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Prevalence of the Addictions: A Problem of the Majority or the Minority?

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Abstract

An increasing number of research studies over the last three decades suggest that a wide range of substance and process addictions may serve similar functions. The current article considers 11 such potential addictions (tobacco, alcohol, illicit drugs, eating, gambling, Internet, love, sex, exercise, work, and shopping), their prevalence, and co-occurrence, based on a systematic review of the literature. Data from 83 studies (each study *n* = at least 500 subjects) were presented and supplemented with small-scale data. Depending on which assumptions are made, overall 12-month prevalence of an addiction among U.S. adults varies from 15% to 61%. The authors assert that it is most plausible that 47% of the U.S. adult population suffers from maladaptive signs of an addictive disorder over a 12-month period and that it may be useful to think of addictions as due to problems of lifestyle as well as to person-level factors.

Keywords

addiction; prevalence; co-occurrence; comorbidity; behavioral addiction

Although often previously associated with physiological tolerance and withdrawal effects, the term “addiction” has achieved a broader definition (e.g., see www.dsm5.org; accessed on February 22, 2010; also Brewer & Potenza, 2008; Griffiths, 2005a; Marks, 1990; Orford, 2001; Schneider & Irons, 2001). Among many researchers and clinicians, “addiction” has come to refer to a disorder in which an individual becomes intensely preoccupied with a behavior that at first provides a desired or appetitive effect. The appetitive effect generally is equated with changes in firing in the mesolimbic dopaminergic system, but there are numerous brain neurotransmission and hormonal systems involved, including mu opioid, serotonin, norepinephrine, anandamide, and the hypothalamic-pituitary-axis (HPA), among others; associated with subjective reports of arousal, pleasure, or fantasy (Brewer & Potenza, 2008; Johansson, Grant, Kim, Odlaug, & Gotestam, 2009; Schneider & Irons, 2001; Volkow & Wise, 2005). The addictive behavior occurs with several pattern variations (e.g., bingeing or sustained preoccupation), but always repeatedly, involving a great deal of time thinking about and engaging in the behavior, which operates beyond the need to remove intense anxiety common in compulsive disorders (Brewer & Potenza, 2008; Marks, 1990).

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An addiction disorder also involves loss of ability to choose freely whether to stop or continue the behavior (loss of control) and leads to experience of behavior-related adverse consequences (Schneider & Irons, 2001). In other words, the person becomes unable to reliably predict when the behavior will occur, how long it will go on, when it will stop, or what other behaviors may become associated with the addictive behavior. As a consequence, other activities are given up or, if continued, are no longer experienced as being as enjoyable as they once were. Further negative consequences of the addictive behavior may include interference with performance of life roles (e.g., job, social activities, or hobbies), impairment of social relationships, criminal activity and legal problems, involvement in dangerous situations, physical injury and impairment, financial loss, or emotional trauma.

Although many drug and nondrug addictions do not appear to produce obvious physical dependence (i.e., physiological-based tolerance and withdrawal effects), they do create a subjective need for increased involvement in the behavior to achieve satiation and abrupt termination of the behavior often leads to symptoms such as depression, intense anxiety, hopelessness, helplessness, and irritability (e.g., see Allegre, Souville, Therme, & Griffiths, 2006; Hausenblas & Down, 2002, regarding exercise dependence). The addictive behavior may seem to the addict “as if” it is the best solution to resolve these negative symptoms (Sussman & Unger, 2004). Regardless of level of physical dependence, relapse rates across various addictions appear to be relatively high (e.g., over 70% for a 1-year period; Brandon, Vidrine, & Litvin, 2007; Hodgins & e-Guebaly, 2004; Miller, Walters, & Bennett, 2001; Schneider & Irons, 2001). The likelihood of these consequences is depicted for 11 potentially addictive behaviors in Table 1 (i.e., cigarettes, alcohol, illicit drugs, binge eating, gambling, Internet, love, sex, exercise, work, and shopping).

Schaef (1987) proposed a typology to differentially classify various addictive behaviors. The first type, *substance addiction*, involves direct manipulation of pleasure through the use of products that are ingested into the body, including drug use disorders and food-related disorders. Drugs of misuse often are grouped into categories such as cigarette smoking, alcohol use, and illicit substance use (Sussman & Ames, 2008). Cigarette smoking (and other nicotine-containing tobacco products), while legal, is highly addictive and a leading behavioral cause of various diseases and premature death, but generally does not cause gross impairment in function while using it. Alcohol, also legal in most countries, is highly addictive, a leading cause of premature death, and causes obvious impairment in function if used excessively. Most illegal drugs tend to lead to noticeable impairment in normal functioning. Eating disorders include anorexia nervosa, bulimia, overeating, and binge eating. Any of these might be considered to show an addictive pattern of behavior, though binge eating disorder (BED) arguably is most like other addictions in its behavioral topography (Faber, Christenson, De Zwaan, & Mitchell, 1995; Goossens, Soenens, & Braet, 2009; Lewinsohn, Seeley, Moerk, & Striegel-Moore, 2002). James, Guo, and Liu (2001) identified converging neuroimaging, cognitive, and behavioral indicators that suggested binge eating and other misuse of food intake reasonably fits within a theoretical model of substance addiction. Volkow and Wise (2005) reported similar results.

The second type, *process addiction*, comprises a series of potentially pathological behaviors that expose individuals to “mood-altering events” by which they achieve pleasure and become dependent (Robinson & Berridge, 2000; Schaef, 1987). There are several process addictions identified in the current literature including gambling, various types of Internet use, love, sex, exercise, work, and compulsive spending (Griffiths, 2005a; Orford, 2001). For example, Young (1999) argued that individuals suffering from Internet addiction are likely to use the Internet to alter their mood state (i.e., attempt to escape when feeling lonely, down, or anxious), are preoccupied with Internet use, report symptoms of tolerance and

withdrawal, have tried unsuccessfully to cut back on use, and have disturbances in their lives because of their Internet use.

Another process addiction example is exercise. Exercise can become a craving for some people when engaged in excessively (e.g., going jogging for extreme distances and periods of time). As a consequence, many occupational, educational, or social activities are neglected, depression occurs when the individual does not exercise, and excessive exercise may lead to repeated injuries (Griffiths, 1997; Thaxton, 1982). A third example is compulsive spending. Compulsive spenders repeatedly incur debt despite negative emotional, social, and financial consequences (Hodgson, Budd, & Griffiths, 2001). They may engage in a pattern of planning and purchasing behavior that at first glance appears normative, but at closer analysis may involve a pattern of repeated buying of one type of item, without using the item, to achieve a sense of pleasure (Black, 2007). They also tend to greatly value money as a solution to emotional problems (Hanley & Wilhelm, 1992).

Some addictions may be self-injurious but still receive social approval. For example, workaholism may at first induce pleasure, then later limit one's social life, induce subjective emotional pain (e.g., of feeling "burned out"), and may even lead to dangerous action (e.g., driving while preoccupied with work matters, driving and mobile telephone use, and driving while being sleep deprived). However, "workaholics" may also continue to receive ongoing social and financial rewards such as job promotion, salary increases, and/or praise from employers and work colleagues (Griffiths, 2005b).

The Current Study

We completed a systematic literature review of 11 addictions. The selected addictions were cigarette (nicotine) dependence, alcohol abuse/dependence, illicit/other drug abuse/dependence, food disorders/addiction (with a focus on BED but not excluding examination of anorexia nervosa and bulimia if examined concurrently with BED), gambling addiction (i.e., pathological gambling), Internet addiction, love addiction, sex addiction, exercise addiction, workaholism, and shopping (spending) addiction. These addictions were selected due to their investigation in previous work (e.g., Adams, 2009; Cook, 1987; Essau, 2008; Freimuth et al., 2008; Griffiths, 2005b; Larkin, Wood, & Griffiths, 2006; MacLaren & Best, 2010; Sussman & Black, 2008), and popular mention in the media. For example, each of these behaviors results thousands of webpages, if one were to do a search in Google (e.g., "binge eating disorder" produces 360,000 webpages, "love addiction" produces 138,000 webpages, "exercise addiction" produces 36,000 webpages, "workaholism" produces 113,000 webpages, and "shopping addiction" produces 110,000 webpages; accessed on March 1, 2010).

We focused on examination of two types of data: prevalence of the addictive behavior and prevalence of co-addictive behavior (i.e., co-occurrence/comorbidity). The goal of the study was to provide estimates of prevalence of these 11 addictive behaviors and co-occurrence of any one or more of these addictions in the general U.S. adult population in a 12-month period. In a sample of 604 U.S. undergraduate college students, Cook (1987) examined measures of 10 of 11 of the addictive behaviors we examined (i.e., cigarettes, alcohol, illicit drugs, obesity, anorexia, bulimia, gambling, relationship, sex, running, work, and shopping). He did not examine Internet addiction, due to the year the study was completed (i.e., the Internet as we know it today did not exist at the time). He found that almost a quarter of the sample (23.8%) responded "no" to all addictive behaviors, along with partner violence and emotional disturbances, suggesting that a high prevalence of addictive behaviors exists among college students. However, he did not separate between the three types of problem

behaviors he studied when reporting that statistic (i.e., addictive behaviors, partner violence, and emotional disturbances).

We used data he provided in his article to calculate the percentage of the addicts who reported only one addictive behavior. This was found to be approximately 11%. (His results were consistent with that of Carnes, Murray, & Charpentier, 2004, who found that less than 13% of a sample of 1,604 adult sex addict inpatients suffered only from one addiction). We also calculated from his data that of those with addictions, 58% reported 2 to 4 co-occurring addictions and 31% reported 5 or more co-occurring addictions. In summary, up to three-quarters of college undergraduates in Cook's study self-reported experiencing at least one addictive behavior and a vast majority of the sample reported multiple co-occurring addictions (e.g., 58% × 76% = 44% of the total sample reported suffering from 2 to 4 co-occurring addictive behaviors).

We surmised when undertaking this review, that we would not be able to locate many studies that examine multiple addictions and their co-occurrence within the same sample. Furthermore, we knew that the variation in prevalence of each addictive behavior might be wide as a function of examining such factors as lifetime versus current prevalence, whether the behavior measured was of abuse or more extreme dependence phenomena, and by demographic variables such as age, gender, and ethnicity (e.g., prevalence of an addiction may be highest in young adults, males are twice as likely as females to report illicit drug use disorders; some authors report that shopping addiction occurs more often in females; Black, 2007; Sussman & Ames, 2008). Therefore, being able to pinpoint prevalence and co-occurrence of the 11 addictions across a population (e.g., U.S. adults) was impossible. However, we decided to examine plausible assumptions that might permit a range of prevalence and co-occurrence calculations. Thus, our goal was to (a) calculate the current prevalence of each addictive behavior and (b) gage the overall current prevalence of any of the set of 11 addictive behaviors, controlling for co-occurrence of the addictive behaviors under different assumptions of likely co-occurrence. We desired to address the question regarding the prevalence and co-occurrence of addictive behaviors in general populations, focusing to the extent possible our subsequent calculations on U.S. adults.

