Published in final edited form as:

Clin Psychol Rev. 2012 March ; 32(2): 105–121. doi:10.1016/j.cpr.2011.12.002.

Tobacco and marijuana use among adolescents and young adults: A systematic review of their co-use

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Abstract

Tobacco (TOB) and marijuana (MJ) are the most widely used drugs among adolescents and young adults. The literature on their co-use, however, has not been systematically reviewed. We identified 163 English language articles published from 1999-2009 examining TOB and MJ co-use, correlates or consequences of co-use, or interventions for prevention or cessation of co-use with participants age 13-25 years. Most studies ($n = 114$, 70%) examined TOB and MJ co-use, and 85% of relationships studied indicated a significant association. Fifty-nine studies (36%) examined correlates or consequences of co-use. Factors consistently associated with increased likelihood of co-use, defined as significant associations in at least four studies, were African-American ethnicity, mental and physical health characteristics (e.g., high-intensity pleasure temperament), and school characteristics (e.g., good grades). The only consistent consequence of co-use was exacerbation of mental health symptoms. Few studies examined prevention ($n = 3$) or cessation ($n = 2$) interventions for TOB and MJ co-use, and the findings were stronger for prevention efforts. A sufficient literature base has documented that TOB and MJ use are strongly related in young people, yet few consistent correlates and consequences of co-use have been identified to inform intervention targets.

Keywords

Tobacco; marijuana; polysubstance use; adolescence; young adulthood

Tobacco (TOB) use is the leading cause of preventable death and is estimated to kill more than 5 million people each year worldwide (World Health Organization, 2009). By the end of this century, TOB is projected to kill a billion people or more (Peto & Lopez, 2001). TOB use among teens and young adults is particularly important to address as more than 90% of U.S. adults who smoke became regular smokers before the age of 18 (U.S. Department of Health and Human Services, 1994). In 2009, 11% of U.S. adolescents and 42% of young adults aged 18-25 reported using a TOB product in the past month (Substance Abuse and Mental Health Services Administration, 2010). Throughout the world, nearly 20% of 13 to 15 year olds use some type of TOB product (Global Youth Tobacco Survey Collaborative Group, 2002). In order to reduce the health and societal impact of TOB use worldwide, it is important to understand factors that contribute to the onset and perpetuation of TOB use

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among young people. Further, TOB is relevant to adolescent and young adult health given its implication as a gateway drug to marijuana and other illicit drug use (Beenstock & Rahav, 2002; Bentler, Newcomb, & Zimmerman, 2002)

Marijuana (MJ) is the most commonly used illicit substance among youth and young adults, with approximately 7% of U.S. adolescents age 12 to 17 and 18% of those age 18 to 25 reporting MJ use in the past month in 2009 (Substance Abuse and Mental Health Services Administration, 2010). Rates for both age groups have increased since 2008, and are highest among young adults compared to any other age group.

There has been great interest in the relationship between TOB and MJ use among teens and young adults. Epidemiological data indicate that the co-use of TOB and MJ increased throughout the 1990s in Western countries (e.g., Choquet, Morin, Hassler, & Ledoux, 2004). Similarly, higher cigarette taxes are associated with lower likelihood of MJ use and frequency of use among adolescents in the U.S. (Farrelly, Bray, Zarkin, & Wendling, 2001). TOB and MJ, taken in combination, potentially raise the likelihood of dependence on these substances and problems associated with their use. For example, one study of college students at the University of Florida who used both cigarettes and MJ found that 65% had smoked both substances in the same hour; 31% reported they smoked TOB to prolong and sustain the effects of MJ; and 55% had friends who engaged in these behaviors (Tullis, DuPont, Frost-Pineda, & Gold, 2003).

As smoked substances, there is evidence that TOB and MJ use support and reinforce use of each other. One mechanism by which this may take place is through the use of “blunts,” or MJ rolled up in a cigar or cigarillo shell. Blunts are an increasingly common drug delivery device among middle and high-school age youth (Golub, Johnson, & Dunlap, 2005), and their use is associated with current cigarette and cigar usage (Soldz, Huyser, & Dorsey, 2003). Several studies have described TOB and MJ co-use through blunts. For example, Sifanek, Johnson, and Dunlap (2005) describe “blunt chasing”—the smoking of a cigarillo or cigar following a blunt—as an emerging phenomenon that further expands the market for TOB products among blunt smokers, and explains how blunts can contribute to the likelihood of nicotine dependence among blunt users. Ethnographic studies of blunt use generally tend to support the notion that for some young people who use MJ, their MJ use supports and reinforces a TOB smoking habit (Amos, Wiltshire, Bostock, Haw, & McNeill, 2004; Highet, 2004; Lee, Battle, Lipton, & Soller, 2010), and that a substitution phenomenon often takes place between the two substances (Akre, Michaud, Berchtold, & Suris, 2009; Amos et al., 2004). In an ethnographic study of blunt users in New York City, Dunlap, Benoit, Sifanek, and Johnson (2006) argued that the culture of blunt smoking (specifically the social aspects of the behavior) calls for a different construction of MJ dependence than current DSM-IV criteria. Interviews with blunt smokers revealed that some do perceive blunt use as “addictive,” and it tends to be the TOB rather than the MJ that contributes to the addictive process.

Viveros, Marco, and File (2006) reviewed the pharmacological processes underlying addiction to TOB and MJ, focusing on adolescent animal studies examining perpetuation of the use of both substances. Their review described systems that were mutually enhanced by the two substances (i.e., reinforcing effects, effects on anxiety-related behaviors) and those that have contrasting effects (i.e., food intake and cognition), suggesting that there is a complex relationship between the two substances. They concluded that “the joint consumption of nicotine and cannabis will [likely] enhance the rewarding effects of low doses” (p. 1174), and called for more human and animal studies in this area, particularly in sex differences in the interaction of TOB and MJ use.

While a number of studies have examined the association between TOB and MJ use both in North America and abroad, the consistency in findings have not been evaluated. In an effort to characterize the relationship between TOB and MJ use among teens and young adults, we present a systematic review of human studies in this area. Specifically, this paper summarizes the literature on TOB and MJ co-use including the relationship of co-use, correlates and consequences of co-use, and the success of interventions for prevention or cessation of co-use.

Method

Articles published in print or online between 1999 and 2009 were identified through computerized literature searches in two databases (PubMed, PsycINFO), published meta-analyses, review articles, and reference lists. Keyword search terms were: *smoking, tobacco, nicotine, or cigarette*, combined with *marijuana or cannabis*. Study title, abstracts, and bodies were reviewed by the first and second authors to determine study inclusion. Selection was restricted to English language publications with adolescent or young adult participants between the ages of 13-25 years. In addition, studies had to report one or more of the following: (1) epidemiology or use patterns of both TOB and MJ, including simultaneous use (e.g., through “blunts” or smoking cigarettes during MJ intoxication); (2) a predictor, correlate, or consequence of co-use; or (3) an intervention that addressed TOB and MJ co-use. Articles that assessed predictors, correlates, consequences, or effects of TOB and MJ use independently, without considering their co-use, were excluded, as were animal studies or human studies with participants over the age of 25 years.

Detailed tables were created by the first and second authors for coding selected study characteristics related to TOB and MJ co-use and to record: 1) patterns of co-use, 2) correlates and consequences of co-use, or 3) outcomes of an intervention addressing prevention or cessation of both TOB and MJ use. Studies that addressed more than one area of TOB and MJ co-use were included in multiple tables. Detailed tables were created to: summarize study samples by sex, age, and study location; categorize the study design as cross-sectional or longitudinal; and categorize the relationship of co-use as positive association, negative association, indeterminate, or null association (effect sizes were included where available). These full data tables are available upon request from the corresponding author. The detailed data tables were analyzed by the first and second authors to create summary tables of the literature using the coding rules detailed below. The summary tables for patterns of co-use are available as supplementary material online.

Coding associations between TOB and MJ use

For studies examining co-use of TOB and MJ, relationships were summarized for cross-sectional and longitudinal studies separately. For studies that considered multiple use relationships, we considered each relationship separately. For example, if a study examined the association between past 30-day TOB and MJ use and also past 30-day TOB use and MJ dependence symptoms, we coded these as two separate relationships. The individual studies used a variety of statistical techniques to evaluate associations, most commonly correlations, *t*-tests, and ANOVAs. Sometimes only multivariate analyses were reported, including linear regression, logistic regression, and structural equation modeling. Due to the heterogeneity in reported effects, measures, and study populations, a formal meta-analysis was deemed inappropriate. Instead, we applied the coding procedure of Sallis, Prochaska, and Taylor (2000) in their review of correlates of physical activity among youth. For studies that found a statistically significant relationship between TOB and MJ use, the direction of association was indicated with a “+” (for a positive association) or a “-” (for a negative association). Studies that reported nonsignificant associations between TOB and MJ use were coded “0,” and those that reported the relationship was unclear from findings were coded “?” For

consistency, findings of univariate tests, which were reported by most studies, were summarized even if multivariate tests were conducted.

Identified studies were categorized by study type and location. Cross-sectional studies that examined TOB and MJ use at a similar point in time (e.g., past 30-day TOB use, past 30-day MJ use) were labeled *cross-sectional*. Studies that examined the association between early use of either TOB or MJ and later use of the other substance in a cross-sectional design were labeled *cross-sectional time course*. Studies that examined the co-use of TOB and MJ at multiple time-points (e.g., past 30-day TOB use and past 30-day MJ use each year for multiple years) were labeled *longitudinal concurrent*. Studies with a longitudinal design that considered whether early TOB use was associated with subsequent MJ use were labeled *longitudinal, TOB precedes MJ*. Finally, studies that considered whether early MJ use was associated with subsequent TOB use were labeled *longitudinal, MJ precedes TOB*. All studies that examined patterns of co-use were further categorized by whether they were conducted in the U.S. or Canada versus other parts of the world. Additionally, we uniquely considered studies examining TOB and MJ co-use among mental health populations. For each study design category, we reported the proportion of relationships studied that found a positive association between TOB and MJ co-use.

Coding associations between correlates and consequences of co-use

For correlates and consequences of co-use, we computed “summary codes” for each category, to summarize the state of the literature for that category. The percentages refer to the number of associations supporting the expected association divided by the total number of associations for the category. Based on the percent of findings supporting the association, each category was classified using the following rules, **consistent with Sallis et al. (2000)**: 0%-33% of analyses supporting a category = no association (0); 34%-59% of analyses supporting = indeterminate, inconsistent (?); 60%-100% of analyses supporting = positive association (+) or negative association (-). Correlates or consequences for which four or more analyses supported an association or no association, were coded as 00, ++, or --. The ?? code indicated a category that has been frequently studied with considerable lack of consistency in the findings.

Coding prevention and intervention studies

Studies describing a prevention or cessation intervention were included if they directly measured TOB and MJ co-use among participants (i.e., not just the use of each substance independently in a sample). We coded each study by findings directly related to the co-use of TOB and MJ (+, -, ?, or 0) and calculated an overall summary rating for each category (prevention, intervention) as described above.

Results

PubMed yielded 1572 and PsycINFO yielded 1254 peer-reviewed studies with at least one TOB- and one MJ-related keyword. Of these 163 were directly relevant to concurrent use of TOB and MJ and had participants who were only adolescents or young adults (ages 13 to 25).

Epidemiology/Use patterns

One hundred studies addressed the co-use of TOB and MJ in a cross-sectional or longitudinal design. We categorized these studies as 1) cross-sectional ($n = 56$); 2) cross-sectional time course ($n = 10$; retrospective assessment of the causal relationship between TOB and MJ use); and/or 3) longitudinal ($n = 37$; Table 1). The results of the review are summarized below. Table 1 summarizes the 169 total associations between TOB and MJ use

for all cross-sectional and longitudinal studies reviewed. Across all relationships examined, there were no indeterminate (?) findings, and thus relationships were only coded as positive (+), negative (-), or null (0).

Cross-sectional studies—Many recent studies with teens and young adults have addressed the question of whether using either TOB or MJ elevates the risk for concurrently using the other substance. In the past 10 years, we found 56 studies with a cross sectional design: 40 conducted in the U.S. and Canada, and 16 conducted in other areas of the world. Sample sizes for these studies ranged from 53 to 45,848 (median = 1049). A variety of TOB and MJ variables were studied, including recent, past, and lifetime use (quantity/frequency), withdrawal symptoms, and dependence symptoms. Forms of TOB studied were cigarettes-only (49 studies; 86%), a substance other than cigarettes (e.g., chew, bidis, blunts; 3 studies; 5%), and both cigarettes and another substance (5 studies; 9%). Of the 87 total relationships studied cross-sectionally, 78 (90%) found a positive association between TOB and MJ use, nine (9%) found no relationship between the two substances in three separate studies, and no studies found a negative relationship between the two substances (Table 1). In two of the three studies that did not find a significant relationship between TOB and MJ use, all participants were smokers, hence variability in smoking patterns was constrained (Aung, Pickworth, & Moolchan, 2004; Shelef, Diamond, Diamond, & Myers, 2009). Thus, there was overwhelming evidence among teens and young adults throughout the world that TOB is associated with the use of MJ.

