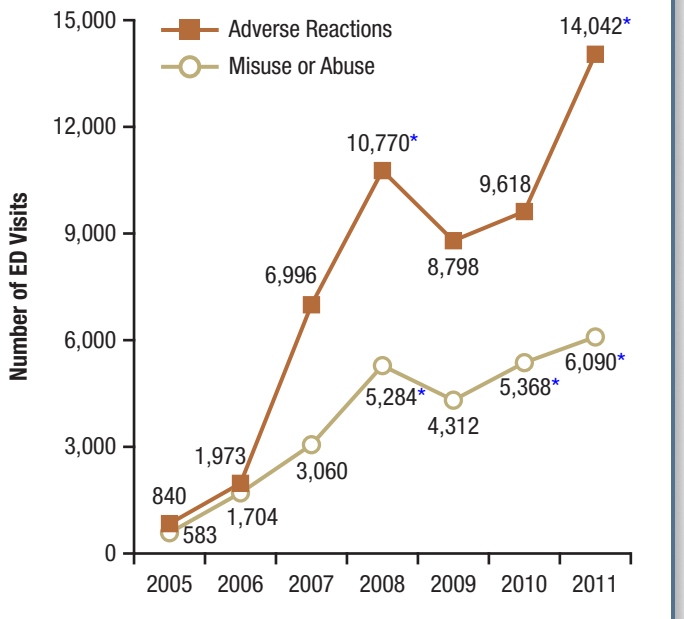
Among energy drink-related ED visits, there were more male patients than female patients in each year since 2007, accounting for approximately two thirds or more of visits. An exception occurred in 2008, when half (54 percent) of visits involving energy drinks were made by male patients (data not shown). ED visits involving energy drinks doubled from 2007 to 2011 for both male and female patients (Figure 3). More specifically, visits by males increased from 7,210 visits in 2007 to 14,905 visits in 2011, and visits by females increased from 2,854 visits in 2007 to 5,878 visits in 2011.

In each year from 2007 to 2011, patients aged 18 to 25 were most commonly involved in energy drink-related ED visits, followed by patients aged 26 to 39. An exception occurred in 2010, when patients aged 26 to 39 were most commonly involved in energy drink-related ED visits (44 percent), followed by patients aged 18 to 25 (29 percent) (data not shown). Among patients aged 40 or older, ED visits involving energy drinks increased 279 percent from 1,382 visits in 2007 to 5,233 visits in 2011 (Figure 4). Visits for younger adults (aged 18 to 25 and aged 26 to 39) appeared to have increased, but the difference was not statistically significant between 2007 and 2011. Visits among adolescents aged 12 to 17 remained stable.

Drug Combinations with Energy Drinks

Of the 20,783 ED visits involving energy drinks in 2011, more than half involved energy drinks only (58 percent), and the remaining 42 percent involved other drugs (Table 1). Pharmaceuticals were most commonly combined with energy drinks (27 percent), with 9 percent involving energy drinks and central nervous system stimulants (e.g., Adderall®, Ritalin®). About 13 percent of visits involved energy drinks and alcohol and one tenth of visits (10 percent) involved energy drinks and illicit drugs, with 5 percent involving energy drinks and marijuana.

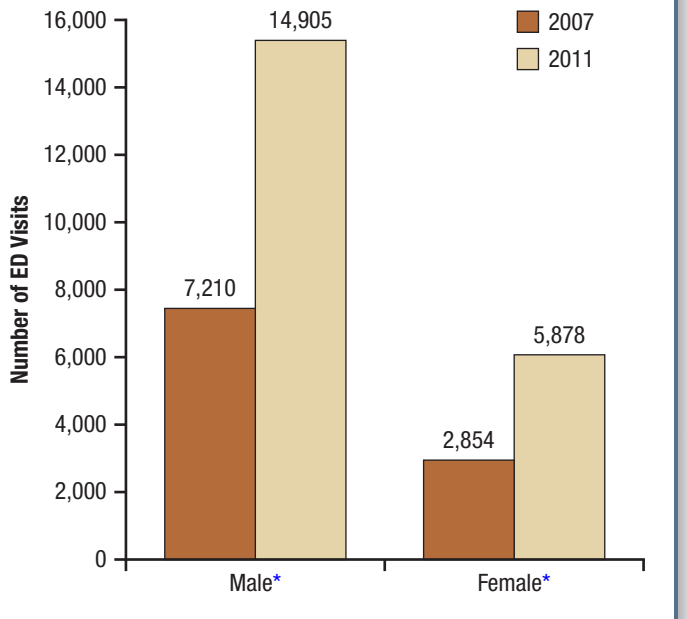
Figure 2. Reason for Energy Drink-Related Emergency Department (ED) Visits, by Year: 2005 to 2011



* Compared with the number of visits in 2007, the difference was statistically significant at the .05 level. The number of visits in years prior to 2007 were not used in statistical tests because of low numbers; the number of visits in 2004 was not shown because of low statistical precision.