Method

Search Strategy

Four search engines were examined: PsycINFO, OVID Medline (1950 through first 2 weeks of April 2010), PubMed, and Google Scholar. The terms used to apply to the 11 addictive behaviors were "tobacco addiction," "nicotine addiction," "alcoholism," "alcohol dependence," "marijuana abuse," "illicit drug abuse," "drug abuse," "drug dependence," "drug addiction," "overeating addiction," "food addiction," "eating addiction," "binge eating disorder," "overeating dependence," "gambling addiction," "compulsive gambling," "pathological gambling," "Internet addiction," "web addiction," "pathological Internet use," "video game addiction" (only searched for Internet-related activity), "love addiction," "pathological love," "sexual dependency," "sex addiction," "sexual compulsivity," "physical activity addiction," "exercise addiction," "workaholic," "work addiction," "shopping addiction," and "compulsive shopping." At least two terms were used to apply to each addictive behavior (e.g., "sex addiction" and "sexual compulsivity"), all crossed with five terms that indicated prevalence ("prevalence" and "incidence") or co-occurrence ("co-occurring addictions," "co-occurring disorders," and "comorbidity"). Titles were examined first to screen potential articles, followed by abstracts, and then manuscripts were downloaded. The reference sections of downloaded manuscripts were examined for additional references not located in the searches. If few relevant articles were found, other terms were attempted or only the addictive behavior was searched for without pairing it with

a prevalence or co-addiction term. A total of 640 initial searches were completed (32 addictive behavior search terms × 5 prevalence/co-occurrence terms × 4 search engines).

Analysis

We established a set of inclusion and exclusion criteria that might permit retention of a variety of studies but also permit some type of comparability across studies. First, we attempted to include only studies that reported a sample size of at least 500 participants (e.g., as in Stucki & Rihs-Middel, 2007). By doing so, we would avoid the most selective, convenient samples. However, if there were few studies available for a particular addictive behavior, we included data-based studies with a smaller sample size in the text. Because so few co-occurrence studies were located, all data-based studies of addiction co-occurrence located in the search were included in the text of this review, regardless of sample size. Second, we limited our age range of inclusion from 16 to 65 years of age, to capture developmental periods from older adolescence at the start of emerging adulthood to middle/older adulthood. In articles that included a wider age range, we attempted to use the data within the 16- to 65-year age range. Third, we included only prevalence studies that examined both males and females, to rule out any particularly selective samples (e.g., single gender chemical dependence inpatients). Fourth, we included only studies that specified use of some measure of addiction and provided any psychometrics indicating reliability or validity (e.g., see Albrecht, Kirschner, & Grusser, 2007). There were some articles that were very influential but did not permit relatively clear estimates of prevalence, and these were excluded from compilation (e.g., Brenner, 1997, regarding Internet addiction). Finally, we attempted to include only data on recent participation in the addictive behavior, primarily participation in the last year, and we screened out studies that reported only lifetime prevalence of an addictive behavior (exceptions are stated in the text).

Data that met the inclusion criteria are shown in Table 2 (n = 83 studies). These data summarize relatively extreme levels of the behavior as being “addicted.” Both drug “abuse” and “dependence” were considered as “addicted” in the table and in our calculations. In studies that measured “at-risk,” “problem,” and “pathological” gambling, generally only pathological gambling was considered in the table (if provided and presented separately from the other categories). Unless otherwise specified, data were on last 12 month use (see Table 2). Calculation of the overall prevalence of the 11 addictive behaviors across studies was completed by considering (to the extent possible) a sample size weighted average of all values provided by empirical data reported. Estimates were calculated across age groups and gender.

Results

Prevalence and Co-Occurrence

We located a total of 83 studies with sample sizes of at least 500 subjects (Table 2). Across these 83 studies, 12 examined cigarette dependence/nicotine addiction (2 of these looked at some type of co-occurrence with at least one other of the 11 addictive behaviors), 22 examined alcohol abuse/dependence (5 of these looked at co-occurrence), 20 examined drug abuse/dependence (3 of these looked at co-occurrence), 9 examined food disorders/addiction (2 of these looked at co-occurrence), 26 examined pathological gambling (7 of these looked at co-occurrence), 16 examined Internet addiction (1 of these looked at co-occurrence), 2 examined love addiction (none of these looked at co-occurrence), 4 examined sex addiction (1 of these looked at co-occurrence), 3 examined exercise addiction (none of these looked at co-occurrence), 3 examined workaholism (none of these looked at co-occurrence), and 4 examined shopping/spending/buying addiction (none of these looked at co-occurrence).

Results are presented as a function of age group (older teens, college age youth, and then adults).

Tobacco/cigarette daily use and dependence—Tobacco and other drug use prevalence have been examined extensively among youth and adults; for example, by the Monitoring the Future (MTF) research group in the United States (http://monitoringthefuture.org; accessed on March 17, 2010; Johnston, O'Malley, Bachman, & Schulenberg, 2009a, 2009b). Daily (20 or more days in last 30 days) cigarette smoking varied from 11.4% among 18-year-olds to 17% among 50-year-olds (Johnston et al., 2009a, 2009b). One may infer that daily cigarette smoking is addictive use, though several studies measure tobacco (nicotine) addiction specifically. Tobacco addiction (dependence) among older teenagers has been found to vary between 6% and 8% (Chen, Sheth, Elliott, & Yeager, 2004; Young et al., 2002). Cook (1987) found a prevalence of 9.6% for tobacco addiction among college students, whereas Dierker et al. (2007) found a tobacco addiction prevalence among incoming college students of 4.4% (4.9% of the full sample being daily smokers). MacLaren and Best (2010) found an even lower prevalence of tobacco dependence among a similar sample of 948 Canadian college student 19-year-olds of 1.7%.

Grant, Hasin, Chou, Stinson, and Dawson (2004) found a prevalence of 12.8% for tobacco addiction among a U.S. national sample of adults (also see Falk, Yi, & Hiller-Sturmhofer, 2006). Goodwin, Keyes, and Hasin (2009), on the other hand, found a prevalence of 21.6% and 17.8% for tobacco addiction among a U.S. national sample of male and female adults, respectively. It appears that daily smoking demonstrates about the same level of prevalence as direct measures of dependence, particularly among adults. Daily cigarette smoking varied considerably by country. For example, Farrell et al. (2003) found that 24% of a large sample of adults in Great Britain smoked 10 or more cigarettes daily. Ulrich, Hill, Rumpf, Hapke, and Meyer (2003) found a daily smoking prevalence of 38.6% in Germany. We estimate last 12-month tobacco dependence prevalence in the general adult population of the United States as being approximately 15% (also see Hughes, Helzer, & Lindberg, 2006).

Alcohol abuse/dependence—In the MTF survey, current daily alcohol use varied from 2.8% to 11% among 18- to 50-year-olds, respectively, but may not reflect problem drinking (Johnston et al., 2009a, 2009b). Occasional heavy drinking (5 or more drinks at least once in last two weeks) varied from 25% among 18-year-olds to 42% among 20-year-olds to 20% among 50-year-olds. Again, this may not indicate problem drinking. However, daily drunkenness (5 or more drinks in 20 of last 30 days) was less than 1% across age groups (Gadalla & Piran, 2007; Johnston et al., 2009a, 2009b). One-year prevalence of alcohol use disorder, abuse, or dependence (based on *Diagnostic and Statistical Manual of Mental Disorders [Fourth Edition; DSM-IV]* criteria), generally was calculated as being about 10% for older teenagers and adults (Alexander & Schweighofer, 1989; Barnes, Welte, Hoffman, & Tidwell, 2009 [higher, at 15% among teenagers and emerging adults]; Chen et al., 2004 [higher, at 16.4% among older teenagers]; Cohen et al., 1993 [higher, at 14.6% among 17- to 20-year-olds]; Cook, 1987; Essau & Hutchinson, 2008; Falk et al., 2006; Farrell et al., 2003 [lower, at 5%among Great Britain adults]; French, Maclean, & Ettner, 2008; Grant et al., 2004; Harford, Grant, Yi, & Chen, 2005; Hasin, Stinson, Ogburn, & Grant, 2007 [lower, at 5.8% among United States 12- to 50-year-olds; 10–15% among 18- to 29-year-olds]; Hill, Rumpf, Hapke, Driessen, & John, 1998; Kandel, Chen, Warner, Kessler, & Grant, 1997 [lower, at 3.6% of general adult population, 5.3% of last year baseline drinkers]; Kilpatrick, Acierno, Saunders, Resnick, & Best, 2000; MacLaren & Best, 2010 [10.2% among Canadian college student 19-year-olds]; Nelson & Wittchen, 1998 [9.9% among teenagers and emerging adults in Germany]; Poelen, Scholte, Engels, Boomsma, & Willemsen, 2005 [lifetime problem, teens and young adults in the Netherlands]; Regier et al., 1990 [4.8% of

general U.S. adult population but only during the last 6 months]; Sussman & Ames, 2008; Young et al., 2002 [15.7% among U.S. 17- to 18-year-olds]). We estimate last 12-month alcohol abuse/dependence prevalence in the general adult population of the United States as being approximately 10% (alcohol dependence is approximately 4% in the United States and elsewhere, e.g., Pirkola, Poikolainen, & Lonnqvist, 2006; Regier et al., 1990; Teesson, Baillie, Lynskey, Manor, & Degenhardt, 2006).

Marijuana and other illicit drug abuse/dependence—In the MTF survey, daily (20 or more days in last 30 days) marijuana smoking varied from 5.4% among 18-year-olds to 2% among 50-year-olds (Johnston et al., 2009a, 2009b). Cohen et al. (1993) found a prevalence of marijuana abuse among 17- to 20-year-olds of 2.9%. Other data on marijuana abuse/dependence among population samples indicated a prevalence among older teenagers and adults of approximately 7% (Agrawal, Neale, Prescott, & Kendler, 2004; Barnes et al., 2009; Coffey et al., 2002; Hall, Degenhardt, & Patton, 2008; Kandel et al., 1997; Kilpatrick et al., 2000; MacLaren & Best, 2010; Young et al., 2002), though Chen, Sheth, Elliott, and Yeager (2004) found a prevalence of 13.4% among teenagers, and Agrawal, Neale, Prescott, and Kendler (2004) found that the marijuana abuse/dependence rate among U.S. college males and females was 18% and 7.5%, respectively. Alternatively, Compton, Grant, Colliver, Glantz, and Stinson (2004), Grant et al. (2004), and Stinson, Ruan, Picering, and Grant (2006) assessed a very large sample and found a 1.5% prevalence of marijuana abuse/dependence among the U.S. general adult population (between 4% and 5% prevalence among those 18 to 29 years of age), and Farrell et al. (2003) found a prevalence of 1.8% in Great Britain. Kandel, Chen, Warner, Kessler, and Grant (1997) found 0.1% prevalence among U.S. adults (9.0% prevalence among those who used in the last year).

Prevalence of other illicit drug abuse disorders, which includes marijuana use in the calculation in some studies, varied between 2% and 5% among teenagers, college age youth, and adults (Alexander & Schweighofer, 1989; Chen et al., 2004; Cohen et al., 1993 [1.1% among 17- to 20-year-olds, clearly excluding marijuana use in the calculation]; Cook, 1987; Grant et al., 2004; Kandel et al., 1997 [lower, at 0.3%; 11.6% among last year baseline users]; Kilpatrick et al., 2000; Regier et al., 1990; Sussman & Ames, 2008; Young et al., 2002). However, Agrawal et al. (2004) found a rate of 9% and 19.2% other illicit drug dependence (excluding marijuana) among 2,125 adult female and male twin pairs, respectively. On the other hand, Compton, Thomas, Stinson, and Grant (2007), and Warner, Kessler, Hughes, Anthony, and Nelson (1995), reported a U.S. general adult 12-month prevalence of illicit drug abuse/dependence (marijuana and other illicit drugs) of 2.0% and 1.8%, respectively. In Great Britain, this prevalence within a general adult population was found to be 2.1% (Farrell et al., 2003). The adult last 12-month illicit drug dependence in Canada was found to be about 1% (Gadalla & Piran, 2007). Based on this pool of studies, we estimate last 12-month illicit drug abuse/dependence (marijuana and/or other drugs) prevalence in the general adult population of the United States as approximately 5% (any drug dependence is 1% to 3%; e.g., Regier et al., 1990; Teesson et al., 2006).