Unadjusted odds ratios indicated that among those who use MJ, the risk for concurrent smoking is six to 12 times higher for adolescents (Okoli, Richardson, Ratner, & Johnson, 2008; Wade & Pevalin, 2005) and two to five times higher for young adults, compared to those who do not use MJ (Lenz, 2003, 2004; Richter et al., 2004; Rigotti, Lee, & Wechsler, 2000; Rose et al., 2007). Among those who use TOB, the risk for MJ use is two to 52 times higher for adolescents (e.g., Abdel-Ghany & Wang, 2003; Everett, Malarcher, Sharp, Husten, & Giovino, 2000; Leatherdale, Hammond, & Ahmed, 2008) and 3 to 6.4 times greater for young adults (Agrawal & Lynskey, 2009; Clough, 2005; Leatherdale, Hammond, Kaiserman, & Ahmed, 2007), depending on the exact definitions of TOB and MJ used. For example, in the 2004 Canadian Youth Smoking Survey of 7th to 9th graders, having ever tried TOB was associated with 52 times greater likelihood of having ever used MJ compared to never trying TOB (Leatherdale et al., 2008), while in the 1997 Youth Risk Behavior Survey for high school students in the U.S., past 30 day use of multiple TOB substances was associated with 31 times greater odds of past 30 day MJ use compared to no TOB use (Everett et al., 2000).

Cross-sectional time course—We identified 10 studies (five in the U.S. or Canada and five in other parts of the world) and 11 total relationships that examined the association between early use of either TOB or MJ and later use of the other substance in a cross-sectional design (Table 1). For studies considering whether TOB use increased the risk of subsequent MJ use (TOB use first), five of the six relationships examined (83%) reported positive associations between the two substances and one found no association. Four studies and five relationships examined whether MJ use predicted later TOB use. All five of the relationships studied (100%) found a positive association between MJ use and subsequent TOB use.

Longitudinal studies—We found 34 separate longitudinal studies examining 71 relationships between TOB and MJ use (Table 1).

Concurrent use: Three studies (four relationships) examined the “concurrent” use of TOB and MJ at multiple time points, and we examined these separately. Of the concurrent

relationships studied, two (50%) found a positive association and two (50%) found no association between TOB and MJ use over time (Table 1).

Longitudinal, TOB use first: Twenty-four identified longitudinal studies conducted globally examined 40 predictive relationships between TOB use and subsequent MJ use. Eleven of fourteen (79%) relationships studied in the US and Canada and 24 of 26 relationships (92%) conducted elsewhere demonstrated a positive association between TOB and subsequent MJ use, and 70% of all relationships tested were significantly positive. There was a strong increased risk of MJ use or developing a MJ use disorder among those who had previously used TOB.

The longitudinal studies that examined TOB use before MJ use generally supported a gateway sequence and progression in addictive substance use (Kandel, Yamaguchi, & Chen, 1992; Lynskey et al., 2003). Early smoking was associated with an increased likelihood of using MJ throughout adolescence and into emerging adulthood, with odds ratios ranging from 1.6 (Griffin, Botvin, Scheier, & Nichols, 2002) to 8.6 (Wade & Pevalin, 2005). Early TOB use was also associated with MJ dependence, with one longitudinal study demonstrating that those who smoked cigarettes early were nearly two times more likely to develop a MJ use disorder compared to their non-smoking counterparts (OR = 1.74; D. W. Brook, Brook, Zhang, Cohen, & Whiteman, 2002; OR = 1.96; Lynskey et al., 2003). Using longitudinal data to model patterns of TOB use over time, Stanton, Flay, Colder, and Mehta (2004) demonstrated that an escalation of TOB use from ages 9 to 15 was associated with MJ use at ages 15 to 18. In studies outside the U.S., cigarette use predicted the onset of MJ use in New Zealand (Fergusson & Horwood, 2000), Israel (Beenstock & Rahav, 2002), England (McCambridge & Strang, 2005), Spain (Guxens, Nebot, & Ariza, 2007), the Netherlands (van Ours, 2007), Finland (Korhonen et al., 2008), and Norway (Pedersen, Mastekaasa, & Wichstrom, 2001). TOB use predicted MJ dependence in Australia (Patton, Coffey, Carlin, Wakefield, & Sawyer, 2006; Swift, Coffey, Carlin, Degenhardt, & Patton, 2008) and New Zealand (Fergusson & Horwood, 2000). Early TOB use (before age 13) posed a risk for later MJ use across Europe (Baumeister & Tossman, 2005) and Australia (Coffey, Carlin, Lynskey, Li, & Patton, 2003; Coffey, Lynskey, Wolfe, & Patton, 2000), and use at age 14 predicted MJ dependence at age 21 in Australia (Hayatbakhsh et al., 2008). Overall, there is a clear association between early TOB use and later MJ use.

Only one identified study found a single null relationship between TOB and subsequent MJ use. Hahm, Wong, Huang, Ozonoff, and Lee (2008) analyzed data from Asian-American adolescents in the 1996 and 2001 National Longitudinal Study of Adolescent Health (Add Health) study and found that among girls, TOB use at age 13 to 22 was not associated with MJ use at ages 18 to 27. In contrast, TOB use was associated with a lower likelihood of MJ use at ages 18 to 27 among Asian men (adjusted OR = .46, .23-.91). The relationship between TOB and MJ use may differ for Asian-American youth compared to other groups, although this difference needs replication.

Longitudinal, MJ use first: Fifteen longitudinal studies conducted globally examined 27 predictive relationships between MJ use and subsequent TOB use, 19 (70%) of which were significant (Table 1). Of the 23 relationships studied in the U.S. or Canada, 15 (65%) found that MJ use predicted subsequent TOB use, and seven (35%) were nonsignificant. Outside the U.S. and Canada, two longitudinal studies examined four positive relationships (100%).

Studies that examined MJ use first generally supported a “reverse gateway effect,” such that those who used MJ were at increased risk of initiating TOB use or developing nicotine dependence later in time (D’Amico & McCarthy, 2006). Data from the Add Health study in 1995 and 1996 reported that MJ use predicted TOB use one year later among youth in

grades 7-12 (OR range: 3.4-23.8; Scal, Ireland, & Borowsky, 2003; OR = 11.5; Wade & Pevalin, 2005). Older adolescents (age 17-21) who had past-month MJ use were more likely to initiate daily cigarette smoking ($\beta = -2.83$) and had a greater likelihood of becoming nicotine dependent (OR = 1.78) six years later (Timberlake et al., 2007). Lifetime MJ use in 9th grade was associated with cigarette smoking between 9th and 12th grades (Audrain-McGovern, Rodriguez, Wileyto, Schmitz, & Shields, 2006b). Another found that smoking MJ was associated with late-onset cigarette smoking among African-American males (White, Violette, Metzger, & Stouthamer-Loeber, 2007b).

Several studies demonstrated that MJ use in adolescence predicted a more extensive pattern of TOB smoking and a higher likelihood of transitioning from TOB use to nicotine dependence throughout adolescence and into young adulthood (Behrendt, Wittchen, Hofler, Lieb, & Beesdo, 2009; J. S. Brook, Ning, & Brook, 2006). Agrawal, Madden, Bucholz, Heath, and Lynskey (2008) demonstrated that women who used MJ before the age of 17 were at 4.4 and 2.8 increased hazards for transitioning from initiation to regular TOB use and from regular TOB use to nicotine dependence, respectively. Patton, Coffey, Carlin, Sawyer, and Lynskey (2005) found that for teen non-smokers, at least one report of weekly MJ use predicted a more than eightfold increase in the odds of later initiation of TOB use (OR 8.3; 95% CI 1.9-36). For 21-year-old smokers, not yet nicotine-dependent, daily MJ use raised the odds of nicotine dependence at the age of 24 years more than threefold (OR 3.6, 1.2, 10).

Three studies failed to find at least one significant relationship between MJ use and subsequent TOB use. Audrain-McGovern et al. (2006a) found no significant relationship between MJ use by 9th grade and smoking status in grades 9-12. In addition, using data from the Add Health study, Timberlake et al. (2007) failed to find relationships between MJ use at age 12-16 and TOB use 6 years later; however, these relationships were significant among young adults age 17-21. Also using data from the Add Health study, Hahn et al. (2008) found that MJ use at ages 13-22 was not associated with TOB use at ages 18-27 among Asian-American men or women. Despite these findings, the evidence for the reverse gateway effect is still fairly robust across all the recent literature from the U.S., Canada, and to a lesser extent, other parts of the world. There are clearly cases where nonsmokers become late adopters of TOB use after they have used MJ. It appears that there are two pathways to TOB and MJ co-use: the traditional/normative path whereby TOB use predicts MJ use (supported by 22 of 33 longitudinal studies; 67%), and then the less common route whereby MJ use leads to late adoption of TOB use (supported by 14 of 33 longitudinal studies; 42%; **Table 1**).

TOB and MJ use among teens and young adults with mental health problems

Adolescents and young adults with mental health problems are at high risk for TOB and MJ co-use, as rates of both TOB (Ramsey, Brown, Strong, & Sales, 2002) and MJ (Roberts, Roberts, & Xing, 2007) use are higher in this population compared to those without such problems. Among teens and young adults with mental health problems, like the general population, there is a strong association between TOB and MJ use. We found eight studies that examined whether there was an association between TOB and MJ use among teens and/or young adults with mental health problems, all (100%) of which found positive relationships (Table 2). Populations studied included young adults in eating disorder treatment (Haug, Heinberg, & Guarda, 2001), teens in psychiatric treatment (Ramsey et al., 2005; Upadhyaya, Brady, Wharton, & Liao, 2003), teens diagnosed with conduct disorder and comorbid alcohol dependence (Kuperman et al., 2001), teens diagnosed with disruptive behavior disorders (i.e., attention deficit disorder or oppositional defiant disorder; August et al., 2006; Burke, Loeber, & Lahey, 2001; Lambert, 2005), and young adults diagnosed with bipolar disorder (Heffner, DelBello, Fleck, Anthenelli, & Strakowski, 2008). Overall, consistent with the literature in community populations, there is a strong positive

relationship between TOB and MJ use among adolescents and young adults who have mental health problems.

Simultaneous use

The issue of simultaneous TOB and MJ use has been recognized as important (Burns, Ivers, Lindorff, & Clough, 2000), especially since the drugs are one of the most common combinations among adolescents and young adults (Barrett, Darredeau, & Pihl, 2006). TOB and MJ co-use represents the second most common pattern of polydrug use among Bosnian adolescents (75%; Redzic, Licanin, & Krosnjarić, 2003), and the third most common combination among Dutch adolescents, following co-use of alcohol with TOB or MJ (Smit, Monshouwer, & Verdurmen, 2002). In a study of 175 MJ users in the UK, Hammersley and Leon (2006) found that only 8 people (4.5%) had never smoked TOB with their MJ. Smoking MJ and TOB mixed together was reported as the most common route of ingestion by 89% of respondents, and 92% said smoking joints or “spliffs” (a slang word for MJ cigarette) was their most common method of use.

We found two controlled studies comparing simultaneous TOB and MJ use to use of MJ alone. Cooper and Haney (2009) compared joints to blunts and found that joints produced greater increases in plasma THC and subjective ratings of MJ intoxication, strength, and quality compared to blunts, especially in women. The increase in heart rate was comparable for blunts and joints, while carbon monoxide levels were higher for blunts, suggesting increased health risk. Comparing MJ users who wore a nicotine patch to those who did not, Penetar et al. (2005) determined that the patch increased heart rate and reported strength of MJ effects. Hence, delivery method (smoked leaf versus transdermal patch) may influence subjective effects of simultaneous TOB and MJ use.

Predictors/correlates of TOB and MJ co-use

While there is a clear association between TOB and MJ use among adolescents and young adults, the factors associated with co-use are less well-identified. Over the past 10 years, a number of factors have been tested as possible correlates or predictors of TOB and MJ co-use. We found 25 individual studies, which examined 24 different predictors or correlates of TOB and MJ co-use, in six categories (genetic/environmental, demographics, individual mental and physical health, parenting characteristics, school characteristics, and other environmental characteristics). Demographic variables were coded separately, while all other variables were coded by category (Table 3). Four genetics studies were identified, and relationships were coded between genetic factors and TOB and MJ co-use. The major finding was that there was a negative relationship between genetic factors and co-use, suggesting that environment (shared or unshared), rather than genetics, accounted for the largest variance in TOB and MJ co-use (3/4 studies; 75%). There were four demographic variables reviewed, with older age (2/3 studies; 66%) and African-American ethnicity (5/6 studies; 83%) showing overall significant associations with TOB and MJ co-use, while male sex (3/6 positive associations, 2/6 negative associations, 1/6 null association) was indeterminate.

All four of the other categories of correlates had significant associations with TOB and MJ use, including mental and physical health (10/15 significant relationships, 66%), parenting characteristics (2/2 relationships, 100%), school characteristics (3/4 relationships, 75%), and other environmental characteristics (i.e., childhood sexual abuse, exposure to violent television; 2/2 relationships, 100%). Twelve mental and physical health characteristics were examined. Variables that had positive relationships with TOB and MJ co-use included high-intensity pleasure temperament, externalizing mental health symptoms, anxiety symptoms, history of being drunk, perceived general health, and perception of early pubertal timing,

while diagnosis of attention-deficit hyperactivity disorder and self-control were negatively associated with TOB and MJ co-use (See Table 3). Sensation-seeking personality traits, depression symptoms, mood disorder, and conduct disorder diagnoses were found to have no relationship with TOB and MJ co-use in three studies.

Two studies examined parenting characteristics, with both demonstrating significant findings. Authoritative parenting style (Stephenson & Helme, 2006) and living with both parents (Suris, Akre, Berchtold, Jeannin, & Michaud, 2007) were protective against co-use. All four school characteristics showed significant relationships with co-use, with vocational education positively associated with co-use (Victoir, Eertmans, Van den Bergh, & Van den Broucke, 2007), while more traditional education such as enrollment in school and good grades (Suris et al., 2007) were protective factors against using both TOB and MJ. Two studies showed positive associations between other environmental characteristics and TOB and MJ co-use, including childhood sexual abuse (Nelson et al., 2006) and exposure to violent television (D. W. Brook, Saar, & Brook, 2008).