Source: 2011 SAMHSA Drug Abuse Warning Network (DAWN).

Figure 3. Energy Drink-Related Emergency Department (ED) Visits, by Gender: 2007 and 2011



* The difference between the number of visits in 2007 and 2011 was statistically significant at the .05 level among both males and females.

Source: 2011 SAMHSA Drug Abuse Warning Network (DAWN).

Most ED visits involving energy drinks only, with no other drug involvement, were classified as adverse reactions (94 percent). In contrast, visits involving energy drinks in combination with other drugs were more commonly classified as misuse or abuse (62 percent) than adverse reactions (31 percent) (data not shown).

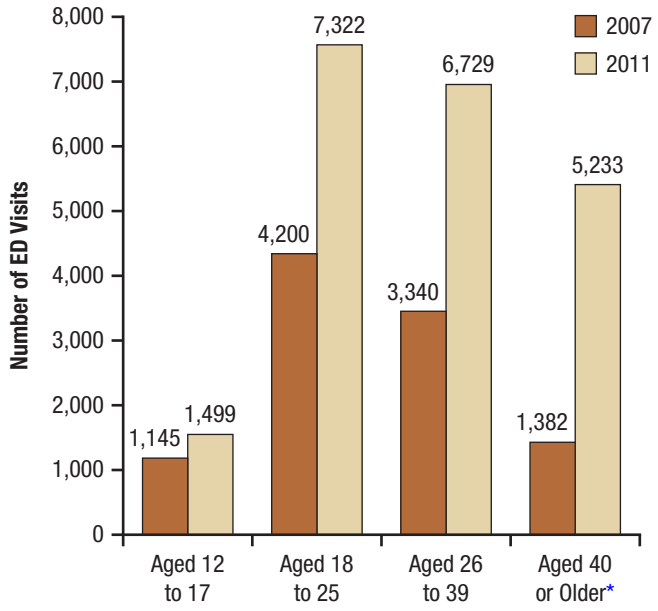
Discussion

Between 2007 and 2011, the number of ED visits involving energy drinks increased, underscoring previously published findings highlighting the increase between 2005 and 2009.[7] The popularity of these drinks persists although large amounts of caffeine can cause adverse effects such as insomnia, nervousness, headache, fast heartbeat, and seizures that are severe enough to require emergency care.[10] This report validates claims that energy drinks can be dangerous when used alone or in combination with other drugs or alcohol.

The occurrence of energy drink-related ED visits among adolescents and young adults shows that these vulnerable populations experience negative health events after consuming energy drinks. In a recent report, the American Academy of Pediatrics discouraged use of energy drinks for children of all ages, including young athletes,[11] and a joint study by the Centers for Disease Control and Prevention and the Institute of Medicine recommended that beverages available in schools should be caffeine-free.[12] Energy drinks can also be problematic among young adults, especially college students, when used in combination with alcohol.[13]

A new finding in this report suggests that older adults may also be vulnerable to the effects of energy drinks, even though the drinks are marketed with claims of having a positive impact on energy and concentration. The safety of these products among adults who take medications or have medical conditions has been questioned.[5] Health professionals can discourage use of energy drinks by explaining that perceived health benefits are largely due to marketing techniques rather than scientific evidence. Because of the drinks' widespread use, it may be beneficial for ED staff to inquire about use of energy drinks when assessing each patient's use of medications or other drugs.

Figure 4. Energy Drink-Related Emergency Department (ED) Visits, by Age Group: 2007 and 2011



* The difference between the number of visits in 2007 and 2011 was statistically significant at the .05 level among patients aged 40 or older.

Source: 2011 SAMHSA Drug Abuse Warning Network (DAWN).

Table 1. Selected Drug Combinations in Energy Drink-Related Emergency Department (ED) Visits: 2011

Drug Combination	Number of ED Visits*	Percentage of ED Visits*
Total ED Visits	**20,783**	**100**
Energy Drinks Only	12,131	58
Energy Drinks in Combination	8,652	42
Any Pharmaceutical Combination	5,542	27
Central Nervous System (CNS) Stimulants	1,864	9
Any Alcohol Combination	2,612	13
Any Illicit Drug Combination	2,047	10
Marijuana	966	5

* Because multiple drugs may be involved in each visit, estimates of visits by drug may add to more than the total number of visits, and percentages may add to more than 100 percent.

Source: 2011 SAMHSA Drug Abuse Warning Network (DAWN).