Co-occurrence of tobacco, alcohol, and illicit drugs with each other or other addictive behaviors: Several studies (only 4 of which involved samples of 500 or more subjects) have found 30–60% co-occurrence of cigarette, alcohol, and other drug use disorders with each other among youth and adults in the United States or elsewhere (Essau & Hutchinson, 2008; Falk et al., 2006; Ford et al., 2009; Kaufman, 1982; Miller, Gold, & Klahr, 1990; Palmer et al., 2009 [lifetime use-based]; Regier et al., 1990 [lifetime use-based]; Stinson, Ruan, Picering, & Grant, 2006; Sussman & Ames, 2008). However, in a large German adult sample, a last 12-month prevalence of only 18.4% alcohol hazardous use/abuse/dependence was found among general population daily smokers (Ulrich, Hill, Rumpf, Hapke, & Meyer, 2003).

In a review by Holderness, Brooks-Gunn, and Warren (1994), there were three small studies (*ns* = 20, 27, and 138) that indicated that approximately 20% of drug abusers also exhibited an eating disorder (bulimia or bulimic behaviors), though Freimuth et al. (2008) suggested this co-occurrence is higher at 35%, and Lesieur and Blume (1993) suggested that the co-occurrence varies by age and is higher among older adults. Lesieur and Blume (1993) reported one study of female alcoholics (*n* = 31) that showed 36% with symptoms of binge eating and 21% with a clinical eating disorder.

Only five studies with a sample size of at least 500 were located that examined co-occurrence of the 8 other addictive behaviors among those suffering from tobacco, alcohol, or illicit drug use disorders, and all of these pertained to gambling addiction (Cunningham-Williams, Cottler, Compton, Spitznagel, & Ben-Abdallah, 2000 [lifetime use]; French et al., 2008; Griffiths, Wardle, Orford, Sproston, & Erens, 2010; Toneatto & Brennan, 2002; Welte, Barnes, Wieczorek, Tidwell, & Parker, 2001). Among a large sample of adults in Great Britain that reported having been “smokers” in the past year, 1.1% reported problem gambling (Griffiths et al., 2010). We could locate no other such studies pertaining to tobacco use. Among mostly large samples of weekly or greater drinkers, and among adult alcoholic inpatients, 3–5% reported a gambling problem (French et al., 2008; Griffiths et al., 2010; Lesieur, Blume, & Zoppa, 1986; Toneatto & Brennan, 2002), although in a representative sample of U.S. adults, 24% of alcohol dependent persons also reported a gambling problem (Welte et al., 2001). In a convenience sample of 97 13- to 18-year-old outpatient substance abusers (alcohol or marijuana abuse/dependence), only 1% (*n* = 1) met criteria for gambling addiction (Kaminer, Burleson, & Jadamec, 2002). Among a sample of 990 drug abusers (ranging from 28% being sedative dependent, to 77% being stimulant dependent), 11% reported also being pathological gamblers (Cunningham-Williams et al., 2000 [lifetime use]), and other mostly small-scale research also indicated that 5–25% of illicit substance abusers were also gambling addicts (Freimuth et al., 2008; Lesieur & Blume, 1993; Lesieur, Blume, & Zoppa, 1986; Petry, 2007; Spunt, Dupont, Lesieur, Liberty, & Hunt, 1998; Steinberg, Kosten, & Rounsaville, 1992; Toneatto & Brennan, 2002).

Freimuth et al. (2008) estimated that about a third of substance abusers also exhibit sexual addition; however, that one report is speculative. Griffin-Shelley (1995) speculated that only 10% of those with drug dependence also suffer from love or sex addiction. We found no other studies indicating co-occurrence of other addictions among cigarette smokers, alcohol abusers, or illicit substance abusers.

Estimating the prevalence of cigarette, alcohol, and illicit drug use (marijuana or other drugs) addictions in U.S. adults at 15%, 10%, and 5%, respectively, if one infers a 50% overlap among any two of the three drug use disorders, then one might sum half of each of these addictive behaviors and find that 15% of the adult population in the United States is addicted to either cigarettes, alcohol, or other drugs, controlling for overlap (30% total if there was no overlap). Tentatively, we estimate a 50% overlap among tobacco, alcohol, or illicit drug addictions. In addition, we tentatively estimate, based on the few gambling and binge eating reports (also see review by Lacey & Evans, 1986), that 20% of cigarette smokers, alcohol abusers, or illicit substance abusers may also experience any of the other eight addictions. This is depicted in Table 3.

Eating disorders—Last year prevalence rates of eating disorders (particularly BED) among older teens and adults varied between 1 and 2% (Allison, Grilo, Masheb, & Stunkard, 2005; Gadalla & Piran, 2007; Gleaves & Carter, 2008; Hay, 1998; Hoek & Hoeken, 2003 [four large studies were cited in their review, but three examined only females]; Smith, Marcus, Lewis, Fitzgibbon, & Schreiner, 1998; Spitzer et al., 1992; Timmerman, Wells, & Chen, 1990 [examined bulimia nervosa]), though Goossens, Soenens,

and Braet (2009) found a prevalence of 7.4% among a sample of Belgium teenagers, Cook (1987) found a prevalence of 6.4% among U.S. college youth (single item used), and MacLaren and Best (2010) found a prevalence of 14.9% among 19-year-old Canadian college youth. Lewinsohn, Seeley, Moerk, and Striegel-Moore (2002) found a prevalence of 3–4% for 24-year-olds. Spitzer et al. (1992) found a 30.1% prevalence among participants of hospital-affiliated weight control programs (who were moderately obese). Based on these studies (9 of 12 which included samples of at least 500 subjects), we estimate a last 12-month prevalence of 2% for eating addiction among general population U.S. adults.

Co-occurrence: Found in primarily small samples (each composed mostly of women), between 20% and 46% of teens and adults with an eating disorder (of some type) reported alcohol or other drug problems (Freimuth et al., 2008; Gleaves & Carter, 2008; Holderness, Brooks-Gunn, & Warren, 1994; Lacey & Evans, 1986; Lewinsohn et al., 2002; Timmerman et al., 1990 [alcohol abuse, about 6% of males and 23% of females with bulimia]), though only 1% of a small sample of 90 female and 5 male teenagers with an eating disorder reported alcohol or other drug use disorder (Castro-Fornieles et al., 2010).

Lewinsohn et al. (2002) found excessive exercise activity among males with BED, but not females; however, percentage overlap was not reported. Freimuth et al. (2008) summarized in their review of primarily small samples that of those with eating disorders, 39–48% also experienced an exercise addiction and 15% also experienced buying addiction. Faber, Christenson, De Zwaan, and Mitchell (1995), among a sample of 84 obese female subjects with BED, found that 15% could be classified as compulsive buyers (compared to 4.4% of obese female non-BED subjects). Faber et al. also mentioned that, in their earlier work, 23.8% of binge eaters reported also being compulsive buyers. There were no other studies reported that examined the relations of eating disorders with other addictions. Tentatively, we estimate that 25% of those with an eating disorder, particularly a BED, experience each of the other 10 addictive disorders.

Problem gambling—North American research studies involving large samples, and meta-analyses, indicated that between 2.1% and 10% of older teenagers experience gambling problems (Barnes et al., 2009; Gupta & Derevensky, 2008; Ladouceur, Boudreault, Jacques, & Vitaro, 1999a; MacLaren & Best, 2010; Shaffer & Hall, 2001 [meta-analysis]; Shaffer, Hall, & Vander Bilt, 1999 [meta-analysis]; Welte, Barnes, Tidwell, & Hoffman, 2008; Westphal, Rush, Steven, & Johnson, 2000; Winters, Stinchfield, & Fulkerson, 1993). Problem gambling rates among older teenagers has shown variations worldwide. A recent review of large-scale studies by Volberg, Gupta, Griffiths, Olason, and Delfabbro (2010) examined adolescent gambling in North America, Europe, and Oceania. The rates of problem/pathological gambling reported in non-North American countries were as follows: Australia, 1–13%; Denmark, 0.8%; Estonia, 3.4%; Finland, 2.3%; Germany, 3%; Great Britain, 2–5.6%; Iceland, 1.9–3%; Italy, 6%; Lithuania, 4–5%; New Zealand, 3.8–13%; Norway, 1.8–3.2%; Romania, 7%; Spain, 0.8–4.6%; and Sweden, 0.9%. This variation may have resulted from the stringency of the instrument used to measure problem gambling, each country's gambling laws, or subject sampling methods used.

Cook (1987) found a prevalence of 2.4% among college youth, and Lesieur et al. (1991) found a prevalence of 4–8% among a large sample of college youth in 5 U.S. states. Among adults, prevalence of gambling addiction is between 1% and 3% of the U.S. population as well as other countries such as Australia, Canada, China, Norway, Switzerland, and Spain (Becona, 1993; Bondolfi, Osiek, & Ferrero, 2000; Cook, 1987; Desai, Desai, & Potenza, 2007; French et al., 2008; Griffiths, 2009a; Griffiths, 2009b; Ladouceur, Jacques, Ferland, & Giroux, 1999b; Petry, 2005, 2007; Philippe & Vallerand, 2007; Schofield, Mummery, Wang, & Dickson, 2004 [lifetime]; Shaffer et al., 1999; Shaffer & Hall, 2001; Sommers,

1988; Stucki & Rihs-Middel, 2007; Volberg, 1994 [lifetime]; Volberg & Steadman, 1988 [lifetime]; Wong & So, 2003), although a two large-sample studies found a prevalence of 0.15% in Norwegian adults (Gotestam & Johansson, 2003) and 4.2% among Texas, U.S. adults (Feigelman, Wallisch, & Lesieur, 1998 [lifetime measure]). Current prevalence rates of pathological gambling may be as high as 15% in some unique populations of teens and adults (e.g., Aboriginal population in North America; Wardman, el-Guebaly, & Hodgins, 2001). We estimate a last 12-month prevalence of gambling addiction of 2% in the general U.S. adult population.

Co-occurrence: Among large older teen samples of heavy gamblers, co-occurrence with heavy use of alcohol or marijuana/other illicit drugs has been found to be 36% (Barnes et al., 2009) and 59% (Westphal et al., 2000). Among large samples of adult gambling addicts, 41–75% reported being current cigarette smokers (Becona, 1993; Desai et al., 2007; Petry, 2007 [review]; Potenza, Steinberg, Wu, Rounsaville, & O'Malley, 2006). In several small samples, 4–11.4% of adult gambling addicts reported alcoholism (Black & Moyer, 1998; Lesieur & Rosenthal, 1991; Netemeyer et al., 1998). In one large sample of gambling-addicted adults that called a gambling helpline, 18% reported problems with alcohol use (Potenza et al., 2006), and in large samples of Spanish and Swiss adults, 14% and 36%, respectively, of probable gambling-addicted adults reported alcohol abuse (Bondolfi et al., 2000). Sampled from large representative samples of U.S. adults, 25% and 33% of gambling addicts reported alcohol dependence (Desai et al., 2007; Welte et al., 2001).

Among mostly small samples of adult gambling addicts, co-occurrence with past year illicit drug problems has been found to vary from 2% to 13% (Black & Moyer, 1998; Lesieur & Rosenthal, 1991; Netemeyer et al., 1998; Petry, 2007; Potenza et al., 2006); however, in one large study of Texas adults, 26% of gambling addicts reported a substance abuse problem (Feigelman et al., 1998).