Consequences of TOB and MJ co-use

Most studies examining the long-term effects of TOB and MJ co-use have been conducted with adult samples, which were not included in the present review. The adult literature supports a substitution phenomenon between TOB and MJ, whereby reduction in use of one substance leads to an increase in use of the other substance (Copersino et al., 2006). Research on the consequences (both immediate and longer-term) of using both TOB and MJ in adolescence and young adulthood is growing (Table 4). Our review identified six categories of consequences. In summary, three categories (risk behaviors, mental health problems, neurocognitive consequences) had significant associations with TOB and MJ use, two were indeterminate (quit attempts/relapse, affective consequences), and one category (health problems) showed no association with TOB and MJ co-use.

Eleven studies examined 12 relationships between using both TOB and MJ and factors associated with quitting each substance such as the likelihood of making a quit attempt or relapsing on one or both substances. Findings in this category are mixed, with five significant (42%), five non-significant (42%), and two indeterminate relationships (17%).

Risk behaviors including driving under the influence of drugs, condom use, and dropping out of high school showed a positive relationship with co-use (3/3, 100% of relationships studied; Table 4). Findings for affective or cognitive consequences were mixed, having three significant relationships (3/5, 60%), but indeterminate results for this category overall. Attitudes toward smoking (Victoir et al., 2007) and motivation (Martin-Soelch et al., 2009) were negatively associated, while MJ motives (Bonn-Miller, Zvolensky, & Bernstein, 2007) were positively associated with co-use. Neither affect-related effect expectancies (Martens & Gilbert, 2008) nor intentions to use either substance (Victoir et al., 2007) were associated with TOB and MJ use.

Four articles tested the relationships between TOB and MJ co-use and mental health symptoms, and all relationships studied were significant. TOB and MJ co-use was related to greater depressive symptoms (Lee Ridner, Staten, & Danner, 2005), greater likelihood of a depression diagnosis (Boys et al., 2003; Green & Ritter, 2000), and greater likelihood of any DSM-IV Axis I psychiatric disorder diagnosis in childhood (Boys et al., 2003). TOB and MJ co-use demonstrates an overall positive relationship to neurocognitive consequences, with two of the three relationships studied (66%) showing positive relationships.

Finally, eight studies examined the relationship between co-use and health functioning with weak evidence of an additional negative effect of MJ over that of TOB alone (2/8 significant

relationships; 25%). Reviews examining the relationship between MJ use and disease risk among adults have concluded that MJ poses no additional risk over TOB use alone on the development of lung cancer (Hashibe et al., 2005; Mehra, Moore, Crothers, Tetrault, & Fiellin, 2006), periodontal disease (Thomson et al., 2008), or overall health (Georgiades & Boyle, 2007; Kertesz et al., 2007) later in life. Two of three studies (67%) in the current review, however, reported elevated rates of respiratory problems associated with TOB and MJ co-use (Taylor et al., 2002; Taylor, Poulton, Moffitt, Ramankutty, & Sears, 2000). Given the limited number of studies examining negative health consequences of TOB and MJ co-use, more research in this area is warranted.

Prevention/Intervention

Moving beyond descriptive studies is intervention research to prevent or treat TOB and MJ co-use associated problems. While a great many intervention studies have addressed the prevention and/or cessation of TOB, alcohol, and MJ use among teens and young adults, few interventions have directly addressed the co-use of TOB and MJ.

Prevention

Between 1999-2009, we found thirty-five peer-reviewed publications that addressed the prevention of both TOB and MJ use among teens and young adults. Of those, only three directly measured the co-use of TOB and MJ and all (100%) found significant effects on co-use (see Table 5). Trudeau, Spoth, Randall, and Azevedo (2007) found that the Iowa Strengthening Families Program, a family-focused universal preventive intervention, slowed the growth of polysubstance use (including TOB, MJ and other drugs) from 6th through 12th grades compared to a minimal contact control condition. A study of TOB smoke-free residence hall policies at three universities in the United States found that at two of the three universities, these policies improved enforcement of MJ policies in residence halls (Gerson, Allard, & Towvim, 2005). Werch, Moore, DiClemente, Bledsoe, and Johli (2005) tested a 12-minute one-on-one consultation integrating alcohol avoidance messages within those promoting fitness and other positive health behaviors on TOB, alcohol, and other substance use outcomes among adolescents. Long-term (3- and 12-month) sustained effects for TOB and MJ use and both vigorous and moderate physical activity were found among adolescents using MJ and/or TOB prior to intervention compared to a minimal contact control condition.

Intervention

Between 1999-2009, eight studies described interventions that were designed to treat TOB and MJ use among teens and/or young adults. However, only two articles, describing the same trial of a one-session Motivational Interviewing intervention, directly measured the co-use of TOB and MJ, and initial findings were not sustained (Table 5). McCambridge and Strang (2004) reported that at termination of treatment, MJ reduction was greatest among heavy cigarette smokers; but these effects were not-significant at the 12-month follow-up (McCambridge & Strang, 2005).

Discussion

We conducted a systematic review of the recent literature describing TOB and MJ co-use among adolescents and young adults. A large body of cross-sectional and longitudinal research globally has defined the basic relationship between TOB and MJ use in young people. Clearly, the use of one substance increases the likelihood of concurrent or future use of the other substance. Research efforts should turn to the more rarely studied areas of who is most likely to co-use TOB and MJ, how this co-use affects young people, and what can be done to prevent or treat TOB and MJ co-use.

Every study that we found examining TOB and MJ co-use among youth and young adults with mental health problems supported a positive association between the two substances. This is consistent with literature demonstrating that TOB smoking and MJ use are higher among those with mental illness compared to the general population (Lasser et al., 2000; Wittchen et al., 2007). Without intervention, few young people stop smoking on their own (Mermelstein, 2003), and rates of successful abstinence are particularly low (2%) among adolescents with co-occurring addictive disorders (Myers & MacPherson, 2004). Evidence is mounting that treating TOB dependence in the context of substance abuse treatment is effective and useful for both TOB and other substance outcomes (Myers & Prochaska, 2008; Prochaska, Delucchi, & Hall, 2004). Integrating TOB treatment into mental health treatment settings has also shown growing promise among adults (McFall et al., 2010). Given the high rate of TOB and MJ co-use among teens and young adults in mental health treatment, our findings indicate that an integrated approach to treatment may also be successful in this population. Research examining the effectiveness of interventions for multiple health risk behavior change (including TOB and MJ) in young people is warranted.

Three correlates had four or more relationships supporting a positive association with co-use: African-American ethnicity, mental and physical health characteristics, and school characteristics. Ethnic differences found in the co-use of TOB and MJ contrast with common differences found for TOB use alone. Epidemiological data show that Caucasian youth and young adults have consistently higher prevalence rates of smoking than African-American, Asian, or Hispanic young people (e.g., **Hu, Davies, & Kandel, 2006**). In the present review, African-American ethnicity was consistently associated with TOB and MJ co-use, likely related to the use of blunts, which has been identified in the qualitative literature as a common method of ingesting MJ among African-American young people (Golub et al., 2005). Research and prevention efforts for TOB and MJ should consider that issues around co-use may differ depending on the route of administration, which is likely to have cultural and social influences. Further, four of the studies considering ethnicity and TOB/MJ co-use identified a pattern whereby African-American youth were more likely to deviate from the traditional “gateway” sequence of substance use initiation compared to youth of other ethnic backgrounds (Aung et al., 2004; Guerra, Romano, Samuels, & Kass, 2000; Vaughn, Wallace, Perron, Copeland, & Howard, 2008; White, Jarrett, Valencia, Loeber, & Wei, 2007a). This has implications for prevention and intervention efforts with youth who may need different messages than are present in interventions that assume a gateway sequence of substance use progression.

Age and ethnicity demonstrated expected associations with TOB and MJ co-use, while sex was coded as indeterminate. Sex is one of the most consistently-studied demographic characteristics related to youth substance use. Epidemiological studies indicate that males are more likely to use either TOB or MJ than females (Substance Abuse and Mental Health Services Administration, 2009); however, the current finding indicates inconsistency in sex differences in the co-use of both substances. Since co-use is so prevalent among both sexes, issues around TOB and MJ co-use should be considered equally important for males and females. There needs to be more research in sex differences in the interaction of TOB and MJ use in order to clarify the inconsistency in findings.

There was a noticeable absence of literature on the parenting and peer characteristics related to TOB and MJ co-use. While numerous studies examined the relationship of parenting characteristics to TOB and MJ use in the same study (e.g., parental control/monitoring, permissiveness, family instability; Marcynyszyn, Evans, & Eckenrode, 2008; e.g., parental control/monitoring, permissiveness, family instability; Pokhrel, Unger, Wagner, Ritt-Olson, & Sussman, 2008; Voisine, Parsai, Marsiglia, Kulis, & Nieri, 2008), this work tended not to measure co-use explicitly. Similarly with peer characteristics, a number of studies have

examined factors such as peer favorable attitudes toward TOB and MJ use (Agrawal, Lynskey, Bucholz, Madden, & Heath, 2007), peer smoking (Griffin et al., 2002), and peer delinquency and rejection (Fite, Colder, Lochman, & Wells, 2008); however, the associations were made between these variables and TOB and MJ independently. There is a need to understand whether the same factors that are associated with use of TOB and MJ also contribute to their co-use, to aid in prevention and intervention with an important group of young people.

Exacerbation of mental health symptoms was the only consistent consequence of TOB and MJ co-use (with four significant relationships), while the few studies that examined it also showed consequences of increased risk behaviors and neurocognitive effects. Of particular interest is the finding that co-use has an indeterminate effect on making a quit attempt or relapsing to TOB or MJ use. In contrast to strong findings that alcohol is associated with relapse to TOB (e.g., Kahler, Spillane, & Metrik, 2010), the effect of MJ on TOB use relapse is less clear. It might be hypothesized that because cigarettes and other smoked TOB products (e.g., cigars, cigarillos) and MJ are smoked substances, substitution of one substance for another would be fairly common. Qualitative studies with TOB and MJ users have identified many themes around substitution, and also that motivation to quit smoking TOB and MJ tends to differ among those who use both substances (Amos et al., 2004; Hight, 2004; Lee et al., 2010; Sifaneck et al., 2005). More research is needed to clarify the cognitive aspects of using both substances and how co-use affects the likelihood of making quit attempts and avoiding relapse.

Mental and physical health consequences of TOB and MJ co-use had contrasting findings. While all studies that examined a mental health effect of using both substances showed an association, physical health effects were less clear. This falls in line with previous research on MJ use that some of the most dangerous public health consequences of its use among young people are mental health problems and behavioral consequences that can result in death (e.g., car accidents; Hall & Degenhardt, 2009). There are known long-term health effects of prolonged MJ use such as respiratory problems and cardiovascular disease (Hall & Degenhardt, 2009), and our review indicates that TOB and MJ co-use is associated with respiratory problems and poorer lung functioning as early as young adulthood (Taylor et al., 2002; Taylor et al., 2000). Findings that TOB and MJ co-use is not associated with overall health problems, periodontal disease, or lung cancer in young people does not preclude these problems from arising later as a result of prolonged TOB and MJ use. Longitudinal studies examining whether TOB and MJ co-use in youth and young adulthood results in chronic health problems is warranted.

Relative to the volume of studies examining correlates and consequences, there was a noticeable absence of literature on prevention interventions measuring TOB and MJ co-use. We found many prevention and intervention studies considering effects on TOB, alcohol and MJ use separately; however, very few studies explicitly examined co-use as a pattern within teens or young adults, or as an outcome to be targeted and evaluated through intervention studies. The current review details the strength of the relationship between TOB and MJ use among young people. Measuring polysubstance use is an important indicator of a successful intervention and should be measured in primary, secondary, and tertiary substance use interventions.

The current study is the first to systematically review research of TOB and MJ co-use. The review included 163 published studies, utilized standardized coding rules, and covered topics spanning rates of co-use, correlates and consequences of co-use, and intervention for prevention or cessation of co-use. There are, however, recognized limitations. The diversity of variables, measures, subject samples, and analysis strategies prevented a true meta-

analysis. This semiquantitative review required the establishment of definitions for consistency of association that may be debatable, as are any arbitrary classifications. However, the categories of evidence and summary codes, which have been used in previous studies (Sallis et al., 2000), do provide a relative assessment of the consistency of findings for TOB and MJ co-use. The present review focused on the consistency of reported associations and was not able to assess the strength of associations. To reduce the number of variables, similar constructs or specific measures of aspects of a general construct were combined into a single category. The review covered a decade of published English-language research from the years 1999 and 2009, inclusive. We judged this to be a broad, but manageable window of review, and we reviewed all published articles meeting the search criteria. A bias toward publishing only positive findings ("file drawer effects;" Dickersin, Chan, Chalmers, Sacks, & Smith, 1987; Rosenthal, 1979) is a concern for reviews in general and may have biased the results presented here. Although various strategies have been suggested to address file drawer effects (e.g., required registration of clinical trials by the NIH and/or journals), attempts to identify unpublished studies across all areas of research remain difficult.

Despite the recognized limitations, this study highlights the unique relationships that TOB and MJ share and points to future research directions. Studies that address substance use among teens and young adults should include assessments of multiple substance use rather than examining each substance independently, as co-use is such a common pattern for youth. It is also clear that there is a great need to develop prevention and intervention programs that address the co-use of TOB and MJ. Interventions designed to treat multiple substance use should assess patterns of co-use so that outcomes can be accurately determined. A better understanding of the factors associated with using TOB and MJ will greatly aid in prevention and intervention efforts with young people.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This study was supported by an institutional training grant (T32 DA007250; PI, J. Sorensen), a center grant from the National Institute on Drug Abuse (P50 DA09253; PI, J. Gwydys), and an individual Postdoctoral Fellowship Award from the California Tobacco-Related Diseases Research Program (18FT-0055; PI, D. Ramo). The preparation of this manuscript was supported in part by a career development award from NIDA (K23 DA018691; J. Prochaska, P.I.), a research project grant from the National Institute of Mental Health (R01 MH083684, J. Prochaska, P.I.), and a research award from the California Tobacco-Related Disease Research Program (#13-KT-0152).