End Notes

1. Food and Drug Administration. (2007). *Medicines in my home: Caffeine and your body*. Retrieved from http://www.fda.gov/downloads/Drugs/ResourcesForYou/Consumers/BuyingUsingMedicineSafely/UnderstandingOver-the-CounterMedicines/UCM205286.pdf
2. Seifert, S. M., Schaechter, J. L., Hershorin, E. R., & Lipshultz, S. E. (2011). Health effects of energy drinks on children, adolescents, and young adults. *Pediatrics, 127*(3), 511-528.
3. Riell, H. (2012, July 17). Bursting with energy. *Convenience Store Decisions*. Retrieved from http://www.csdecisions.com/2012/07/17/bursting-with-energy-2/
4. Meier, B. (2012, November 14). Caffeinated drink cited in reports of 13 deaths. *New York Times*. Retrieved from http://www.nytimes.com/2012/11/15/business/5-hour-energy-is-cited-in-13-death-reports.html
5. Miller, K. E. (2008). Energy drinks, race, and problem behaviors among college students. *Journal of Adolescent Health, 43*(5), 490-497.
6. Thombs, D. L., O'Mara, R. J., Tsukamoto, M., Rossheim, M. E., Weiler, R. M., Merves, M. L., & Goldberger, B. A. (2010). Event-level analyses of energy drink consumption and alcohol intoxication in bar patrons. *Addictive Behaviors, 35*(4), 325-330.
7. Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality. (November 22, 2011). *The DAWN Report*: *Emergency department visits involving energy drinks*. Rockville, MD.
8. Within DAWN, an ED visit is categorized as an adverse reaction when the chart documents that a prescription or over-the-counter pharmaceutical, taken as prescribed or directed, produced an adverse drug reaction, side effect, drug-drug interaction, or drug-alcohol interaction. Although energy drinks are not treated as drugs by the Food and Drug Administration, ED visits involving energy drinks were classified as adverse reactions if the chart documented them as such. If other substances are reported on the chart as involved in the visit, an energy drink is not necessarily the sole reason for the adverse reaction.
9. Misuse or abuse cases within DAWN are broadly defined to include all visits associated with illicit drugs, alcohol use in combination with other drugs, alcohol use only among those younger than 21 years old, and nonmedical use of pharmaceuticals.
10. Clauson, K. A., Shields, K. M., McQueen, C. E., & Persad, N. (2008). Safety issues associated with commercially available energy drinks. *Journal of the American Pharmacists Association, 48*(3), e55-e67.
11. Committee on Nutrition and the Council on Sports Medicine and Fitness. (2011). Sports drinks and energy drinks for children and adolescents: Are they appropriate? *Pediatrics, 127*(6), 1182-1189.
12. Centers for Disease Control and Prevention. (2011). *Adolescent and school health: Nutrition standards for foods in schools*. Retrieved from http://www.cdc.gov/healthyyouth/nutrition/standards.htm
13. Arria, A. M., Caldeira, K. M., Kasperski, S. J., Vincent, K. B., Griffiths, R. R., O'Grady, K. E. (2011). Energy drink consumption and increased risk for alcohol dependence. *Alcoholism, Clinical and Experimental Research, 35*(2), 365-375.

Suggested Citation

Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality. (January 10, 2013). *The DAWN Report: Update on Emergency Department Visits Involving Energy Drinks: A Continuing Public Health Concern.* Rockville, MD.

The Drug Abuse Warning Network (DAWN) is a public health surveillance system that monitors drug-related morbidity and mortality. DAWN uses a probability sample of hospitals to produce estimates of drug-related emergency department (ED) visits for the United States and selected metropolitan areas annually. DAWN also produces annual profiles of drug-related deaths reviewed by medical examiners or coroners in selected metropolitan areas and States.

Any ED visit related to recent drug use is included in DAWN. All types of drugs—licit and illicit—are covered. Alcohol involvement is documented for patients of all ages if it occurs with another drug. Alcohol is considered an illicit drug for minors and is documented even if no other drug is involved. The classification of drugs used in DAWN is derived from the Multum *Lexicon*, copyright 2010 Lexi-Comp, Inc., and/or Cerner Multum, Inc. The Multum Licensing Agreement governing use of the *Lexicon* can be found at http://www.samhsa.gov/data/DAWN.aspx.

DAWN is one of three major surveys conducted by the Substance Abuse and Mental Health Services Administration's Center for Behavioral Health Statistics and Quality (SAMHSA/CBHSQ). For more information on other CBHSQ surveys, go to http://www.samhsa.gov/data/. SAMHSA has contracts with Westat (Rockville, MD) and RTI International (Research Triangle Park, NC) to operate the DAWN system and produce publications.

For publications and additional information about DAWN, go to http://www.samhsa.gov/data/DAWN.aspx.

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