In a large sample of adult gambling addicts, 33% were obese, though a formal eating disorder was not diagnosed (Desai et al., 2007). In a sample of 30 adult gambling addicts, 6% reported an eating disorder (Black & Moyer, 1998). Among 225 adult gambling addicts, 19.6% also met the criteria for sexual addiction (Grant & Steinberg, 2005). Lesieur and Rosenthal (1991) reported two conference papers of small samples of adult gambling addicts (Adkins and colleagues, and their own), in which 12% and 14% were potentially sexually addicted, 24% were shopping addicts (all females), and 20% were binge eaters (all females). Kausch (2003) reported on 94 adult gambling addicts, in which 30.9% suffered from sexual addiction and 24.5% suffered from buying/shopping addiction. In the study by Netemeyers et al. (1998) of 44 adult gambling addicts, 29.3% reported buying addiction. We could locate no other data on co-occurrence of other addictions among gambling addicts.

Based on the studies reviewed, we estimate that 50%, 30%, and 20% of gambling addicts also are cigarette, alcohol, and illicit drug use addicts, respectively. These estimates are similar to those suggested by Lesieur and Blume (1993). The alcohol and drug use co-occurrence estimates are a little lower than those suggested by Freimuth et al. (2008), and Kausch (2003), but are based on a larger pool of studies (albeit not a large pool). In addition, we speculate that 20% of adult gambling addicts suffer from any of the other 7 addictions. We acknowledge that gambling often involves sedentary behavior and probably would reveal a low relation with exercise addiction, but there are no data to support this contrary speculation.

Internet addictions—In a nationally representative sample of 12-, 14-, 16-, and 18-year-olds in Finland, only 1.7% and 1.4% of boys and girls, respectively, reported Internet addiction (Kaltiala-Heino, Lintonen, & Rimpela, 2004). In Korea, 1.6% of a large school-

based convenience sample of 15- to 16-year-olds reported Internet addiction (Kim et al., 2006). However, in a later study, in Korea, using similar inclusion criteria and scoring, 10.7% of a random school sample of 903 14- to 18-year-olds reported Internet addiction (Park, Kim, & Cho, 2008). In China, 2.4% of a large sample of 12- to 18-year-old youth (mean = 15 years old) reported Internet addiction (Cao & Su, 2006).

Studies of mostly large samples of university students provided estimates of addictive Internet use of 5.9–9.3%, mostly for social contact and to reduce loneliness (Anderson, 2001; Chou & Hsiao, 2000 [in Taiwan]; Kubey, Lavin, & Barrows, 2001; Morahan-Martin & Schumacher, 2000 [277 Internet users]). However, Grusser, Thalemann, and Griffiths (2007) found that 11.9% of a large sample of over 7,000 online gamers (mean age = 21 years) were addicted to online games on the Internet. In addition, Niemz, Griffiths, and Banyard (2005) found a prevalence of 18.3% among 371 British college students (28.7% of males and 9.5% of females), and Leung (2004) found a 37.9% current prevalence among a large sample of Hong Kong 16- to 24-year-olds. Fortson, Scotti, Chen, Malone, and Del Ben (2007) found that while 21.9%of a large sample of college youth met criteria for Internet abuse, only 1.2% met criteria for Internet dependence.

Among large samples of adults contacted through online surveys, 3.5–9.6% were found to be Internet addicts (Cooper, Morahan-Martin, Mathy, & Maheu, 2002; Greenfield, 1999; Whang, Lee, & Chang, 2003). For instance, Greenfield (1999) conducted an online survey with 17,251 adult respondents. Internet addiction was assessed using 10 modified items from *DSM-IV* criteria for pathological gambling. Greenfield reported that 6% of respondents met the criteria for addicted Internet use. A much lower prevalence of 0.7% was found by Aboujaoude, Koran, Gamel, Large, and Serpe (2006), through a random digit dialing telephone survey of general population U.S. adults, and a 1.0% prevalence was found in a large, stratified probability sample of Norway adults (Bakken, Wenzel, Gotestam, Johansson, & Oren, 2009). Thus, as research criteria become more restrictive, involve a general population (i.e., includes non-baseline Internet users as well as baseline users), and involve an assessment of adults, prevalence drops dramatically (e.g., Shaw & Black, 2008). We estimate the last 12-month prevalence of U.S. general adult Internet addiction of 2%.

Co-occurrence: Among a large sample of teenagers and adults in Norway, 13.6% of Internet addicts self-reported also experiencing past year alcohol and substance abuse (Bakken et al., 2009). Shapira et al. (2003) reviewed 2 small studies (n = 21 and 20) by Black and colleagues and Shapira and colleagues. Averaging across these studies, 12% of adult Internet addicts reported alcohol abuse/dependence, 5% reported drug abuse/dependence, 10% reported binge eating, 5% reported gambling addiction (Shapira study only), and 10% reported sex addiction/psychosexual disorders. In a study of fifteen 23-year-old Internet addicts, one person (7.5% of sample) reported BED (Bernardi & Pallanti, 2009). We could locate no other studies that examined other addictions among Internet addicts. Based on these data, we speculate that 10% of general adult Internet addicts are addicted to any 1 of the other 10 addictive behaviors.

Love and sex—Cook (1987) reported prevalence estimates of 25.9% and 16.8% for love and sex addiction, respectively, among U.S. college youth. MacLaren and Best (2010) provided estimates of 11.9% for relationship submissive/love addiction and 10.3% for sex addition among 948 19-year-old Canadian college youth. Likewise, among a sample of 240 college students, Seegers (2003) found that 13.5% were at risk for or were sexually addicted. Cooper, Morahan-Martin, Mathy, and Maheu (2002) found a 9.6% online sexual addiction prevalence among a large sample of adult Internet users. However, most researchers place prevalence of love addiction or compulsive sexual behavior at 3–6% of the general adult population (Freimuth et al., 2008; Krueger & Kaplan, 2001; Kuzma & Black, 2008;

Sussman, 2010). We speculate that 3% of U.S. adults are love addicts and that 3% are sex addicts.

Co-occurrence: Griffin-Shelley (1995) speculated that 50% of adult sex addicts also are drug dependent. Carnes (1991) found, that in his sample of 932 adult sex addicts, 42% also suffered from alcohol or drug addiction, 38% suffered from an eating disorder, 28% were workaholics, and 26% were compulsive spenders. Likewise, in a larger sample of 1,604 adult residential treatment sex addicts, Carnes, Murray, and Charpentier (2005) found that approximately 37% reported addiction to nicotine, 46% reported addiction to alcohol, 40% reported addiction to other substances, 24% reported addiction to eating, 6% reported addiction to gambling, 12% reported addiction to exercise, 34% reported workaholism, and 31% reported addiction to shopping/buying. Kuzma and Black (2008) reviewed 3 small studies of adult sexual addiction (n = 36, 26, and 25, by Black et al., Kafka & Prentky, and Raymond et al.). Averaging across these 3 small studies, 60% of sex addicts also reported a substance use disorder of some type, 6% reported an eating disorder, 5% reported gambling addiction, and 5% reported buying/shopping addiction. Based on their review of 5 small studies, Freimuth et al. (2008) calculated that 39–42% of adult sex addicts suffered from substance-related disorders, 22–38% suffered from an eating disorder, 4–11% suffered from gambling addition, 8% suffered from exercise addiction, and 13–26% suffered from buying addiction. Based on these few studies completed, we speculate that 50% of love addicts are also sex addicts, and the converse. In addition, we speculate that co-occurrence of love and sex addiction with the 3 substance use disorders are 40%, whereas co-occurrence with the remaining 6 addictions are 20%.

Exercise—Exercise addiction was estimated at being from 3% to 5% of the U.S. population, although large and small sample studies were completed primarily with college youth (Allegre et al., 2006; Cook, 1987; Downs, Hausenblas, & Nigg, 2004; Terry, Szabo, & Griffiths, 2004). A few studies of college youth report prevalence as high as 21.8–25.6% (Garman, Hayduk, Crider, & Hodel, 2004; MacLaren & Best, 2010). Unfortunately, a vast majority of studies completed to date were not designed to examine prevalence of exercise addiction (Hausenblas & Downs, 2002). Based on the few studies completed, we speculate that the prevalence of last 12-month exercise dependence among U.S. adults is 3%, though it may be less because adults tend to become more sedentary as they age.

Co-occurrence: We located no studies on the co-occurrence of exercise addiction with other disorders with a sample size of at least 500. There is some suggestion that there exist persons only dependent on exercise (primary exercise addition), who are similar in other ways to nonaddicts whereas there are others who also have eating disorder (secondary exercise addiction) and report the myriad of features associated with addictiveness (Bamber, Cockerill, & Carroll, 2000). Among 125 Parisian male and female current exercise addicts (defined at 3 or more criteria of 7; mean age = 28.6 years), 20% reported nicotine dependence, 8% reported alcohol dependence, 70% reported being bulimic, and 63% reported being shopping addicts (Lejoyeux, Avril, Richoux, Embouazza, & Nivoli, 2008). They were about twice as likely as nonaddicted exercisers to be bulimics and shopping addicts, but they were very similar in prevalence to nonaddicted exercisers on cigarette and alcohol dependence. Among 265 U.S. young adult women runners and non-runners, 25% of those who ran more than 30 miles per week showed a high risk for anorexia nervosa (Estok & Rudy, 1996). We speculate that 15% of exercise addicts are also addicted to smoking, alcohol, or illicit drugs and that 25% exhibit the remaining addictions. However, much more research is needed here.

Work—Current prevalence of workaholism in large samples have been found to be approximately 8–17.5% (Burke, 1999, 2000; Cook, 1987; MacLaren & Best, 2010) among college-educated persons and estimates as high as 23–25% have been provided in smaller samples (Doerfler & Kammer, 1986 [female attorneys, physicians, and psychologists/therapists]; Freimuth et al., 2008). However, others have estimated that only 5% of the U.S. population are workaholics (Machlowitz, 1980). Tentatively, we estimate a prevalence of workaholism as 10% of the U.S. adult population.

Co-occurrence: There are only a few, mostly anecdotal reports of the co-occurrence of workaholism with other addictions (e.g., Carnes, 1991; Carnes et al., 2004; Carnes, Murray, & Charpentier, 2005), and these reports tend to link other addictions to workaholism rather than the converse. Tentatively, based on the few sources available, we speculate that 20% of workaholics are addicted to other behaviors.

Shopping—Prevalence of addiction to shopping was 10.7% in Cook's (1987) college sample, and a few reports place it between 12% and 21.8% among younger people (e.g., see Dittmar, 2005; MacLaren & Best, 2010), though most estimates place it as ranging from 1% to 6% among adults (Faber & O'Guinn, 1992; Freimuth et al., 2008). Koran, Faber, Aboujaoude, Large, and Serpe (2006) found a randomly sampled telephone current prevalence estimate of shopping addiction for the U.S. adult population (n = 2,513) of 5.8%. Neuner, Raab, and Reisch (2005) provided a representative prevalence estimate of German adults (n = 974 in 2001) of 7.6%. We estimate a prevalence of 6% of U.S. adults suffering from shopping addiction based on the study by Koran et al. (2006).