Appendix A: Studies that met review criteria

Abdel-Ghany, M., & Wang, M. Q. (2003). Contemporaneous and intertemporal relationship between the consumption of licit and illicit substances by youth. *Journal of Family and Economic Issues*, 24(3), 281-289. doi:10.1023/A:1025447305590

Abrantes, A. M., Lee, C. S., MacPherson, L., Strong, D. R., Borrelli, B., & Brown, R. A. (2009). Health risk behaviors in relation to making a smoking quit attempt among adolescents. *Journal of Behavioral Medicine*, 32(2), 142-149. doi:10.1007/s10865-008-9184-1

Agrawal, A., Grant, J. D., Waldron, M., Scherrer, J. F., Madden, P. A. F., Heath, A. C., ... Duncan, A. E. (2006). Risk for initiation of substance use as a function of age of onset of cigarette, alcohol and cannabis use: Findings in a midwestern female twin cohort. *Preventive*

Medicine: An International Journal Devoted to Practice and Theory, 43(2), 125-128. doi:10.1016/j.ypmed.2006.03.022

Agrawal, A., Lynskey, M. T., Bucholz, K. K., Madden, P. A., & Heath, A. C. (2007). Correlates of cannabis initiation in a longitudinal sample of young women: The importance of peer influences. *Preventive Medicine*, 45, 31-34. doi:10.1016/j.ypmed.2007.04.012

Agrawal, A., Lynskey, M. T., Madden, P. A., Pergadia, M. L., Bucholz, K. K., & Heath, A. C. (2009). Simultaneous cannabis and tobacco use and cannabis-related outcomes in young women. *Drug and Alcohol Dependence*, 101(1-2), 8-12. doi:10.1016/j.drugalcdep.2008.10.019

Agrawal, A., Lynskey, M. T., Pergadia, M. L., Bucholz, K. K., Heath, A. C., Martin, N. G., & Madden, P. A. F. (2008a). Early cannabis use and DSM-IV nicotine dependence: A twin study. *Addiction*, 103(11), 1896-1904. doi:10.1111/j.1360-0443.2008.02354.x

Agrawal, A., Madden, P. A. F., Bucholz, K. K., Heath, A. C., & Lynskey, M. T. (2008b). Transitions to regular smoking and to nicotine dependence in women using cannabis. *Drug and Alcohol Dependence*, 95(1-2), 107-114. doi:10.1016/j.drugalcdep.2007.12.017
Aitken, S. S., DeSantis, J., Harford, T. C., & Fe Caces, M. (2000). Marijuana use among adults: A longitudinal study of current and former users. *Journal of Substance Abuse*, 12(3), 213-226. doi:10.1016/S0899-3289(00)00051-1

Amos, A., Wiltshire, S., Bostock, Y., Haw, S., & McNeill, A. (2004). 'you can't go without a fag . . . You need it for your hash'-a qualitative exploration of smoking, cannabis and young people. *Addiction*, 99, 77- 81. doi:10.1111/j.1360-0443.2004.00531.x

Audrain-McGovern, J., Rodriguez, D., Patel, V., Faith, M. S., Rodgers, K., & Cuevas, J. (2006). How do psychological factors influence adolescent smoking progression? The evidence for indirect effects through tobacco advertising receptivity. *Pediatrics*, 117(4), 1216-1225. doi:10.1542/peds.2005-0808

Audrain-McGovern, J., Rodriguez, D., Wileyto, E. P., Schmitz, K. H., & Shields, P. G. (2006). Effect of team sport participation on genetic predisposition to adolescent smoking progression. *Archives of General Psychiatry*, 63(4), 433-441. doi:10.1001/archpsyc.63.4.433

August, G. J., Winters, K. C., Realmuto, G. M., Fahnhorst, T., Botzet, A., & Lee, S. (2006). Prospective study of adolescent drug use among community samples of adhd and nonadhd participants. *Journal of the American Academy of Child and Adolescent Psychiatry*, 45(7), 824-832. doi:10.1097/01.chi.0000219831.16226.f8

Aung, A. T., Pickworth, W. B., & Moolchan, E. T. (2004). History of marijuana use and tobacco smoking topography in tobacco-dependent adolescents. *Addictive Behaviors*, 29(4), 699-706. doi:10.1016/j.addbeh.2004.02.012

Barrett, S. P., Darredeau, C., & Pihl, R. O. (2006). Patterns of simultaneous polysubstance use in drug using university students. *Human Psychopharmacology: Clinical and Experimental*, 21(4), 255-263. doi:10.1002/hup.766

Baumeister, S. E., & Tossman, P. (2005). Association between early onset of cigarette, alcohol and cannabis use and later drug use patterns: An analysis of a survey in european metropolises. *European Addiction Research*, 11(2), 92-98. doi:10.1159/000083038

Behrendt, S., Wittchen, H. U., Hofler, M., Lieb, R., & Beesdo, K. (2009). Transitions from first substance use to substance use disorders in adolescence: Is early onset associated with a

rapid escalation? *Drug and Alcohol Dependence*, 99(1-3), 68-78. doi:10.1016/j.drugalcdep.2008.06.014

Bingham, C. R., & Shope, J. T. (2004). Adolescent problem behavior and problem driving in young adulthood. *Journal of Adolescent Research*, 19(2), 205-223. doi:10.1177/0743558403258269

Bonn-Miller, M. O., & Zvolensky, M. J. (2009). An evaluation of the nature of marijuana use and its motives among young adult active users. *American Journal on Addictions*, 118(5), 409-416. doi:10.3109/10550490903077705

Bonn-Miller, M. O., Zvolensky, M. J., & Bernstein, A. (2007). Marijuana use motives: Concurrent relations to frequency of past 30-day use and anxiety sensitivity among young adult marijuana smokers. *Addictive Behaviors*, 32(1), 49-62. doi:10.1016/j.addbeh.2006.03.018

Bonn-Miller, M. O., Zvolensky, M. J., Leen-Feldner, E. W., Feldner, M. T., & Yartz, A. R. (2005). Marijuana use among daily tobacco smokers: Relationship to anxiety-related factors. *Journal of Psychopathology and Behavioral Assessment*, 27(4), 279-289. doi:10.1007/s10862-005-2408-6

Bonn-Miller, M. O., Zvolensky, M. J., Marshall, E. C., & Bernstein, A. (2007). Incremental validity of anxiety sensitivity in relation to marijuana withdrawal symptoms. *Addictive Behaviors*, 32(9), 1843-1851. doi:10.1016/j.addbeh.2006.12.016

Boys, A., Farrell, M., Taylor, C., Marsden, J., Goodman, R., Brugha, T., ... Meltzer, H. (2003). Psychiatric morbidity and substance use in young people aged 13-15 years: Results from the child and adolescent survey of mental health. *British Journal of Psychiatry*, 182(6), 509-517. doi:10.1192/bjp.182.6.509

Brook, D. W., Brook, J. S., Zhang, C., Cohen, P., & Whiteman, M. (2002). Drug use and the risk of major depressive disorder, alcohol dependence and substance use disorders. *Archives of General Psychiatry*, 59(11), 1039-1044. doi:10.1001/archpsyc.59.11.1039

Brook, D. W., Saar, N. S., & Brook, J. S. (2008). Earlier violent television exposure and later drug dependence. *The American Journal on Addictions*, 117(4), 271-277. doi:10.1080/10550490802138590

Brook, J. S., Balka, E. B., Ning, Y., Finch, S. J., & Whiteman, M. (2006). Smoking involvement during adolescence among african americans and puerto ricans: Risks to psychological and physical well-being in young adulthood. *Psychological Reports*, 99(2), 421-438. doi:10.2466/PRO.99.6.421-438

Burke, J. D., Loeber, R., & Lahey, B. B. (2001). Which aspects of adhd are associated with tobacco use in early adolescence? *Journal of Child Psychology and Psychiatry*, 42(4), 493-502. doi:10.1111/1469-7610.00743

Burns, C. B., Ivers, R. G., Lindorff, K. J., & Clough, A. R. (2000). Cannabis: A trojan horse for nicotine? *Australian and New Zealand Journal of Public Health*, 24(6), 637. doi:10.1111/j.1467-842X.2000.tb00533.x

Busen, N. H., Modeland, V., & Kouzekanani, K. (2001). Adolescent cigarette smoking and health risk behavior. *Journal of Pediatric Nursing*, 16(3), 187-193. doi:10.1053/jpdn.2001.24182

- Caldeira, K. M., Arria, A. M., O'Grady, K. E., Vincent, K. B., & Wish, E. D. (2008). The occurrence of cannabis use disorders and other cannabis-related problems among first-year college students. *Addictive Behaviors*, 33(3), 397-411. doi:10.1016/j.addbeh.2007.10.001
- Camenga, D. R., Klein, J. D., & Roy, J. (2006). The changing risk profile of the american adolescent smoker: Implications for prevention programs and tobacco interventions. *Journal of Adolescent Health*, 39(1), 120 e121-110. doi:10.1016/j.jadohealth.2005.10.014
- Caris, L., Wagner, F. A., Rios-Bedoya, C. F., & Anthony, J. C. (2009). Opportunities to use drugs and stages of drug involvement outside the united states: Evidence from the republic of chile. *Drug and Alcohol Dependence*, 102(1-3), 30-34. doi:10.1016/j.drugalcdep.2008.12.004
- Chédebois, L., Regner, I., van Leeuwen, N., Chauchard, E., Sejourne, N., Rodgers, R., & Chabrol, H. (2009). Relative contributions of acculturation and psychopathological factors to cannabis use among adolescents from migrant parents. *Addictive Behaviors*, 34(12), 1023-1028. doi:10.1016/j.addbeh.2009.06.011
- Coffey, C., Carlin, J. B., Lynskey, M., Li, N., & Patton, G. C. (2003). Adolescent precursors of cannabis dependence: Findings from the victorian adolescent health cohort study. *British Journal of Psychiatry*, 182(4), 330-336. doi:10.1192/bjp.182.4.330
- Coffey, C., Lynskey, M., Wolfe, R., & Patton, G. C. (2000). Initiation and progression of cannabis use in a population-based australian adolescent longitudinal study. *Addiction*, 95(11), 1679-1690. doi:10.1046/j.1360-0443.2000.951116798.x
- Cooper, Z. D., & Haney, M. (2009). Comparison of subjective, pharmacokinetic, and physiological effects of marijuana smoked as joints and blunts. *Drug and Alcohol Dependence*, 103(3), 107-113. doi:10.1016/j.drugalcdep.2009.01.023
- Creemers, H. E., Korhonen, T., Kaprio, J., Vollebergh, W. A. M., Ormel, J., Verhulst, F. C., & Huizink, A. C. (2009). The role of temperament in the relationship between early onset of tobacco and cannabis use: The trails study. *Drug and Alcohol Dependence*, 104(1-2), 113-118. doi:10.1016/j.drugalcdep.2009.04.010
- Cropsey, K. L., Linker, J. A., & Waite, D. E. (2008). An analysis of racial and sex differences for smoking among adolescents in a juvenile correctional center. *Drug and Alcohol Dependence*, 92(1-3), 156-163. doi:10.1016/j.drugalcdep.2007.07.018
- D'Amico, E. J., & McCarthy, D. M. (2006). Escalation and initiation of younger adolescents' substance use: The impact of perceived peer use. *Journal of Adolescent Health*, 39(4), 481-487. doi:10.1016/j.jadohealth.2006.02.010
- de Dios, M. A., Vaughan, E. L., Stanton, C. A., & Niaura, R. (2009). Adolescent tobacco use and substance abuse treatment outcomes. *Journal of Substance Abuse Treatment*, 37(1), 17- 24. doi:10.1016/j.jsat.2008.09.006
- Delnevo, C. D., & Hrywna, M. (2006). The relationship of cigars, marijuana, and blunts to adolescent bidi use. *Public Health Reports*, 121(5), 603-608.
- Diego, M. A., Field, T. M., & Sanders, C. E. (2003). Academic performance, popularity, and depression predict adolescent substance use. *Adolescence*, 38(149), 35-42.