Co-occurrence: Among shopping addicts, in primarily small samples, prevalence of substance use disorders ranged from 21% to 46% (Black, 2007), and prevalence of bulimia nervosa and binge eating ranged from 8% to 35% (Black, 2007; Freimuth et al., 2008). Two surveys of small samples (n = 24 and 19) indicated that 46–47% of compulsive buyers also were alcoholics (which was found to subsume other drug abuse), 17% and 5%, respectively, suffered from BED (the latter study failing to show elevated prevalence compared to non-shopping addicts), and 8% were also gambling addicts (Faber et al., 1995; Mitchell et al., 2002 [did not examine gambling]). We speculate that the co-occurrence of shopping addiction with all other 10 types of addiction is 20%.

Co-Addictive Behavior Assumptions and Overall Prevalence

Based on the above review, we estimated the overall last 12-month prevalence of the 11 addictive behaviors among U.S. adults as follows: cigarettes—15%, alcohol—10%, illicit drug use—5%, eating—2%, gambling—2%, Internet—2%, love—3%, sex—3%, exercise—3%, work—10%, and shopping—6%. Only 20 of the large-scale studies reported in Table 2 provided any information on specific co-addictions. Thus, we made liberal use of small-scale studies in the text. A matrix of addiction co-occurrence was created estimated from these data, as shown in Table 3. Considering all 11 of these addictions, one could make any of the 3 assumptions regarding their co-occurrence. First, one might assume that there was no overlap among the addictions. If so, one would simply add up individual addictive behavior prevalence, and the total percentage of addictions would add to 61%. Clearly, because co-addictions were widely reported, this assumption is untenable.

Second, one might assume that there was "total overlap" among the addictions; that is, that the same people suffered from all of these 11 addictions. If this was true, then the sufferers of addictive behaviors would report experiencing all 11 addictions with 100% overlap. If there was 100% overlap, one could consider overall prevalence as being the single highest prevalence addictive behavior, which would be cigarette smoking at approximately 15% of

the population. However, for any two addictions, co-occurrence averages 23.42% (range = 10–50%), across 110 pairs of estimates provide in Table 3 (Also see discussion by Essau, 2008).

Third, one might assume that there are people who are addicted to single behaviors and people who are addicted to two or more behaviors. This assumption is consistent with the available data. Ascertaining the percentage of the population with nonoverlapping and overlapping addictive behavior has not been well addressed as of yet. However, one may make a range of estimates. One estimate is derived by removing from each addictive behavior's prevalence the average co-occurrence (23.42%), and then summing up the remaining "unique variance." That would equal 46.71%. That estimate is the same as subtracting from the total prevalence assuming nonoverlap (61%), 23.42% of that total (i.e., 61% − [61% × 23.42%]). In that case, approximately 47% of the U.S. adult population would be estimated to be suffering from an addictive behavior over the last 12 months. If one used an algorithm suggesting that a certain percentage (say 25%) of people suffered from a co-addiction and, if they do, then a certain percentage of them (say 50%) are likely to have suffered from a third addiction, the additional co-addiction variance would be culled from within the initially reported co-occurrence (because the third addictive behavior is a conditional probability; e.g., see figure in Regier et al., 1990). Therefore, no additional decrease in overall prevalence of an addictive behavior would be observed.

A second estimate derived from the third assumption is based on the argument that most people do not experience multiple addictions except for one shared addictive behavior, most popularly cigarette smoking. If one simply removes cigarette smoking prevalence from the list, assuming that it co-occurs with all other addictive behaviors, then approximately 46% of the population would be estimated to be suffering from an addictive behavior (i.e., 61% − 15%).

A third estimate derived from the third assumption is that, perhaps, one should remove the prevalence of the addiction most strongly associated with all others, and then remove 25% of the remainder from each addictive behavior, assuming some residue overlap, to derive a more conservative percentage. By doing so, approximately 34.5% (i.e., 46% − [46% × 25%]) of the population would be estimated to have an addictive behavior. The second and third estimates derived from the third assumption are likely to be overly conservative because no one addictive behavior is differentially and more strongly associated with all other addictions. For example, cigarette smoking clearly is strongly associated with alcohol use, other drug use, and gambling, but not the other behaviors.

In summary, one might assume total nonoverlap, total overlap, or partial overlap among the addictive behaviors. Partial overlap appears to fit the data the best. Within this model, one may remove the average two-addiction overlap, the highest prevalence addiction assuming it overlaps with all over addictions, or the highest prevalence addiction plus an additional 25% assuming a relatively conservative model. There are many other estimates that could be made. For example, one other estimate would derive from the assertion that the highest prevalence of co-occurrence (approximately 50%) should be removed from each other addictive behavior, simply to be very conservative, or perhaps, stemming from the belief that persons who are addicts are "hard wired" as addicts, and they must suffer from multiple addictions. Only 30.5% of the population would be estimated to be suffering from at least one addictive disorder if that 50% were removed (i.e., 61% − [61% × 50%]).

Considering these different algorithms, we believe that taking the total prevalence summed across all behaviors and subtracting from that sum the average co-occurrence of any two

addictions best reflects the pattern depicted in Table 3. Thus, we estimate that approximately 47% of the adult U.S. population suffers from 1 of these 11 addictions in a 12-month period.

Discussion

This article investigated the prevalence and co-occurrence of 11 potentially addictive behaviors reported in the literature among adults. Addictions to eating, gambling, the Internet, love, sex, and exercise appear to have a prevalence rate about 2–3%, involving a minority of the population. Addictions to alcohol, cigarette smoking, illicit drugs (such as marijuana), work, and shopping appear to have a prevalence rate of about 5–15% of the population. It is not clear why these different behaviors differ in prevalence. One may speculate that addictions directly involving relatively immediate aversive consequences (quick financial loss, social rejection, and injury from overtraining) would tend to be the lowest in prevalence. Behaviors that are not restricted by society, or are even promoted by society (demonstrating the least immediately aversive consequences), would tend to be of highest prevalence. This perspective appears to fit the data to some extent (e.g., cigarette smoking in some locations, alcohol use, work, and shopping are relatively socially accepted) and suggests that aspects of the large social environment impacts on popularity of mode of expression (if not reporting) of addictive behavior.

As a prime example, the fact that the few available workaholism estimates are so high is not surprising because individuals in full-time employment are expected to work at least an 8-hr day. For those addicted to work, the fact that the activity has to be engaged in to earn money means that it can remain hidden from most people (such as wives and partners); although it may preclude in-depth participation in a family life. The conceptualization of the “costs” workaholism is complicated by the socioenvironmental context. For instance, Griffiths (2005b) cites the example of a 23-year-old single male with no responsibilities, who may work 16 hours a day 7 days a week but suffer few negative effects in his life as a result (and may be promoted, get huge financial rewards). However, another older male, married with 3 children also working 16 hours a day every day is likely to have many areas of conflict in his life (e.g., relationship problems). Although these two males may be engaged in identical work behaviors, only one of them may be deemed problematic and/or addicted.

There are many other reasons that may partially explain differences in prevalence rates including factors such as how accessible the activity is to the user. Most of the highly prevalent addictive behaviors are highly accessible by the population. As an obvious example, at the time of Cook’s (1987) study, the Internet as we know it now did not exist; therefore, Internet addiction simply did not exist. People cannot become addicted to behaviors that they have no access to. As the internet becomes a dominant mode of communication among general adult populations, it is feasible that the percentage of adult internet addicts will increase greatly.

The relative likelihood of participating in multiple addictive behaviors concurrently may be affected by financial cost and activity demands. As an example, for an addicted gambler who spends much time in a casino, possibly most financial resources will go into the maintenance of the gambling behavior leaving very few financial resources left to participate in other costly activities. In addition, the addicted gambler may not have much additional time to leave the casino and engage concurrently in shopping, sex, work, or exercise addictions. However, the casino social context may promote tobacco and alcohol addictions and may tolerate other drug addictions. This may partly explain why drug addictions tend to have a higher prevalence and co-occurrence than some process/behavioral addictions—drug addictions can be adapted into behavioral repertoires including day-to-day work and leisure time.

Much research is needed to assess prevalence, and all possible patterns of co-occurrence, of addictive behaviors within the same large samples of persons to be able to more precisely address issues that have been discussed in this article. Based on what is known, a reasonable estimate derived from removing the approximately 23% mean co-occurrence across 110 pairs, is that about 47% of the U.S. adult population suffers from an addictive behavior—with serious negative consequences—in a 12-month period.

It is curious that addiction may be so highly prevalent. There is an enormous stigma associated with being an addict (Leshner, 1997); people commonly believe that drug addicts are bad people, weak willed, immoral, or selfish (Sussman & Ames, 2008). If the stigma perspective was accurate, and the prevalence estimates calculated in the current study are accurate, one might conclude that almost half of U.S. adults are "bad people." It is not clear that people are willing to believe that generalization. Possibly, imparting a general awareness of the potentially high prevalence of the addictions could lower stigma associated with the condition (assuming that stigma is prefaced based in part on the assumption of low prevalence). Alternatively, social condemnation may not be of "addiction" per se, but only of certain extremes of addiction (e.g., working long hours without bathing). More research on perceptions of addictions is needed.

Addiction as a Disease or Problem in Living

At present, most professionals consider addiction to be a chronic, relapsing disease (e.g., Leshner, 1997; Sussman & Ames, 2008), similar to other chronic disorders such as hypertension or asthma (O'Brien & McLellan, 1996). Therefore, it becomes imperative to distinguish whether addiction is a very common disease-like phenomenon (perhaps, as common as some types of flu), or whether, with such apparently high prevalence, addiction reflects some other or additional (multiple) phenomena. For example, perhaps, addiction (also) is a condition of lifestyle modeled by social–environmental conditions (Sussman & Ames, 2008), possibly with critical periods of development in which one is most vulnerable to imprint this lifestyle (Volkow & Wise, 2005). If addiction is popularly learned by victims, differing in objects of addiction by accessibility to the objects, social circumstances, time demands, and other social environmental–developmental forces, then arguably social policy changes are needed, which could inhibit or redirect such excessive behavior away from self-destructive outcomes throughout the lifespan, and channel behavior in more constructive directions (see Griffiths, 2009b; Marks, 1990; Orford, 2001; Schaef, 1987).

Taken further, Larkin, Wood, and Griffiths (2006) argue that health professionals must be careful not to attach the pejorative label of "addiction" to people who, while they are heavily involved in, or strongly identified with, a particular activity, are not suffering unpleasant consequences. As Larkin and colleagues (2006) note, unless people are at obvious risk for experiencing physical, emotional, relational, and financial difficulties as a result of their activity, it is both pointless and unfair to describe them as suffering from a disease-like condition.

Unfortunately, regardless of one's perception of "addiction," consistent engagement in any of the 11 behaviors presented in this article may cause significant changes in the brain pathways, in particular the mesolimbic dopaminergic (reward) system (Leshner, 1997; Sussman & Ames, 2008). These changes, in turn, may be involved in difficulty with cessation of addictive behavior. At some point, addictions often do lead to an accumulation of various negative consequences (Sussman & Ames, 2008). Even so-called positive addictions (Glasser, 1976; Griffiths, 1996) might have negative consequences for the addict (see Brown, 1993, on "mixed blessings"). This may include burnout from workaholism, for example. What is perhaps most important to target by health professionals is the compulsion to seek repeatedly certain behaviors even with knowledge of potentially dire health and

social consequences. This compulsion may be a function of neurobiological changes, associated psychological states (e.g., subjective sense of restlessness, irritability, or discontent), and social facilitation of the behavior. Future research is needed to better understand why some people quit easily and others do not, and whether differences in ease of quitting might be a function of the relative influence of physiology versus social context. Certainly, the extent that a disease label facilitates compassion in treatment, it may continue to serve a heuristic function (Sussman & Ames, 2008)

Limitations

There are numerous limitations with the analysis attempted in this study. First, there was a paucity of data on the prevalence and co-occurrence of some of the addictive behaviors (i.e., love, sex, exercise, workaholism, and shopping). More studies on these behaviors with large samples are needed. Second, very few studies examined multiple addictions in the same sample. Further work of this type might be enlightening. For example, in a factor analytic study, some legal addictive behaviors were found to load on the same factor (work, eating, love, exercise, and shopping), whereas gambling was found to load on a separate factor (perhaps, less socially approved of but generally legal), and drug use (tobacco, alcohol, and illicit drug use) and sex addiction was found to load on a third factor, perhaps reflecting relatively extreme behaviors (MacLaren & Best, 2010). Additional research that examines patterns of covariation of addictive behaviors in the same sample might enable various stakeholder communities (including researchers and practitioners in the addictive behaviors field) to learn more about the underlying etiology and co-occurrence of addictive behaviors and, consequently, how to best treat these behaviors.