- Duhig, A. M., Cavallo, D. A., McKee, S. A., George, T. P., & Krishnan-Sarin, S. (2005). Daily patterns of alcohol, cigarette, and marijuana use in adolescent smokers and nonsmokers. *Addictive Behaviors*, 30(2), 271-283. doi:10.1016/j.addbeh.2004.05.016
- Ellickson, P. L., Tucker, J. S., & Klein, D. J. (2001). High-risk behaviors associated with early smoking: Results from a 5-year follow-up. *Journal of Adolescent Health*, 28(6), 465-473. doi:10.1016/S1054-139X(00)00202-0
- Ellickson, P. L., Tucker, J. S., & Klein, D. J. (2001). Sex differences in predictors of adolescent smoking cessation. *Health Psychology*, 20(3), 186-195. doi: 10.1037/0278-6133.20.3.186
- Ernst, M., Luckenbaugh, D. A., Moolchan, E. T., Leff, M. K., Allen, R., Eshel, N., ... Kimes, A. (2006). Behavioral predictors of substance-use initiation in adolescents with and without attention-deficit/hyperactivity disorder. *Pediatrics*, 117(6), 2030-2039. doi:10.1542/peds.2005-0704
- Everett, S. A., Malarcher, A. M., Sharp, D. J., Husten, C. G., & Giovino, G. A. (2000). Relationship between cigarette, smokeless tobacco, and cigar use, and other health risk behaviors among u.S. High school students. *Journal of School Health*, 70(6), 234-240. doi: 10.1111/j.1746-1561.2000.tb07424.x
- Faeh, D., Viswanathan, B., Chiolerio, A., Warren, W., & Bovet, P. (2006). Clustering of smoking, alcohol drinking and cannabis use in adolescents in a rapidly developing country. *BMC Public Health*, 6, 169. doi:10.1186/1471-2458-6-169
- Fergusson, D. M., & Horwood, L. J. (2000). Cannabis use and dependence in a new zealand birth cohort. *New Zealand Medical Journal*, 113(1109), 156-158.
- Flisher, A. J., Kramer, R. A., Hoven, C. W., King, R. A., Bird, H. R., Davies, M., ... Shaffer, D. (2000). Risk behavior in a community sample of children and adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry*, 39(7), 881-887. doi: 10.1097/00004583-200007000-00017
- Fried, P. A., Watkinson, B., & Gray, R. (2006). Neurocognitive consequences of cigarette smoking in young adults--a comparison with pre-drug performance. *Neurotoxicology and Teratology*, 28(4), 517-525. doi:10.1016/j.ntt.2006.06.003
- Georgiades, K., & Boyle, M. H. (2007). Adolescent tobacco and cannabis use: Young adult outcomes from the ontario child health study. *Journal of Child Psychology and Psychiatry*, 48(7), 724-731. doi:10.1111/j.1469-7610.2007.01740.x
- Gerson, M., Allard, J. L., & Towvim, L. G. (2005). Impact of smoke-free residence hall policies: The views of administrators at 3 state universities. *Journal of American College Health*, 54(3), 157-165. doi:10.3200/JACH.54.3.157-165
- Gledhill-Hoyt, J., Lee, H., Strote, J., & Wechsler, H. (2000). Increases use of marijuana and other illicit drugs at us colleges in the 1990s: Results of three national surveys. *Addiction*, 95(11), 1655-1667. doi:10.1046/j.1360-0443.2000.951116556.x
- Godeau, E., Vignes, C. I., ter Bogt, M. T., Gabhainn, S. N., & Navarro, F. I. (2007). Cannabis use by 15-year-old schoolchildren: Data from the hbsc/who international survey in 32 western countries. *Alcoologie et Addictologie*, 29(Suppl 4), 28S-34S.

- Green, B. E., & Ritter, C. (2000). Marijuana use and depression. *Journal of Health and Social Behavior*, 41(1), 40-49. doi:10.2307/2676359
- Griffin, K. W., Botvin, G. J., Scheier, L. M., & Nichols, T. R. (2002). Factors associated with regular marijuana use among high school students: A long-term follow-up study. *Substance Use and Misuse*, 37(2), 225-238. doi:10.1081/JA-120001979
- Guerra, L. M., Romano, P. S., Samuels, S. J., & Kass, P. H. (2000). Ethnic differences in adolescent substance initiation sequences. *Archives of Pediatrics and Adolescent Medicine*, 154(11), 1089-1095.
- Guxens, M., Nebot, M., & Ariza, C. (2007). Age and sex differences in factors associated with the onset of cannabis use: A cohort study. *Drug and Alcohol Dependence*, 88(2-3), 234-243. doi:10.1016/j.drugalcdep.2006.10.018
- Hahm, H. C., Wong, F. Y., Huang, Z. J., Ozonoff, A., & Lee, J. (2008). Substance use among asian americans and pacific islanders sexual minority adolescents: Findings from the national longitudinal study of adolescent health. *Journal of Adolescent Health*, 42(3), 275-283. doi:10.1016/j.jadohealth.2007.08.021
- Hammersley, R., & Leon, V. (2006). Patterns of cannabis use and positive and negative experiences of use amongst university students. *Addiction Research & Theory*, 14(2), 189-205. doi:10.1080/16066350500453309
- Han, C., McGue, M. K., & Iacono, W. G. (1999). Lifetime tobacco, alcohol and other substance use in adolescent minnesota twins: Univariate and multivariate behavioral genetic analyses. *Addiction*, 94(7), 981-993. doi:10.1046/j.1360-0443.1999.9479814.x
- Hancox, R. J., Poulton, R., Ely, M., Welch, D., Taylor, D. R., McLachlan, C. R., ... Sears, M. R. (2010). Effects of cannabis on lung function: A population-based cohort study. *European Respiratory Journal*, 35(1), 42-47. doi:10.1183/09031936.00065009
- Hashibe, M., Straif, K., Tashkin, D. P., Morgenstern, H., Greenland, S., & Zhang, Z.-F. (2005). Epidemiologic review of marijuana use and cancer risk. *Alcohol*, 35(3), 265-275. doi:10.1016/j.alcohol.2005.04.008
- Haug, N. A., Heinberg, L. J., & Guarda, A. S. (2001). Cigarette smoking and its relationship to other substance use among eating disordered inpatients. *Eating and Weight Disorders*, 6(3), 130-139.
- Hayatbakhsh, M. R., McGee, T. R., Bor, W., Najman, J. M., Jamrozik, K., & Mamun, A. A. (2008). Child and adolescent externalizing behavior and cannabis use disorders in early adulthood: An australian prospective birth cohort study. *Addictive Behaviors*, 33(3), 422-438. doi:10.1016/j.addbeh.2007.10.004
- Heffner, J. L., DelBello, M. P., Fleck, D. E., Anthenelli, R. M., & Strakowski, S. M. (2008). Cigarette smoking in the early course of bipolar disorder: Association with ages-at-onset of alcohol and marijuana use. *Bipolar Disorders*, 10(7), 838-845. doi:10.1111/j.1399-5618.2008.00630.x
- Helstrom, A., Bryan, A., Hutchison, K. E., Riggs, P. D., & Blechman, E. A. (2004). Tobacco and alcohol use as an explanation for the association between externalizing behavior and illicit drug use among delinquent adolescents. *Prevention Science*, 5(4), 267-277. doi:10.1023/B:PREV.0000045360.23290.8f

- Huebner, A. J., Shettler, L., Matheson, J. L., Meszaros, P. S., Piercy, F. P., & Davis, S. D. (2005). Factors associated with former smokers among female adolescents in rural virginia. *Addictive Behaviors*, 30(1), 167-173. doi:10.1016/j.addbeh.2004.04.004
- Huebner, A. J., Shettler, L., Matheson, J. L., Meszaros, P. S., Piercy, F. P., & Davis, S. D. (2006). Examining ethnic differences in predictors of female adolescent smoking in rural virginia. *Journal of Child & Adolescent Substance Abuse*, 15(3), 63-81. doi:10.1300/J029v15n03_05
- Jacobsen, L. K., Krystal, J. H., Mencl, W. E., Westerveld, M., Frost, S. J., & Pugh, K. R. (2005). Effects of smoking and smoking abstinence on cognition in adolescent tobacco smokers. *Biological Psychiatry*, 57(1), 56-66. doi:10.1016/j.biopsych.2004.10.022
- Jacobsen, L. K., Pugh, K. R., Constable, R. T., Westerveld, M., & Mencl, W. E. (2007). Functional correlates of verbal memory deficits emerging during nicotine withdrawal in abstinent adolescent cannabis users. *Biological Psychiatry*, 61(1), 31-40. doi:10.1016/j.biopsych.2006.02.014
- Kapusta, N. D., Plener, P. L., Schmid, R., Thau, K., Walter, H., & Lesch, O. M. (2007). Multiple substance use among young males. *Pharmacology, Biochemistry, and Behavior*, 86, 306-311. doi:10.1016/j.pbb.2006.10.007
- Kapusta, N. D., Ramskogler, K., Hertling, I., Schmid, R., Dvorak, A., Walter, H., & Lesch, O. M. (2006). Epidemiology of substance use in a representative sample of 18-year-old males. *Alcohol and Alcoholism*, 41(2), 188-192. doi:10.1093/alcalc/agh251
- Kertesz, S. G., Pletcher, M. J., Safford, M., Halanych, J., Kirk, K., Schumacher, J., ... Kiefe, C. I. (2007). Illicit drug use in young adults and subsequent decline in general health: The coronary artery risk development in young adults (cardia) study. *Drug and Alcohol Dependence*, 88(2-3), 224-233. doi:10.1016/j.drugalcdep.2006.10.017
- Kohn, L., Kittel, F., & Piette, D. (2004). Peer, family integration and other determinants of cannabis use among teenagers. *International Journal of Adolescent Medicine and Health*, 16(4), 359-370. doi:10.1515/IJAMH.2004.16.4.359
- Kokkevi, A., Gabhainn, S. N., & Spyropoulou, M. (2006). Early initiation of cannabis use: A cross-national european perspective. *Journal of Adolescent Health*, 39(5), 712-719. doi:10.1016/j.jadohealth.2006.05.009
- Korhonen, T., Huizink, A. C., Dick, D. M., Pulkkinen, L., Rose, R. J., & Kaprio, J. (2008). Role of individual, peer and family factors in the use of cannabis and other illicit drugs: A longitudinal analysis among finnish adolescent twins. *Drug and Alcohol Dependence*, 97(1-2), 33-43. doi:10.1016/j.drugalcdep.2008.03.015
- Korhonen, T., van Leeuwen, A. P., Reijneveld, S. A., Ormel, J., Verhulst, F. C., & Huizink, A. C. (2010). Externalizing behavior problems and cigarette smoking as predictors of cannabis use: The trails study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 49(1), 61-69. doi:10.1097/00004583-201001000-00010
- Kuperman, S., Schlosser, S. S., Kramer, J. R., Bucholz, K., Hesselbrock, V., Reich, T., & Reich, W. (2001). Developmental sequence from disruptive behavior diagnosis to adolescent alcohol dependence. *American Journal of Psychiatry*, 158(12), 2022-2026. doi:10.1176/appi.ajp.158.12.2022

- Lai, S., Lai, H., Page, J. B., & McCoy, C. B. (2000). The association between cigarette smoking and drug abuse in the united states. *Journal of Addictive Disorders, 19*, 11- 24. doi: 10.1300/J069v19n04_02
- Lambert, N. (2005). The contribution of childhood adhd, conduct problems, and stimulant treatment to adolescent and adult tobacco and psychoactive substance abuse. *Ethical Human Psychology and Psychiatry: An International Journal of Critical Inquiry, 7*(3), 197-221.
- Lane, S. D., Cherek, D. R., Tcheremissine, O. V., Steinberg, J. L., & Sharon, J. L. (2007). Response perseveration and adaptation in heavy marijuana-smoking adolescents. *Addictive Behaviors, 32*(5), 977-990. doi:10.1016/j.addbeh.2006.07.007
- Leatherdale, S. T., Ahmed, R., & Kaiserman, M. (2006). Marijuana use by tobacco smokers and nonsmokers: Who is smoking what? *Canadian Medical Association Journal, 174*(10), 1399. doi:10.1503/cmaj.051614
- Leatherdale, S. T., Hammond, D., & Ahmed, R. (2008). Alcohol, marijuana, and tobacco use patterns among youth in canada. *Cancer Causes & Control, 19*(4), 361-369. doi: 10.1007/s10552-007-9095-4
- Leatherdale, S. T., Hammond, D. G., Kaiserman, M., & Ahmed, R. (2007). Marijuana and tobacco use among young adults in canada: Are they smoking what we think they are smoking? *Cancer Causes and Control, 18*(4), 391-397. doi:10.1007/s10552-006-0103-x
- Lee, J. P., Battle, R. S., Lipton, R., & Soller, B. (2010). 'smoking': Use of cigarettes, cigars and blunts among southeast asian american youth and young adults. *Health Education Research, 25*(1), 83-96. doi:10.1093/her/cyp066
- Lee Ridner, S., Staten, R. R., & Danner, F. W. (2005). Smoking and depressive symptoms in a college population. *Journal of School Nursing, 21*(4), 229-235. doi: 10.1177/10598405050210040801
- Lenz, B. K. (2003). Correlates of young adult tobacco use: Application of a transition framework. *The Journal of School Nursing, 19*(4), 232-237. doi: 10.1177/10598405030190040901
- Lenz, B. K. (2004). Tobacco, depression, and lifestyle choices in the pivotal early college years. *Journal of American College Health, 52*(5), 213-219. doi:10.3200/JACH.52.5.213-220
- Lynskey, M. T., Heath, A. C., Bucholz, K. K., Slutske, W. S., Madden, P. A., Nelson, E. C., ... Martin, N. G. (2003). Escalation of drug use in early-onset cannabis users vs co-twin controls. *JAMA: Journal of the American Medical Association, 289*(4), 427-433. doi: 10.1001/jama.289.4.427
- Manning, V., Best, D., Rawaf, S., Rowley, J., Floyd, K., & Strang, J. (2001). Drug use in adolescence: The relationship between opportunity, initial use and continuation of use of four illicit drugs in a cohort of 14-16-yr-olds in south london. *Drugs: Education, Prevention & Policy, 8*(4), 397-405. doi:10.1080/09687630110046144
- Marcynyszyn, L. A., Evans, G. W., & Eckenrode, J. (2008). Family instability during early and middle adolescence. *Journal of Applied Developmental Psychology, 29*(5), 380-392. doi:10.1016/j.appdev.2008.06.001