Third, prevalence of an addictive behavior considered in our analysis depended on the inclusion criteria. For example, we attempted to consider only those who reported relatively extreme levels of gambling (“pathological gambling”) as being gambling addicts. Had we consistently included less extreme “problem gambling” (Lesieur et al., 1991), the prevalence of gambling would have been doubled and the overlap with other addictive behaviors might have been greater. As another example within the realm of Internet addiction, we tried to only include general population samples in our research. However, much of the research on Internet addiction has been carried out on self-selected samples of Internet users and not on general population studies. Thus, rates of Internet addiction would tend to be inflated. As a third example, some researchers have addressed sexual addiction as number of orgasms per week, as opposed to consequences criteria, and the relation between sexual frequency and adverse consequences is not clear (Kaplan & Krueger, 2010). If we had defined sexual addiction as experiencing orgasms at least 7 days a week, the prevalence would be relatively higher at 5–7%. As a fourth example, while a majority of studies focused on a last 12-month time frame and used a *DSM* model, there was some variation in time frame and scoring criteria (see Table 2). This adds yet more noise when thinking about inclusion criteria compared across addictions. As a fifth example, we attempted to focus on U.S. adults. Including other countries or age groups in the calculations may have altered some results (e.g., prevalence of cigarette smoking tends to be higher in some European countries than in the United States).

Fourth, this study did not examine the concept of “substitute addictions.” The notion of substitute addiction has been discussed for many years by members of the recovery movement and by recovery specialists (Chiauzzi, 1991; Gorski & Miller, 1986; Horvath, 1999, 2006; Murphy & Hoffman, 1993; Sussman & Black, 2008). This concept refers to any addictive behavior that serves at least one key function previously achieved by another addictive behavior, and it is plausible that any of these addictive behaviors may serve as substitutes for each other. Unless both addictions were engaged in the same 12-month period, they would not have been addressed as co-occurring addictions in the current study.

Fifth, only identifying the "object" of an addiction may not provide knowledge of its specifics, which may vary across individuals. For example, Griffiths (2000a) argued that there is a need to distinguish between addictions *to* the Internet and addictions *on* the Internet (e.g., gambling, computer gaming, love, or sex). Of course, some behaviors engaged on the Internet (e.g., cybersex, cyberstalking, and romance chat) may be behaviors that the person would only carry out on the Internet because the medium may be perceived as anonymous, non-face-to-face, and disinhibiting (Griffiths, 2000a, 2000b; Young, 1996).

Sixth, simply identifying co-occurrence of addictions does not identify causation of "unique" and "shared" components. Future research needs to assess possible reasons why some people might suffer from one addictive behavior but not another, or why some people tend to suffer particular multiple addictions (e.g., such as may be the case among sufferers of Borderline Personality Disorder; Bagby, Vachon, Bulmash, & Quilty, 2008). Furthermore, one must still account for the fact that, for example, a significant minority of people become addicted to heroin or gambling, but very few are thought to become addicted to, say, gardening.

Finally, the list of addictions selected in this article could be accused of convenience sampling. There are other potentially addictive behaviors that one might also include in such an analysis that may or may not be experienced by the same people. Other behaviors that have been considered addictive include caffeine (Cook, 1987), religion (Sussman & Black, 2008; Taylor, 2002), offline video games (Fisher, 1994 [6% of 467 11- to 16-year-old U.K. youth were found to be video game addicts]; Griffiths & Meredith, 2009), compulsive skin picking or hair pulling (i.e., trichotillomania; Brewer & Potenza, 2008; Marks, 1990), kleptomania (Cook, 1987; Marks, 1990), mobile telephone use (Bianchi & Phillips, 2005), pica (Lacey, 1990), tanning (Poorsattar & Hornung, 2010), and even violent behavior (Sussman & Ames, 2008) or stealing cars and going joy riding (Kellett & Gross, 2006). More research on the breadth of addictive behaviors may lead to a better understanding of addictive processes underlying specific objects of addiction.

Conclusions

Vulnerable individuals may attempt to manipulate continuously their neurobiological circuitry to obtain a more comfortable subjective state. In addition, it is likely that society promotes some addictive behavioral processes such as drinking alcohol, overeating, or working to excess. It is quite reasonable to assert that at least a large minority of the world's population suffers from an addictive process at any point in time. While controversial, a high prevalence of some type of addiction among a significant minority of the population might suggest that addiction is a natural state of affairs as a human being. As Marks (1990) provocatively suggested, "life is a series of addictions and without them we die" (p. 1389). Clearly, much more research is needed in this arena. We speculate that the addictions are as much a function of lifestyle as of individual neurochemistry.

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Table 1

Speculation on Negative Consequences of 11 Potentially Addictive Behaviors

	Cigs	Alc	Drugs	Eat	Gamble	Net	Love	Sex	Exercise	Work	Shop
Roles	+/−	+	+	+/−	+/−	+/−	+/−	+/−	−	−	−
Social	+	+	+	+	+	+	+	+	+	+	+
Legal	+/−	+	+	−	+/−	+/−	+/−	+/−	−	−	−
Danger	+/−	+	+	−	+/−	−	−	+/−	−	−	−
Physical	+	+	+	+	−	−	−	+/−	+	−	−
Financial	+/−	+	+	+/−	+	−	+/−	+/−	−	−	+
Emotional	+	+	+	+	+	+	+	+	+	+	+
Tolerance-like	+	+	+	+	+	+	+	+	+	+	+
Withdrawal-like	+	+	+	+	+	+	+	+	+	+	+

Notes. + = criterion applies; +/− = criterion might apply or sometimes applies; − = criterion does not apply; cigs = cigarette/tobacco dependence; alc = alcohol abuse/dependence; drugs = drug abuse/dependence; eat = eating disorders, particularly binge eating disorder; gamble = gambling addiction; net = Internet addiction; love = love addiction; sex = sex addiction; exercise = exercise addiction; work = workaholism; shop = shopping addiction.

Table 2

Prevalence and Co-Occurrence of 11 Addictions of Studies With *N*s at Least 500

Name and Year	Sample Size, Age Range/ Mean	Location	Addictions Studied	Results
Aboujaoude et al., 2006	2,513 general population adults; mean age = 48.5 years	United States	Internet addiction; current; *DSM* model; 5+ of 8 items	0.7% Internet addiction
Agrawal et al., 2004	1,191 male and 934 female twin pairs; age range = 21–62 years (mean age = 35.8 years)	United States	Marijuana and other illicit drug abuse; last 12 months; *DSM* model	7.5% and 18% cannabis abuse/ dependence, females and males; 9% and 19.2% other illicit drug abuse/ dependence, females and males
Anderson, 2001	1,302 college students from 7 colleges; age range = 18 to 22+ years	United States	Internet addiction; last 12 months; *DSM* model, 3+ of 7 items	9.8% Internet addiction among Internet users; 8.1% among full sample, including non-Internet users
Bakken et al., 2009	3,399 general population; age range = 16–74 years	Norway	Internet addiction; current; past year alcohol and substance abuse; *DSM* model; YDQ (5+ of 8 items)	1.0% Internet addiction; 13.6% of Internet addicts past year alcohol and substance abuse
Barnes et al., 2009	2,274 general population; age range = 14–21 years	United States	Gambling; last 12 months; *DSM* model; 3 gambling measures, SOGS-RA and two *DSM* types (3+ of 12 gambling problems; 3+ of 19 alcohol, marijuana symptoms)	10% gambling addiction; 4% tobacco dependence; 15% alcohol abuse, 7% marijuana abuse, approximately 36% of heavy gamblers also heavy drinkers and marijuana smokers
Becona, 1993	1,615 random population sample; age range = 18 to 65+ years	Spain	Gambling addiction; current; *DSM* model; 4+ of 8 items; daily smoking, very heavy drinking	1.7% gambling addiction; 75% gambling addicts daily cigarette smokers and 14.3% heavy alcohol use
Bondolfi et al., 2000	2,526 representative sample, telephone interviews; age range = 18 to 65+ years (80% < 29 years)	Switzerland	Gambling addiction, alcohol abuse; last 12 months; *DSM* model; SOGS (5+ of 20 items); CAGE screen for alcohol, 2+ of 4 items	0.8% gambling addiction; 36% of potential or probably gambling addicts also alcohol abusers
Burke, 1999	30 mostly White professional adults; age range = 35–50 years	Canada	Workaholism; current; high score on 15 items and low score on 10 items (involvement but not enjoy; "Workaholism Triad" measure)	15.9% of males and 16.8% of females work addiction
Cao & Su, 2006	2,620 junior and senior high school youth; age range = 12–18 years (mean age = 15.19 years)	China	Internet addiction; current; *DSM* model; YDQ (6+ of 8 items)	2.4% Internet addiction
Carnes et al., 2005	1,6042 residents of a sex addiction treatment program; age range = 18 to 65+ years	United States	Sex addiction co-occurrence with 8 other addictions; last 12 months; *DSM* model	Among sex addicts: 37% nicotine, 46% alcohol, 40% other substances, 24% eating, 6% gambling, 12% exercise, 34% workaholism, 31% shopping/buying addiction
Chen et al., 2004	1,044 high school youth; age range = 14–18 years	United States	Cigarette, alcohol, marijuana, other illicit drugs abuse/ dependence; last 12 months; *DSM* model	8.0% cigarette, 16.4% alcohol, 13.4% marijuana, and 3.9% other illicit drugs abuse/dependence
Chou & Hsiao, 2000	910 college students from 12 universities; mean age = 21.1 years	Taiwan	Internet addiction; current; *DSM* model; top 10% C-IRABI-II, YDQ (5+ of 8 items)	5.9% Internet addiction
Coffey et al., 2002	1,601 young adults; mean age = 20.7 years	Australia	Marijuana dependence; last 12 months; *DSM* model	7% marijuana dependence
Cohen et al., 1993	776 youths, convenience sample; age range = 10–20 years (examined data of older youth)	United States	Alcohol, marijuana, other drug abuse; last 12 months; *DSM* model	3.5% alcohol, 1.4% marijuana, 0.6 other drug abuse among 14- to 16-year-olds; 14.6% alcohol, 2.9%

Name and Year	Sample Size, Age Range/ Mean	Location	Addictions Studied	Results
				marijuana, 1.1 other drug abuse among 17- to 20-year-olds
Compton et al., 2004	86,000 general population; age range = 18–65 years	United States	Marijuana abuse/dependence; last 12 months; *DSM* model	1.5% marijuana abuse or dependence (varied from 4.2% to 4.9% if 18–29 years old)
Compton et al., 2007	43,093 general population; age range = 18–65 years	United States	Marijuana/other illicit drugs abuse/dependence; last 12 months and lifetime; *DSM* model	2.0% and 10.3% 12-month and lifetime drug abuse/dependence
Cook, 1987	604 university students; mean age = 22.6 and 21.3 years, for males and females	United States	Ten addictive behaviors; current; single-item measures of addiction	9.6% cigarettes, 10.5% alcohol, 4.3% illicit drugs, 6.4% obesity (16.6% considering obesity, anorexia, or bulimia), 25.9% relationship, 16.8% sex, 2.4% gambling, 4.6% running, 17.5% workaholic, and 10.7% shopping addiction; see text for some co-occurrence information
Cooper et al., 2002	7,037 online survey, convenience sample; age range = 18–80 years (mean age = 32 years)	80% from United States and 20% from elsewhere (not specified)	Internet and sex addiction; current; single item (addicted to Internet, sex, both, neither)	9.6% Internet addiction; 9.6% sex addiction; co-occurrence not reported
Cunningham-Williams et al., 2000	990 drug abusers either from treatment settings (*n* = 512) or from the community (*n* = 478); mean age = 32.2 years	United States	Gambling addiction and substance dependence; lifetime use (SAM); *DSM* model; DIS III-R (4+ of 9 items pathological gambling, 1+ of 9 problem gambling items)	11% drug abusers (alcohol and other drugs) gambling addicts and 22% problem gambling; of problem gamblers, 79% nicotine, 69% alcohol, 46% marijuana, 26% sedative, 48% opiate, 82% stimulant dependence
Desai et al., 2007	17,280 (from among 43,093) general population; age range = 40–64 years	United States	Gambling addiction; among them nicotine dependence, alcohol abuse/dependence; last 12 months; *DSM* model; 3+ of 10 symptoms for gambling	0.5% gambling addiction; of them, 41% nicotine dependent, 25% alcohol abuse/dependent; also 33% obese, though no indication of a formal eating disorder
Dierker et al., 2007	859 first year college students; mean age = 18 years	United States	Tobacco use and dependence; last 12 months; *DSM* model	20.5% smoked in last 7 days, 4.9% daily smokers, 4.4% nicotine dependence
Downs et al., 2004	855 university students from fitness classes; mean age = 21.4 years	United States	Exercise; last 12 months; *DSM* model; modified EDS (3+ of 7 symptoms strongly endorsed)	5% exercise addiction
Falk et al., 2006	43,093 general population; age range = 18–65 years	United States	Nicotine dependence, alcohol abuse/dependence; last 12 months; *DSM* model	12.8% nicotine dependence, 8.4% alcohol abuse/dependence; 34% alcohol abuse/dependence also nicotine dependence
Farrell et al., 2003	10,108 general population; age range = 16–64 years	Great Britain	Tobacco, alcohol, marijuana, other drug addiction; last 12 months; ICD model (dependence)	24% smoked greater than 10 cigarettes per day, 5% alcohol dependence, 1.8% marijuana dependence, 1.2% other drug dependence (2.1% marijuana or other drug dependence),
Feigelman et al., 1998	6,308 random sample; age range = 8 to 35+ years	United States	Gambling addiction; lifetime for gambling, last 12 months for substance abuse; *DSM* model; SOGS (3+ of 20 items)	4.2% gambling addiction; 26% of gambling addicts had substance abuse problem
Fortson et al., 2007	411 university students (full sample close to 500); mean age = 20.1 years	United States	Internet; last 12 months; *DSM* model; 3 items for abuse; 6 items for dependence, high point on each rating scale	21.9% Internet abuse and 1.2% Internet dependence
French et al., 2008	41,270 general population; age range = 18–65 years	United States	Gambling problems and alcohol abuse/dependence; last 12 months; *DSM* model; 1+ of 15 gambling problems	2.8% with 1+ gambling problem, 8.5% alcohol abuse/dependence; among weekly or greater drinkers, 4.1% with a gambling problem

Name and Year	Sample Size, Age Range/ Mean	Location	Addictions Studied	Results
Gadalla & Piran, 2007	36,984 general population; age range = 15–65 years	Canada	Eating, alcohol, and other drug abuse (CIDI); last 12 months; *DSM* model; EAT-26 (21+ of 78 on eating disorder measure)	0.5% and 2.8% “;risk”; for eating disorders among males and females; 3.9% and 1.3% alcohol, 1.1% and 0.5% illicit drug abuse
Gentile, 2009	1,178 general population; age range = 8–18 years	United States	Internet; last 12 months; *DSM* model; 6+ of 11 symptoms	8.5% Internet-based video game addiction
Goodwin et al., 2009	43,093 general population; age range = 18–65 years	United States	Cigarette dependence; last 12 months; *DSM* model	21.6% and 17.8% tobacco addiction among males and females
Goossens et al., 2009	708 community sample of teens; age range = 12–16 years (mean age = 14 years)	Belgium	Binge eating; last 28 days; *DSM* model; 41 item measure of loss of control (EDE-Q, EDI-2)	16.7% loss of control over eating in last month, and 7.4% objective report of binge eating
Gotestam & Johansson, 2003	2,014 representative sample; age range = 18 to 50+ years	Norway	Gambling addiction; last 12 months; *DSM* model; 5+ of 10 symptoms	0.15% gambling addiction
Grant et al., 2004a	43,093 general population; age range = 18–65 years	United States	Nicotine dependence; last 12 months; *DSM* model	12.8% nicotine dependence
Grant et al., 2004b	43,093 general population; age range = 18–65 years	United States	Substance abuse/dependence disorder; last 12 months; *DSM* model	9.35% any substance abuse/ dependence (8.46% alcohol 2.0% any drug, 1.45% cannabis)
Greenfield, 1999	17,251 general population Internet users; age range = 8–85 years (mean age = 33 years)	Mostly United States and Canada, online	Internet addiction; current; *DSM* model; VAS (5+ of 10 symptoms)	6% Internet addiction
Griffiths et al., 2010	9,003 general population; age range = 16 to 65+ years	Great Britain	Gambling, alcohol, and smoking abuse/addiction; last 12 months; *DSM* model; 3+ of 10 symptoms (*DSM* and PGSI)	0.9% past year problem gambling, 1.1% problem gambling among “;smokers in past year”; (0.4% among nonsmokers), and 2.3% among very heavy drinkers (0.2% among moderate drinkers)
Grusser et al., 2007	7,069 gamers (94% male), mean age = 21.1 years	Germany and United Kingdom	Online/Internet gaming last 12 months; *DSM* model; 3+ of 10 symptoms (ICD model)	11.9% online gaming addiction
Harford et al., 2005	55,561 general population; age range = 12–50 years	United States	Alcohol abuse and dependence; last 12 months; *DSM* model	5.8% alcohol abuse/dependence (3.8% abuse, 2.0% dependence); 15.2% among 18- to 23-year-olds and 10.0% among 24- to 29-year-olds
Hasin et al., 2007	43,093 general population; age range = 18 to 65+ years	United States	Alcohol abuse and dependence; last 12 months; *DSM* model	8.5% alcohol abuse/dependence (4.7% abuse, 3.8% dependence)
Hay, 1998	3,001 community based sample; age range = 15–65 years	Australia	Binge eating disorder; last 3 months; *DSM* model; 2 interview questions	1% eating addiction (binge eating disorder)
Hill et al., 1998	929 general medical practice patients; age range = 14–75 years	Germany	Alcohol abuse and dependence; last 12 months; *DSM* model	3.5% alcohol abuse and 7.2% alcohol dependence
Kaltiala-Heino et al., 2004	7,292 general population youth reached through a postal survey; age range=12–18 years (12-, 14-, 16-, and 18-year-olds)	Finland	Internet addiction; last 12 months; *DSM* model; 4+ of 7 symptoms	1.7% and 1.4% of boys and girls, respectively, Internet addicts
Kandel et al., 1997	87, 915 general population; age range = 12–65 years	United States	Nicotine, alcohol, marijuana, cocaine dependence proxy measure; last 12 months; *DSM* model; 3+ of 7 symptoms	28% nicotine, 5.2% alcohol (8.1% 12–25 years old), 8.2% marijuana, 11.6% cocaine dependence among baseline users; 8.7% nicotine, 3.6% alcohol, 0.1% marijuana, 0.3% cocaine dependence on full sample

Name and Year	Sample Size, Age Range/ Mean	Location	Addictions Studied	Results
Kilpatrick et al., 2000	4,023 household probability sample of youth; age range = 12–17 years (32% were 16 or 17 years old)	United States	Alcohol, marijuana, hard drug abuse/dependence; last 12 months; *DSM* model	4%, 1%, 1% alcohol, marijuana, hard drug abuse/dependence overall (9%, 7%, and 2% among 16- to 17-year-olds)
Kim et al., 2006	1,573 high school students from 6 schools; age range = 15–16 years	Korea	Internet addiction; current; *DSM* model; IAS (70+ of 100 score)	1.6% Internet addiction
Koran et al., 2006	2,513 random sample telephone survey of adults; age range = 18–85 years	United States	Buying/shopping addiction; current; 2 standard deviations < mean, 7-item scale (CBS)	5.8% shopping addiction (6.0% females, 5.5% males)
Kubey et al., 2001	572 college students; mean age = 20.25 years	United States	Internet addiction; current; single item	9.3% Internet addiction
Ladouceur et al., 1999a	3,426 junior and senior high school youth; age range = 12–18 years (mean age = 14.8 years)	Canada	Gambling addiction; last 12 months; *DSM* model; SOGS (5+ of 19 items)	2.6% gambling addiction
Ladouceur et al., 1999b	1,002 (in 1989) and 1,257 (in 1996); age range = 18 to 65+ years	Canada	Gambling addiction last 12 months; *DSM* model; SOGS (5+ of 19 items)	1.2% in 1989, 2.1% in 1996 gambling addiction
Lesieur et al., 1991	1,771 college youth; mean age = 22.3 years	United States	Gambling addiction last 12 months; *DSM* model; SOGS (5+ of 19 items)	4–8% gambling addiction
Leung, 2004	699 telephone probability sample; age range 16–24 years (mean age = 19.8 years)	Hong Kong	Internet addiction; current; *DSM* model; YDQ (5+ of 8 items)	37.9% Internet addiction
Lewinsohn et al., 2002	941 young adults originally from 9 senior high schools; mean age = 24 years	United States	Binge eating disorder; last 3 months; *DSM* model; 3 items (1 of them open-ended coded)	2.6% and 4.0% eating addiction men and women; binge eating men engaged in excessive exercise though % not reported; 24% eating addicts reported alcohol abuse/dependence, and 17% reported illicit drug abuse/ dependence
MacLaren & Best, 2010	948 college students from 2 universities; mean age = 19.6 years	Canada	Tobacco, alcohol, illicit drugs, eating, gambling, love, sex, exercise, work, shopping addictions; current; *DSM* model; 10 item scales for each, 90^{th} %ile considered addicted	1.7% tobacco, 10.2% alcohol, 8.5% illicit drugs, 14.9% food bingeing, 9% gambling, 11.9% love (submissive relationship), 10.3% sex, 25.6% exercise, 12.4% work, and 21.8% shopping addiction; see text for co-occurrence information
Nelson & Wittchen, 1998	3,021 stratified random sample of youths; age range = 14–24 years	Germany	Alcohol abuse/dependence; last 12 months; *DSM* model	9.9% for alcohol abuse/dependence; 8.0% for men, and 2.5% for women
Neuner, Raab, & Reisch, 2005	974 (in 2001), 1,444 (in 1991) representatively selected adults; mean age = 42.1 years	Germany	Shopping addiction; current; G-CBS (2 standard deviations < mean on 16-item scale, score of 45 of the 64)	7.6% shopping addiction in 2001 (8% West Germany, 6.5% East Germany), much higher than in 1991 (5.1% in West Germany and 1% in East Germany)
Park, Kim, & Cho, 2008	903 youth from randomly selected schools; age range = 14–18 years	Korea	Internet addiction; current; *DSM* model; IAS (twenty 5-point items, 70+ of 100)	10.7% Internet addiction
Philippe & Vallerand, 2007	810 community-dwelling older person sample; mean age = 66.1 years	Canada	Gambling addiction; last 12 months; *DSM* model; SOGS-R (5+ of 21 items)	1.2% gambling addiction
Pirkola et al., 2006	6,005 general population survey; age range = 30 to 65+ years	Finland	Alcohol dependence; last 12 months; *DSM* model, 1+ symptom	3.9% alcohol dependence (4.1% remitted)