- Martens, K. M., & Gilbert, D. G. (2008). Marijuana and tobacco exposure predict affect-regulation expectancies in dual users. *Addictive Behaviors*, 33(11), 1484-1490. doi:10.1016/j.addbeh.2008.07.002
- Martin-Soelch, C., Kobel, M., Stoecklin, M., Michael, T., Weber, S., Krebs, B., & Opwis, K. (2009). Reduced response to reward in smokers and cannabis users. *Neuropsychobiology*, 60(2), 94-103. doi:10.1159/000239685
- McCaffrey, D. F., Liccardo Pacula, R., Han, B., & Ellickson, P. (2009). Marijuana use and high school dropout: The influence of unobservables. *Health Economics*. doi:10.1002/hec.1561
- McCambridge, J., & Strang, J. (2004). The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people: Results from a multi-site cluster randomized trial. *Addiction*, 99(1), 39-52. doi:10.1111/j.1360-0443.2004.00564.x
- McCambridge, J., & Strang, J. (2005a). Age of first use and ongoing patterns of legal and illegal drug use in a sample of young londoners. *Substance Use and Misuse*, 40(3), 313-319. doi:10.1081/JA-200049333
- McCambridge, J., & Strang, J. (2005b). Deterioration over time in effect of motivational interviewing in reducing drug consumption and related risk among young people. *Addiction*, 100(4), 470-478. doi:10.1111/j.1360-0443.2005.01013.x
- McGee, R., Williams, S., Poulton, R., & Moffitt, T. (2000). A longitudinal study of cannabis use and mental health from adolescence to early adulthood. *Addiction*, 95(4), 491-503. doi:10.1046/j.1360-0443.2000.9544912.x
- Mehra, R., Moore, B. A., Crothers, K., Tetrault, J., & Fiellin, D. A. (2006). The association between marijuana smoking and lung cancer: A systematic review. *Archives of Internal Medicine*, 166(13), 1359-1367. doi:10.1001/archinte.166.13.1359
- Moberg, D. P., & Rettammel, R. J. (2001). Tobacco use trends and correlates among students in the madison metropolitan school district. *WMJ*, 100(3), 43-48.
- Moolchan, E. T., Zimmerman, D., Sehnert, S. S., Zimmerman, D., Huestis, M. A., & Epstein, D. H. (2005). Recent marijuana blunt smoking impacts carbon monoxide as a measure of adolescent tobacco abstinence. *Substance Use and Misuse*, 40(2), 231-240. doi:10.1081/JA-200048461
- Neale, M. C., Harvey, E., Maes, H. H. M., Sullivan, P. F., & Kendler, K. S. (2006). Extensions to the modeling of initiation and progression: Applications to substance use and abuse. *Behavior Genetics*, 36(4), 507-524. doi:10.1007/s10519-006-9063-x
- Nelson, E. C., Heath, A. C., Lynskey, M. T., Madden, P. A. F., Martin, N. G., Statham, D. J., & Bucholz, K. K. (2006). Childhood sexual abuse and risks for licit and illicit drug-related outcomes: A twin study. *Psychological Medicine*, 36(10), 1473-1483. doi:10.1017/S0033291706008397
- Nyari, T. A., Heredi, K., & Parker, L. (2005). Addictive behaviour of adolescents in secondary schools in hungary. *European Addiction Research*, 11(1), 38-43. doi:10.1159/000081415

- Ohene, S.-A., Ireland, M., & Blum, R. W. (2005). The clustering of risk behaviors among caribbean youth. *Maternal & Child Health Journal*, 9(1), 91-100. doi:10.1007/s10995-005-2452-6
- Okoli, C. T., Richardson, C. G., Ratner, P. A., & Johnson, J. L. (2008). Adolescents' self-defined tobacco use status, marijuana use, and tobacco dependence. *Addictive Behaviors*, 33(11), 1491-1499. doi:10.1016/j.addbeh.2008.05.008
- Okoli, C. T., Richardson, C. G., Ratner, P. A., & Johnson, J. L. (2009). Non-smoking youths' "Perceived" Addiction to tobacco is associated with their susceptibility to future smoking. *Addictive Behaviors*, 34(12), 1010-1016. doi:10.1016/j.addbeh.2009.06.010
- Pampel, F. C., & Aguilar, J. (2008). Changes in youth smoking, 1976-2002: A time-series analysis. *Youth & Society*, 39(4), 453-479. doi:10.1177/0044118X07308070
- Parkes, A., Wight, D., Henderson, M., & Hart, G. (2007). Explaining associations between adolescent substance use and condom use. *Journal of Adolescent Health*, 40(2), 180 e181-118. doi:10.1016/j.jadohealth.2006.09.012
- Patrick, M. E., Collins, L. M., Smith, E., Caldwell, L., Flisher, A., & Wegner, L. (2009). A prospective longitudinal model of substance use onset among south african adolescents. *Substance Use and Misuse*, 44(5), 647-662. doi:10.1080/10826080902810244
- Patton, G. C., Coffey, C., Carlin, J. B., Sawyer, S. M., & Lynskey, M. (2005). Reverse gateways? Frequent cannabis use as a predictor of tobacco initiation and nicotine dependence. *Addiction*, 100(10), 1518-1525. doi:10.1111/j.1360-0443.2005.01220.x
- Patton, G. C., Coffey, C., Carlin, J. B., Sawyer, S. M., & Wakefield, M. (2006). Teen smokers reach their mid twenties. *Journal of Adolescent Health*, 39(2), 214-220. doi:10.1016/j.jadohealth.2005.11.027
- Pedersen, W., Mastekaasa, A., & Wichstrom, L. (2001). Conduct problems and early cannabis initiation: A longitudinal study of gender differences. *Addiction*, 96(3), 415-431. doi:10.1046/j.1360-0443.2001.9634156.x
- Penetar, D. M., Kouri, E. M., Gross, M. M., McCarthy, E. M., Rhee, C. K., Peters, E. N., & Lukas, S. E. (2005). Transdermal nicotine alters some of marihuana's effects in male and female volunteers. *Drug and Alcohol Dependence*, 79(2), 211-223. doi:10.1016/j.drugalcdep.2005.01.008
- Perkins, K. A., Coddington, S. B., Karelitz, J. L., Jetton, C., Scott, J. A., Wilson, A. S., & Lerman, C. (2009). Variability in initial nicotine sensitivity due to sex, history of other drug use, and parental smoking. *Drug and Alcohol Dependence*, 99(1-3), 47-57. doi:10.1016/j.drugalcdep.2008.06.017
- Peters, E. N., & Hughes, J. R. (2010). Daily marijuana users with past alcohol problems increase alcohol consumption during marijuana abstinence. *Drug and Alcohol Dependence*, 106(2-3), 111-118. doi:10.1016/j.drugalcdep.2009.07.027
- Prinstein, M. J., & La Greca, A. M. (2004). Childhood peer rejection and aggression as predictors of adolescent girls' externalizing and health risk behaviors: A 6-year longitudinal study. *Journal of Consulting and Clinical Psychology*, 72(1), 103-112. doi:10.1037/0022-006X.72.1.103

- Ramsey, S. E., Brown R.A., Strong D.R., Stuart, G. L., Weinstock, M. C., & Myers, M. G. (2005). Cigarette smoking and substance use among adolescents in psychiatric treatment. *Journal of Child & Adolescent Substance Abuse*, 14, 1-13. doi:10.1300/J029v14n04_01
- Ream, G. L., Benoit, E., Johnson, B. D., & Dunlap, E. (2008). Smoking tobacco along with marijuana increases symptoms of cannabis dependence. *Drug and Alcohol Dependence*, 95(3), 199-208. doi:10.1016/j.drugalcdep.2008.01.011
- Redzic, A., Licanin, I., & Krosnjarić, S. (2003). Simultaneous abuse of different psychoactive substances among adolescents. *Bosnian Journal of Basic Medical Sciences*, 3(1), 44-48.
- Reid, A., Lynskey, M., & Copeland, J. (2000). Cannabis use among Australian adolescents: Findings of the 1998 national drug strategy household survey. Australian and New Zealand Journal of Public Health, 24 (6), 596-602. doi:10.1111/j.1467-842X.2000.tb00523.x
- Reiman, A. (2009). Cannabis as a substitute for alcohol and other drugs. *Harm Reduction Journal*, 6, 35. doi:10.1186/1477-7517-6-35
- Riehm, K. S., Stephens, R. L., & Schurig, M. L. (2009). Substance use patterns and mental health diagnosis among youth in mental health treatment: A latent class analysis. *Journal of Psychoactive Drugs*, 41(4), 363-368.
- Rigotti, N. A., Lee, J. E., & Wechsler, H. (2000). US college students' use of tobacco products: Results of a national survey. *JAMA: Journal of the American Medical Association*, 284(6), 699-705. doi:10.1001/jama.284.6.699
- Rose, J. S., Herman, D. S., Hagerty, C., Phipps, M. G., Peipert, J. F., & Stein, M. D. (2007). Marijuana use among young women in a primary care setting. *Journal of General Internal Medicine*, 22(6), 826-829. doi:10.1007/s11606-007-0168-6
- Rudatsikira, E., Maposa, D., Mukandavire, Z., Muula, A. S., & Siziya, S. (2009). Prevalence and predictors of illicit drug use among school-going adolescents in Harare, Zimbabwe. *Annals of African Medicine*, 8(4), 215-220. doi:10.4103/1596-3519.59574
- Sartor, C. E., Agrawal, A., Lynskey, M. T., Bucholz, K. K., Madden, P. A., & Heath, A. C. (2009). Common genetic influences on the timing of first use for alcohol, cigarettes, and cannabis in young African-American women. *Drug and Alcohol Dependence*, 102(1-3), 49-55. doi:10.1016/j.drugalcdep.2008.12.013
- Sartor, C. E., Xian, H., Scherrer, J. F., Lynskey, M. T., Duncan, A. E., Haber, J. R., ... Jacob, T. (2008). Psychiatric and familial predictors of transition times between smoking stages: Results from an offspring-of-twins study. *Addictive Behaviors*, 33(2), 235-251.
- Scal, P., Ireland, M., & Borowsky, I. W. (2003). Smoking among American adolescents: A risk and protective factor analysis. *Journal of Community Health: The Publication for Health Promotion and Disease Prevention*, 28(2), 79-97. doi:10.1023/A:1022691212793
- Schmid, B., Hohm, E., Blomeyer, D., Zimmermann, U. S., Schmidt, M. H., Esser, G., & Laucht, M. (2007). Concurrent alcohol and tobacco use during early adolescence characterizes a group at risk. *Alcohol and Alcoholism*, 42(3), 219-225. doi:10.1093/alcalc/agn024
- Sheer, A. J., Gorelick, D. A., Collins, C. C., Schroeder, J. R., Heishman, S. J., Leff, M. K., & Moolchan, E. T. (2009). Interest in marijuana treatment programs among teenage smokers

- and nonsmokers. *Journal of Substance Abuse Treatment*, 37(4), 421-425. doi:10.1016/j.jsat.2009.04.007
- Shelef, K., Diamond, G. S., Diamond, G. M., & Myers, M. G. (2009). Changes in tobacco use among adolescent smokers in substance abuse treatment. *Psychology of Addictive Behaviors*, 23(2), 355-361. doi:10.1037/a0014517
- Siqueira, L. M., & Brook, J. S. (2003). Tobacco use as a predictor of illicit drug use and drug-related problems in colombian youth. *Journal of Adolescent Health*, 32(1), 50-57. doi:10.1016/S1054-139X(02)00534-7
- Smit, F., Monshouwer, K., & Verdurmen, J. (2002). Polydrug use among secondary school students: Combinations, prevalences and risk profiles. *Drugs: Education, Prevention & Policy*, 9(4), 355-365. doi:10.1080/09687630210155313
- Stanton, W. R., Flay, B. R., Colder, C. R., & Mehta, P. (2004). Identifying and predicting adolescent smokers' developmental trajectories. *Nicotine & Tobacco Research*, 6(5), 843-852. doi:10.1080/14622200410001734076
- Stephenson, M. T., & Helme, D. W. (2006). Authoritative parenting and sensation seeking as predictors of adolescent cigarette and marijuana use. *Journal of Drug Education*, 36(3), 247-270. doi:10.2190/Y223-2623-7716-2235
- Stoltz, A. D., & Sanders, B. D. (2000). Cigar and marijuana use: Their relationship in teens. *The Journal of School Nursing*, 16(4), 28-35. doi:10.1177/105984050001600404
- Suris, J. C., Akre, C., Berchtold, A., Jeannin, A., & Michaud, P. A. (2007). Some go without a cigarette: Characteristics of cannabis users who have never smoked tobacco. *Archives of Pediatric and Adolescent Medicine*, 161, 1042-1047.
- Swift, W., Coffey, C., Carlin, J. B., Degenhardt, L., & Patton, G. C. (2008). Adolescent cannabis users at 24 years: Trajectories to regular weekly use and dependence in young adulthood. *Addiction*, 103(8), 1361-1370. doi:10.1111/j.1360-0443.2008.02246.x
- Tang, Z., & Orwin, R. G. (2009). Marijuana initiation among american youth and its risks as dynamic processes: Prospective findings from a national longitudinal study. *Substance Use and Misuse*, 44(2), 195-211. doi:10.1080/10826080802347636
- Taylor, D. R., Poulton, R., Moffitt, T. E., Ramankutty, P., & Sears, M. R. (2000). The respiratory effects of cannabis dependence in young adults. *Addiction*, 95(11), 1669-1677. doi:10.1046/j.1360-0443.2000.951116697.x
- Taylor, D. R., Fergusson, D. M., Milne, B. J., Horwood, L. J., Moffitt, T. E., Sears, M. R., & Poulton, R. (2002). A longitudinal study of the effects of tobacco and cannabis exposure on lung function in young adults. *Addiction*, 97(8), 1055-1061. doi:10.1046/j.1360-0443.2002.00169.x
- Taylor, J., Malone, S., Iacono, W. G., & McGue, M. (2002). Development of substance dependence in two delinquency subgroups and nondelinquents from a male twin sample. *Journal of the American Academy of Child and Adolescent Psychiatry*, 41(4), 386-393. doi:10.1097/00004583-200204000-00010
- Thomson, W. M., Poulton, R., Broadbent, J. M., Moffitt, T. E., Caspi, A., Beck, J. D., et al. (2008). Cannabis smoking and periodontal disease among young adults. *JAMA: Journal of the American Medical Association*, 299(5), 525-531. doi:10.1001/jama.299.5.525