Name and Year	Sample Size, Age Range/ Mean	Location	Addictions Studied	Results
Poelen et al., 2005	4,090 twin registry; age range examined = 16–30 years	Netherlands	Alcohol abuse; lifetime; 2+ of 4 CAGE items	10.3% alcohol abuse (15% males and 5% females)
Potenza et al., 2006	943 persons that called a gambling helpline; age range = 18–78 years (mean age = 43 years)	United States	Co-occurrence of gambling problems with tobacco, alcohol, and drug use; current; callers to a gambling helpline; single-item drug reports	Among gambling addicts (those who called the helpline), 53% daily tobacco use, 18% alcohol problem, and 11% drug use problem
Regier et al., 1990	20,291 general population; age range = 18 to 65+ years	United States	Alcohol and drug abuse/ dependence; *DSM* model; last 6 months for prevalence; lifetime for co-occurrence	4.8% alcohol (2% abuse, 2.8% dependence); 2.0% any other drug (0.8% abuse, 1.2% dependence); if alcohol—21.5% drug, abuse/ dependence, if drug—46% alcohol abuse/dependence
Scherer, 1997	531 undergraduate and graduate college students; age range 18–30 years (mean age = 24 years)	United States	Internet addiction; last 12 months; *DSM* model; 3+ of 10 symptoms	9% Internet addiction (13% of weekly users)
Schofield et al., 2004	1,029 randomly selected telephone adult sample; age range = 18 to 65+ years	Norway	Gambling addiction; lifetime; *DSM* model; SOGS (5+ of 20 items)	0.8% gambling addiction
Shaffer et al., 1999; Shaffer & Hall, 2001	122,286 aggregate subjects from a meta-analysis; age range = 13–65 years	United States and Canada	Gambling addiction; last 12 months; *DSM* model; estimates of pathological gambling from 134 studies	1.14% adults, 5.77%adolescents (in their 2001 meta-analysis, they find 1.46% for adults and 4.80% for adolescents) gambling addiction
Smith et al., 1998	3,948 biracial sample, age range = 28–40 years	United States	Binge eating disorder; last 6 months; *DSM* model; 5 criteria (QEWP-R)	1.5% binge eating disorder
Sommers, 1988	534 telephone population survey; age range = 17 to 65+ years	United States	Gambling addiction; current; *DSM* model; 3+ of 8 criteria	3.4% gambling addiction
Spitzer et al., 1992	1,984 community subjects; age range = 17–80 years (mean age = approximately 38 years)	United States	Binge eating disorder; last 6 months; *DSM* model; 5 criteria	2% binge eating disorder prevalence in general population; 30.1% among participants of hospital affiliated weight control programs
Stinson et al., 2006	43,093 general population; age range = 18–65 years	United States	Marijuana abuse/dependence, nicotine dependence, and alcohol abuse/dependence; last 12 months; *DSM* model	1.4% 12-month marijuana abuse/ dependence; among them, 53.1% and 57.6% nicotine dependence and alcohol abuse/dependence
Stucki & Rihs-Middel, 2007	412,100 total from a metaanalysis of 33 studies (28 were reports); mostly adults (age = 18 years old in 24 of the studies)	9 studies in United States, 11 studies in Canada, 13 in Europe or Austro-Asia	Gambling addiction; last 12 months mostly; *DSM* model; 3 types of measures (SOGS, PGSI, and *DSM*)	1.6% gambling addiction (weighted mean)
Teesson et al., 2006	7,570 and 7,423 representative general population Australian and U.S., respectively; age range = 18–54 years	United States and Australia	Alcohol, and any drug dependence (marijuana included in any drug category); last 12 months; *DSM* model	3.1% and 5.3% alcohol dependence in the United States and Australia, respectively, and 1.1% and 2.7% any drug dependence
Timmerman et al., 1990	1,391 high school students; mean age = 16.5 years	United States	Bulimia and alcohol abuse; current; *DSM* model; 5 symptoms for bulimia (21 items); AAIS score > 42 (14 items) for alcohol abuse	2% girls, 0.1% boys bulimia; 12.5% girls, 9% boys alcohol abuse; of bulimics 0% males, 4.65% females alcohol abuse; if “;almost”; bulimic (4 instead of 5 criteria), 6.15% of males and 23.26 of females alcohol abuse
Toneatto & Brennan, 2002	580 addiction program residents; age range = 18 to 65+ years	United States	Gambling and substance abuse; last 12 months; *DSM* model; SOGS (5+ of 20 items)	10.5% gambling addiction; of primary marijuana, cocaine, opiate, and alcohol abusers, 24%, 11.5%, 4.8%, and 4.0% gambling addicts

Name and Year	Sample Size, Age Range/ Mean	Location	Addictions Studied	Results
Ulrich et al., 2003	1,567 general population subsample of daily smokers for last 6 months; age range = 18–64 years	Germany	Alcohol hazard (20–40 g males, 30–60 g females pure alcohol)/abuse/dependence among daily smokers; last 12 months; *DSM* model; CIDI, SCAN	38.6% of general population daily smokers; of daily smokers, 18.4% alcohol hazardous use/abuse/ dependence
Volberg, 1994	4,500 general adult population; median age range = 33–38 years	United States (5 states: MA, MD, NJ, CA, and IA)	Gambling addiction; lifetime; *DSM* model; SOGS (5+ of 20 items)	0–2.3% (average about 1.2) gambling addiction
Volberg & Steadman, 1988	1,000 representative sampling; age range = 18–65 years	United States	Gambling addiction; lifetime; *DSM* model; SOGS (5+ of 20 items)	1.4% gambling addiction
Warner et al., 1995	65,244 general population; age range = 15- to 54-year-old (median age = 35 years)	United States	Drug dependence; last 12 months; *DSM* model; CIDI (3+ of 9)	1.8% last year illicit drug addiction
Welte et al., 2001	2,638 general population; age range = 18 to 65+ years	United States	Gambling and alcohol addiction; current; *DSM* model; SOGS (5+ of 20 items) and DIS (5+ of 10 items) for gambling	1.9% gambling addiction, 1.8% alcohol dependence (2.5% alcohol abuse or dependence); 33% of gambling addicts also alcohol dependent; and 24% of alcohol dependent also gambling addicts
Welte et al., 2008	2,271 representative sample; age range = 14–21 years	United States	Gambling addiction SOGS-RA (4+ of 12 items) and DIS (5+ of 13 items)	2.1% gambling addiction
Westphal et al., 2000	11,736 random sample; age range = 12–18 years	United States	Gambling addiction; last 12 months; *DSM* model; SOGS-RA (4+ of 12 items)	5.8% gambling addiction; 59% of gambling addicts also used alcohol or illegal drugs at least weekly
Whang et al., 2003	13,588 Internet users; age range = 13–60 years (mean age = 26.74 years)	Korea	Internet addiction; current; *DSM* model; IAS, score of 60 or higher (across 20 items)	3.5% Internet addiction
Winters et al., 1993	702 general population youth; age range = 15–18 years (mean age = 16.2 years)	United States	Gambling addiction; last 12 months; SOGS-RA (2+ of 12 items)	8.7% gambling addiction
Wong & So, 2003	2,004 representative sample; age range = 15–64 years, (84% 18–55 years)	Hong Kong	Gambling addiction; last 12 months; *DSM* model; 5+ of 10 symptoms	1.8% gambling addiction
Young et al., 2002	3,072 community-based; age range = 12–18 years (mean age = 15.85 years)	United States	Tobacco, alcohol, marijuana, and other drug dependence; last 12 months; *DSM* model (*DSM*-SAM)	6.0% tobacco, 15.7% alcohol, 7.8% marijuana, 2.8% other drug dependence, among 17- to 18-year-olds

Notes. AAIS = Adolescent Alcohol Involvement Scale; CAGE = alcohol abuse screener; CIDI = Composite International Diagnostic Interview; CBS = Compulsive Buying Scale; DIS = Diagnostic Interview Schedule; *DSM* = Diagnostic and Statistical Manual of the American Psychiatric Association (questionnaire or interview directly mapped onto criteria); EAT = Eating Attitude Test; EDE = Modified Eating Disorder Examination Interview; EDI = Eating Disorder Inventory; EDS = Exercise Dependence Scale; IAS = Internet Addiction Scale; ICD = International Statistical Classification of Diseases and Related Health Problems; IRABI = Internet-Related Addictive Behavior Inventory; PGSI = Problem Gambling Severity Index (Canadian Problem Gambling Index); QEWP = Questionnaire on Eating and Weight Patterns; SAM = Substance Abuse Module; SCAN = Schedules of Clinical Assessment in Neuropsychiatry; SOGS = South Oaks Gambling Survey; VAS = Virtual Addiction Survey; YDQ = Young Diagnostic Questionnaire.

Table 3

Estimated Prevalence and Co-Occurrence of 11 Different Addictive Behaviors

If, Then	Prev	Cigs	Alc	Drugs	Eat	Gamble	Net	Love	Sex	Exercise	Work	Shop
Cigs	15%		50%	50%	20%	20%	20%	20%	20%	20%	20%	20%
Alc	10%	50%		50%	20%	20%	20%	20%	20%	20%	20%	20%
Drugs	5%	50%	50%		20%	20%	20%	20%	20%	20%	20%	20%
Eat	2%	25%	25%	25%		25%	25%	25%	25%	25%	25%	25%
Gamble	2%	50%	30%	20%	20%		20%	20%	20%	20%	20%	20%
Net	2%	10%	10%	10%	10%	10%		10%	10%	10%	10%	10%
Love	3%	40%	40%	40%	20%	20%	20%		50%	20%	20%	20%
Sex	3%	40%	40%	40%	20%	20%	20%	50%		20%	20%	20%
Exercise	3%	15%	15%	15%	25%	25%	25%	25%	25%		25%	25%
Work	10%	20%	20%	20%	20%	20%	20%	20%	20%	20%		20%
Shop	6%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	

Notes. Prev = prevalence of abuse/dependence; cigs = cigarette (nicotine) dependence; alc = alcohol abuse/dependence; drugs = drug abuse/dependence; eat = binge eating disorder; exercise = exercise addiction; gamble = gambling addiction; love = love addiction; net = Internet addiction; sex = sex addiction; shop = shopping/buying addiction; work = workaholism; if do not remove co-addictions (assume nonoverlap) = 61% overall prevalence; if remove highest prevalence addiction (15%) = 61–15% = 46% overall prevalence; if remove average of co-addictions (average over 110 pairs is 23.42%) = 61% − (61% × 23.42%) = 46.71% overall prevalence.