- Timberlake, D. S. (2009). A comparison of drug use and dependence between blunt smokers and other cannabis users. *Substance Use and Misuse*, 44(3), 401-415. doi: 10.1080/10826080802347651
- Timberlake, D. S., Haberstick, B. C., Hopfer, C. J., Bricker, J., Sakai, J. T., Lessem, J. M., & Hewitt, J. K. (2007). Progression from marijuana use to daily smoking and nicotine dependence in a national sample of u.S. Adolescents. *Drug and Alcohol Dependence*, 88(2-3), 272-281. doi:10.1016/j.drugalcdep.2006.11.005
- Trudeau, L., Spoth, R., Randall, G. K., & Azevedo, K. (2007). Longitudinal effects of a universal family-focused intervention on growth patterns of adolescent internalizing symptoms and polysubstance use: Gender comparisons. *Journal of Youth and Adolescence*, 36(6), 725-740. doi:10.1007/s10964-007-9179-1
- Tullis, L. M., DuPont, R., Frost-Pineda, K., & Gold, M. S. (2003). Marijuana and tobacco: A major connection? *Journal of Addictive Diseases*, 22(3), 51-62. doi:10.1300/J069v22n03_05
- Upadhyaya, H. P., Brady, K. T., Wharton, M., & Liao, J. (2003). Psychiatric disorders and cigarette smoking among child and adolescent psychiatry inpatients. *The American Journal on Addictions*, 12(2), 144-152. doi:10.1080/10550490390201407
- Vaughn, M., Wallace, J., Perron, B., Copeland, V., & Howard, M. (2008). Does marijuana use serve as a gateway to cigarette use for high-risk african-american youth? *American Journal of Drug and Alcohol Abuse*, 34(6), 782-791. doi:10.1080/00952990802455477
- Vega, W. A., & Gil, A. G. (2005). Revisiting drug progression: Long-range effects of early tobacco use. *Addiction*, 100(9), 1358-1369. doi:10.1111/j.1360-0443.2005.01141.x
- Victoir, A., Eertmans, A., Van den Bergh, O., & Van den Broucke, S. (2007). Association of substance-use behaviours and their social-cognitive determinants in secondary school students. *Health Education Research*, 22(1), 81-94. doi:10.1093/her/cyl050
- Wade, T. J., & Pevalin, D. J. (2005). Adolescent delinquency and health. *Canadian Journal of Criminology and Criminal Justice*, 47(4), 619-654.
- Wagner, F. A., & Anthony, J. C. (2002). Into the world of illegal drug use: Exposure opportunity and other mechanisms linking the use of alcohol, tobacco, marijuana, and cocaine. *American Journal of Epidemiology*, 155(10), 918-925. doi:10.1093/aje/155.10.918
- Werch, C., Moore, M. J., DiClemente, C. C., Bledsoe, R., & Jobli, E. (2005). A multihealth behavior intervention integrating physical activity and substance use prevention for adolescents. *Prevention Science*, 6(3), 213-226. doi:10.1007/s11121-005-0012-3
- White, H. R., Jarrett, N., Valencia, E. Y., Loeber, R., & Wei, E. (2007). Stages and sequences of initiation and regular substance use in a longitudinal cohort of black and white male adolescents. *Journal of Studies on Alcohol and Drugs*, 68(2), 173-181.
- White, H. R., Violette, N. M., Metzger, L., & Stouthamer-Loeber, M. (2007). Adolescent risk factors for late-onset smoking among african american young men. *Nicotine & Tobacco Research*, 9(1), 153-161. doi:10.1080/14622200601078350
- Wichstrom, T., & Wichstrom, L. (2009). Does sports participation during adolescence prevent later alcohol, tobacco and cannabis use? *Addiction*, 104(1), 138-149. doi:10.1111/j.1360-0443.2008.02422.x

- Wills, T. A., Ainette, M. G., Stoolmiller, M., Gibbons, F. X., & Shinar, O. (2008). Good self-control as a buffering agent for adolescent substance use: An investigation in early adolescence with time-varying covariates. *Psychology of Addictive Behaviors*, 22(4), 459-471. doi:10.1037/a0012965
- Wittchen, H. U., Behrendt, S., Hofler, M., Perkonig, A., Rehm, J., Lieb, R., & Beesdo, K. (2009). A typology of cannabis-related problems among individuals with repeated illegal drug use in the first three decades of life: Evidence for heterogeneity and different treatment needs. *Drug and Alcohol Dependence*, 102(1-3), 151-157. doi:10.1016/j.drugalcdep.2009.02.012
- Young, S. E., Rhee, S. H., Stallings, M. C., Corley, R. P., & Hewitt, J. K. (2006). Genetic and environmental vulnerabilities underlying adolescent substance use and problem use: General or specific? *Behavior Genetics*, 36(4), 603-615. doi:10.1007/s10519-006-9066-7
- Young, V. D., & Harrison, R. (2001). Race/ethnic differences in the sequences of drugs used by women. *Journal of Drug Issues*, 31(2), 293-324.

References

- Abdel-Ghany M, Wang MQ. Contemporaneous and Intertemporal Relationship Between the Consumption of Licit and Illicit Substances by Youth. *Journal of Family and Economic Issues*. 2003; 24(3):281-289.
- Agrawal A, Lynskey MT. Tobacco and cannabis co-occurrence: Does route of administration matter? *Drug and Alcohol Dependence*. 2009; 99(1-3):240-247. [PubMed: 18926646]
- Agrawal A, Lynskey MT, Bucholz KK, Madden PA, Heath AC. Correlates of cannabis initiation in a longitudinal sample of young women: the importance of peer influences. *Prevention Medicine*. 2007; 45:31-34.
- Agrawal A, Madden PAF, Bucholz KK, Heath AC, Lynskey MT. Transitions to regular smoking and to nicotine dependence in women using cannabis. *Drug and Alcohol Dependence*. 2008; 95(1-2): 107-114. [PubMed: 18325694]
- Akre C, Michaud PA, Berchtold A, Suris JC. Cannabis and tobacco use: where are the boundaries? A qualitative study on cannabis consumption modes among adolescents. *Health Education Research*. 2009; 25(1):74-82. [PubMed: 19515745]
- Amos A, Wiltshire S, Bostock Y, Haw S, McNeill A. 'You can't go without a fag . . . you need it for your hash'-a qualitative exploration of smoking, cannabis and young people. *Addiction*. 2004; 99:77-81. [PubMed: 14678065]
- Audrain-McGovern J, Rodriguez D, Patel V, Faith MS, Rodgers K, Cuevas J. How do psychological factors influence adolescent smoking progression? The evidence for indirect effects through tobacco advertising receptivity. *Pediatrics*. 2006a; 117(4):1216-1225. doi:10.1542/peds.2005-0808. [PubMed: 16585318]
- Audrain-McGovern J, Rodriguez D, Wileyto EP, Schmitz KH, Shields PG. Effect of team sport participation on genetic predisposition to adolescent smoking progression. *Archives of General Psychiatry*. 2006b; 63(4):433-441. doi:10.1001/archpsyc.63.4.433. [PubMed: 16585473]
- August GJ, Winters KC, Realmuto GM, Fahnhorst T, Botzet A, Lee S. Prospective Study of Adolescent Drug Use Among Community Samples of ADHD and Non-ADHD Participants. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2006; 45(7):824-832. [PubMed: 16832319]
- Aung AT, Pickworth WB, Moolchan ET. History of marijuana use and tobacco smoking topography in tobacco-dependent adolescents. *Addictive Behaviors*. 2004; 29(4):699-706. doi:10.1016/j.addbeh.2004.02.012. [PubMed: 15135551]
- Barrett SP, Darredeau C, Pihl RO. Patterns of simultaneous polysubstance use in drug using university students. *Human Psychopharmacology: Clinical and Experimental*. 2006; 21(4):255-263. [PubMed: 16783813]

- Baumeister SE, Tossman P. Association between Early Onset of Cigarette, Alcohol and Cannabis Use and Later Drug Use Patterns: An Analysis of a Survey in European Metropolises. *European Addiction Research*. 2005; 11(2):92–98. [PubMed: 15785070]
- Beenstock M, Rahav G. Testing Gateway Theory: do cigarette prices affect illicit drug use? *Journal of Health Economics*. 2002; 21(4):679–698. [PubMed: 12146597]
- Behrendt S, Wittchen HU, Hofler M, Lieb R, Beesdo K. Transitions from first substance use to substance use disorders in adolescence: Is early onset associated with a rapid escalation? *Drug and Alcohol Dependence*. 2009; 99(1-3):68–78. [PubMed: 18768267]
- Bentler, PM.; Newcomb, MD.; Zimmerman, MA. Cigarette use and drug use progression: Growth trajectory and lagged effect hypotheses.. In: Kandel, DB., editor. *Stages and Pathways of Drug Involvement*. Cambridge University Press; Cambridge, UK: 2002. p. 223-253.
- Bonn-Miller MO, Zvolensky MJ, Bernstein A. Marijuana use motives: concurrent relations to frequency of past 30-day use and anxiety sensitivity among young adult marijuana smokers. *Addictive Behaviors*. 2007; 32(1):49–62. doi:10.1016/j.addbeh.2006.03.018. [PubMed: 16647822]
- Boys A, Farrell M, Taylor C, Marsden J, Goodman R, Brugha T, et al. Psychiatric morbidity and substance use in young people aged 13-15 years: Results from the Child and Adolescent Survey of Mental Health. *British Journal of Psychiatry*. 2003; 182(6):509–517. [PubMed: 12777342]
- Brook DW, Brook JS, Zhang C, Cohen P, Whiteman M. Drug use and the risk of major depressive disorder, alcohol dependence and substance use disorders. *Archives of General Psychiatry*. 2002; 59(11):1039–1044. [PubMed: 12418937]
- Brook DW, Saar NS, Brook JS. Earlier violent television exposure and later drug dependence. *The American Journal on Addictions*. 2008; 17(4):271–277. [PubMed: 18612881]
- Brook JS, Ning Y, Brook DW. Personality risk factors associated with trajectories of tobacco use. *American Journal on Addictions*. 2006; 15(6):426–433. doi:10.1080/10550490600996363. [PubMed: 17182444]
- Burke JD, Loeber R, Lahey BB. Which aspects of ADHD are associated with tobacco use in early adolescence? *Journal of Child Psychology and Psychiatry*. 2001; 42(4):493–502. [PubMed: 11383965]
- Burns CB, Ivers RG, Lindorff KJ, Clough AR. Cannabis: a Trojan horse for nicotine? *Australian and New Zealand Journal of Public Health*. 2000; 24(6):637. [PubMed: 11215017]
- Choquet M, Morin D, Hassler C, Ledoux S. Is alcohol, tobacco, and cannabis use as well as polydrug use increasing in France? *Addictive Behaviors*. 2004; 29(3):607–614. [PubMed: 15050678]
- Clough AR. Associations between tobacco and cannabis use in remote indigenous populations in Northern Australia. *Addiction*. 2005; 100(3):346–353. [PubMed: 15733248]
- Coffey C, Carlin JB, Lynskey M, Li N, Patton GC. Adolescent precursors of cannabis dependence: Findings from the Victorian Adolescent Health Cohort Study. *British Journal of Psychiatry*. 2003; 182(4):330–336. [PubMed: 12668409]
- Coffey C, Lynskey M, Wolfe R, Patton GC. Initiation and progression of cannabis use in a population-based Australian adolescent longitudinal study. *Addiction*. 2000; 95(11):1679–1690. [PubMed: 11219371]
- Cooper ZD, Haney M. Comparison of subjective, pharmacokinetic, and physiological effects of marijuana smoked as joints and blunts. *Drug and Alcohol Dependence*. 2009; 103(3):107–113. doi:10.1016/j.drugalcdep.2009.01.023. [PubMed: 19443132]
- Copersino ML, Boyd SJ, Tashkin DP, Huestis MA, Heishman SJ, Dermand JC, et al. Quitting Among Non-Treatment-Seeking Marijuana Users: Reasons and Changes in Other Substance Use. *The American Journal on Addictions*. 2006; 15(4):297–302. [PubMed: 16867925]
- D'Amico EJ, McCarthy DM. Escalation and Initiation of Younger Adolescents' Substance Use: The Impact of Perceived Peer Use. *Journal of Adolescent Health*. 2006; 39(4):481–487. [PubMed: 16982381]
- Dickersin K, Chan S, Chalmers TC, Sacks HS, Smith H. Publication bias and clinical trials. *Control Clin Trials*. 1987; 8(4):343–353. [PubMed: 3442991]
- Dunlap E, Benoit E, Sifaneck SJ, Johnson BD. Social constructions of dependency by blunts smokers: Qualitative reports. *International Journal of Drug Policy*. 2006; 17(3):171–182. [PubMed: 19430592]

- Everett SA, Malarcher AM, Sharp DJ, Husten CG, Giovino GA. Relationship between cigarette, smokeless tobacco, and cigar use, and other health risk behaviors among U.S. high school students. *Journal of School Health*. 2000; 70(6):234–240. [PubMed: 10937370]
- Farrelly MC, Bray JW, Zarkin GA, Wendling BW. The joint demand for cigarettes and marijuana: Evidence from the National Household Surveys on Drug Abuse. *Journal of Health Economics*. 2001; 20:51–68. [PubMed: 11148871]
- Fergusson DM, Horwood LJ. Cannabis use and dependence in a New Zealand birth cohort. *New Zealand Medical Journal*. 2000; 113(1109):156–158. [PubMed: 10894340]
- Fite PJ, Colder CR, Lochman JE, Wells KC. The relation between childhood proactive and reactive aggression and substance use initiation. *Journal of Abnormal Child Psychology*. 2008; 36(2):261–271. [PubMed: 17823863]
- Georgiades K, Boyle MH. Adolescent tobacco and cannabis use: Young adult outcomes from the Ontario Child Health Study. *Journal of Child Psychology and Psychiatry*. 2007; 48(7):724–731. [PubMed: 17593153]
- Gerson M, Allard JL, Towvim LG. Impact of smoke-free residence hall policies: The views of administrators at 3 state universities. *Journal of American College Health*. 2005; 54(3):157–165. [PubMed: 16335315]
- Global Youth Tobacco Survey Collaborative Group. Tobacco use among youth: a cross country comparison. *Tobacco Control*. 2002; 11(3):252–270. [PubMed: 12198280]
- Golub A, Johnson BD, Dunlap E. The growth in marijuana use among American youths during the 1990s and the extent of blunt smoking. *Journal of Ethnicity in Substance Use*. 2005; 4(3-4):1–21. doi:10.1300/J233v04n03_01.
- Green BE, Ritter C. Marijuana use and depression. *Journal of Health and Social Behavior*. 2000; 41(1):40–49. [PubMed: 10750321]
- Griffin KW, Botvin GJ, Scheier LM, Nichols TR. Factors associated with regular marijuana use among high school students: A long-term follow-up study. *Substance Use and Misuse*. 2002; 37(2):225–238. [PubMed: 11863277]
- Guerra LM, Romano PS, Samuels SJ, Kass PH. Ethnic differences in adolescent substance initiation sequences. *Archives of Pediatrics and Adolescent Medicine*. 2000; 154(11):1089–1095. [PubMed: 11074848]
- Guxens, M. n.; Nebot, M.; Ariza, C. Age and sex differences in factors associated with the onset of cannabis use: A cohort study. *Drug and Alcohol Dependence*. 2007; 88(2-3):234–243. [PubMed: 17161922]
- Hahm HC, Wong FY, Huang ZJ, Ozonoff A, Lee J. Substance use among Asian Americans and Pacific Islanders sexual minority adolescents: Findings from the National Longitudinal Study of Adolescent Health. *Journal of Adolescent Health*. 2008; 42(3):275–283. [PubMed: 18295136]
- Hall W, Degenhardt L. Adverse health effects of non-medical cannabis use. *Lancet*. 2009; 374:1383–1391. [PubMed: 19837255]
- Hammersley R, Leon V. Patterns of cannabis use and positive and negative experiences of use amongst university students. *Addiction Research & Theory*. 2006; 14(2):189–205.
- Hashibe M, Straif K, Tashkin DP, Morgenstern H, Greenland S, Zhang Z-F. Epidemiologic review of marijuana use and cancer risk. *Alcohol*. 2005; 35(3):265–275. [PubMed: 16054989]
- Haug NA, Heinberg LJ, Guarda AS. Cigarette smoking and its relationship to other substance use among eating disordered inpatients. *Eating and Weight Disorders*. 2001; 6(3):130–139. [PubMed: 11589415]
- Hayatbakhsh MR, McGee TR, Bor W, Najman JM, Jamrozik K, Mamun AA. Child and adolescent externalizing behavior and cannabis use disorders in early adulthood: an Australian prospective birth cohort study. *Addictive Behaviors*. 2008; 33(3):422–438. doi:10.1016/j.addbeh.2007.10.004. [PubMed: 17996381]
- Heffner JL, DelBello MP, Fleck DE, Anthenelli RM, Strakowski SM. Cigarette smoking in the early course of bipolar disorder: Association with ages-at-onset of alcohol and marijuana use. *Bipolar Disorders*. 2008; 10(7):838–845. [PubMed: 19032716]
- Hight G. The role of cannabis in supporting young people's cigarette smoking: A qualitative exploration. *Health Education Research*. 2004; 19(6):635–643. [PubMed: 15199002]

- Hu M-C, Davies M, Kandel DB. Epidemiology and correlates of daily smoking and nicotine dependence among young adults. *American Journal of Public Health*. 2006; 96(2):299–308. [PubMed: 16380569]
- Kahler CW, Spillane NS, Metrik J. Alcohol use and initial smoking lapses among heavy drinkers in smoking cessation treatment. *Nicotine & Tobacco Research*. 2010; 12(7):781–785. doi:10.1093/ntr/ntq083. [PubMed: 20507898]
- Kandel DB, Yamaguchi K, Chen K. Stages in the progression of drug involvement from adolescence to adulthood: Further evidence for the Gateway Theory. *Journal of Studies on Alcohol*. 1992; 53:447–457. [PubMed: 1405637]
- Kertesz SG, Pletcher MJ, Safford M, Halanych J, Kirk K, Schumacher J, et al. Illicit drug use in young and subsequent decline in general health: The Coronary Artery Risk Development in Young Adults (CARDIA) Study. *Drug and Alcohol Dependence*. 2007; 88(2-3):224–233. [PubMed: 17137732]
- Korhonen T, Huizink AC, Dick DM, Pulkkinen L, Rose RJ, Kaprio J. Role of individual, peer and family factors in the use of cannabis and other illicit drugs: A longitudinal analysis among Finnish adolescent twins. *Drug and Alcohol Dependence*. 2008; 97(1-2):33–43. [PubMed: 18455885]
- Kuperman S, Schlosser SS, Kramer JR, Bucholz K, Hesselbrock V, Reich T, Reich W. Developmental sequence from disruptive behavior diagnosis to adolescent alcohol dependence. *American Journal of Psychiatry*. 2001; 158(12):2022–2026. [PubMed: 11729019]
- Lambert N. The contribution of childhood ADHD, conduct problems, and stimulant treatment to adolescent and adult tobacco and psychoactive substance abuse. *Ethical Human Psychology and Psychiatry: An International Journal of Critical Inquiry*. 2005; 7(3):197–221.
- Lasser K, Boyd JW, Woolhandler S, Himmelstein DU, McCormick D, Bor DH. Smoking and mental illness: A population-based prevalence study. *JAMA: The Journal of the American Medical Association*. 2000; 284(20):2606–2610. [PubMed: 11086367]
- Leatherdale ST, Hammond D, Ahmed R. Alcohol, marijuana, and tobacco use patterns among youth in Canada. *Cancer Causes & Control*. 2008; 19(4):361–369. [PubMed: 18058247]
- Leatherdale ST, Hammond DG, Kaiserman M, Ahmed R. Marijuana and tobacco use among young adults in Canada: are they smoking what we think they are smoking? *Cancer Causes and Control*. 2007; 18(4):391–397. doi:10.1007/s10552-006-0103-x. [PubMed: 17235494]
- Lee JP, Battle RS, Lipton R, Soller B. ‘Smoking’: use of cigarettes, cigars and blunts among Southeast Asian American youth and young adults. *Health Education Research*. 2010; 25(1):83–96. doi: 10.1093/her/cyp066. [PubMed: 19959564]
- Lee Ridner S, Staten RR, Danner FW. Smoking and depressive symptoms in a college population. *Journal of School Nursing*. 2005; 21(4):229–235. [PubMed: 16048368]
- Lenz BK. Correlates of young adult tobacco use: Application of a transition framework. *The Journal of School Nursing*. 2003; 19(4):232–237. [PubMed: 12882607]
- Lenz BK. Tobacco, Depression, and Lifestyle Choices in the Pivotal Early College Years. *Journal of American College Health*. 2004; 52(5):213–219. [PubMed: 15029943]
- Lynskey MT, Heath AC, Bucholz KK, Slutske WS, Madden PA, Nelson EC, et al. Escalation of drug use in early-onset cannabis users vs co-twin controls. *JAMA: The Journal of the American Medical Association*. 2003; 289(4):427–433. [PubMed: 12533121]
- Marcynyszyn LA, Evans GW, Eckenrode J. Family instability during early and middle adolescence. *Journal of Applied Developmental Psychology*. 2008; 29(5):380–392.
- Martens KM, Gilbert DG. Marijuana and tobacco exposure predict affect-regulation expectancies in dual users. *Addictive Behaviors*. 2008; 33(11):1484–1490. [PubMed: 18715720]
- Martin-Soelch C, Kobel M, Stoecklin M, Michael T, Weber S, Krebs B, Opwis K. Reduced response to reward in smokers and cannabis users. *Neuropsychobiology*. 2009; 60(2):94–103. doi: 10.1159/000239685. [PubMed: 19776653]
- McCambridge J, Strang J. The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people: Results from a multi-site cluster randomized trial. *Addiction*. 2004; 99(1):39–52. [PubMed: 14678061]

- McCambridge J, Strang J. Age of First Use and Ongoing Patterns of Legal and Illegal Drug Use in a Sample of Young Londoners. *Substance Use and Misuse*. 2005; 40(3):313–319. [PubMed: 15776979]
- McFall M, Saxon AJ, Malte CA, Chow B, Bailey S, Baker DG, et al. Integrating tobacco cessation into mental health care for posttraumatic stress disorder: a randomized controlled trial. *JAMA: The Journal of the American Medical Association*. 2010; 304(22):2485–2493. doi:10.1001/jama.2010.1769. [PubMed: 21139110]
- Mehra R, Moore BA, Crothers K, Tetraault J, Fiellin DA. The association between marijuana smoking and lung cancer: a systematic review. *Archives of Internal Medicine*. 2006; 166(13):1359–1367. doi:10.1001/archinte.166.13.1359. [PubMed: 16832000]
- Mermelstein R. Teen smoking cessation. *Tobacco Control*. 2003; 12(Suppl 1):i25–34. [PubMed: 12773783]
- Myers MG, MacPherson L. Smoking Cessation Efforts Among Substance Abusing Adolescents. *Drug and Alcohol Dependence*. 2004; 73:209–213. [PubMed: 14725961]
- Myers MG, Prochaska JJ. Does smoking intervention influence adolescent substance use disorder treatment outcomes? *Substance Abuse*. 2008; 29:81–88. [PubMed: 19042327]
- Nelson EC, Heath AC, Lynskey MT, Madden PAF, Martin NG, Statham DJ, Bucholz KK. Childhood sexual abuse and risks for licit and illicit drug-related outcomes: A twin study. *Psychological Medicine*. 2006; 36(10):1473–1483. [PubMed: 16854248]
- Okoli CT, Richardson CG, Ratner PA, Johnson JL. Adolescents' self-defined tobacco use status, marijuana use, and tobacco dependence. *Addictive Behaviors*. 2008; 33(11):1491–1499. [PubMed: 18571870]
- Patton GC, Coffey C, Carlin JB, Sawyer SM, Lynskey M. Reverse gateways? Frequent cannabis use as a predictor of tobacco initiation and nicotine dependence. *Addiction*. 2005; 100(10):1518–1525. [PubMed: 16185213]
- Patton GC, Coffey C, Carlin JB, Wakefield M, Sawyer SM. Teen Smokers Reach Their Mid Twenties. *Journal of Adolescent Health*. 2006; 39(2):214–220. [PubMed: 16857533]
- Pedersen W, Mastekaasa A, Wichstrom L. Conduct problems and early cannabis initiation: A longitudinal study of gender differences. *Addiction*. 2001; 96(3):415–431. [PubMed: 11255582]
- Penetar DM, Kouri EM, Gross MM, McCarthy EM, Rhee CK, Peters EN, Lukas SE. Transdermal nicotine alters some of marijuana's effects in male and female volunteers. *Drug and Alcohol Dependence*. 2005; 79(2):211–223. [PubMed: 16002030]
- Peto, R.; Lopez, AD. Future worldwide health effects of current smoking patterns.. In: Koop, CE.; Pearson, CE.; Schwarz, MR., editors. *Critical Issues in Global Health*. Wiley; San Francisco: 2001. p. 154-161.
- Pokhrel P, Unger JB, Wagner KD, Ritt-Olson A, Sussman S. Effects of parental monitoring, parent-child communication, and parents' expectation of the child's acculturation on the substance use behaviors of urban, Hispanic adolescents. *Journal of Ethnicity in Substance Abuse*. 2008; 7(2): 200–213. [PubMed: 19042806]
- Prochaska JJ, Delucchi K, Hall SM. A Meta-Analysis of Smoking Cessation Interventions With Individuals in Substance Abuse Treatment or Recovery. *Journal of Consulting and Clinical Psychology*. 2004; 72(6):1144–1156. doi:10.1037/0022-006x.72.6.1144. [PubMed: 15612860]
- Ramsey SE, Brown RA, Strong DR, Stuart GL, Weinstock MC, Myers MG. Cigarette smoking and substance use among adolescents in psychiatric treatment. *Journal of Child & Adolescent Substance Abuse*. 2005; 14:1–13.
- Ramsey SE, Brown RA, Strong DR, Sales SD. Cigarette smoking among adolescent psychiatric inpatients: prevalence and correlates. *Annals of Clinical Psychiatry*. 2002; 14:149–153. [PubMed: 12585564]
- Redzic A, Licanin I, Krosnjar S. Simultaneous abuse of different psychoactive substances among adolescents. *Bosnian Journal of Basic Medical Sciences*. 2003; 3(1):44–48. [PubMed: 16209667]
- Richter KP, Kaur H, Resnicow K, Nazir N, Mosier MC, Ahluwalia JS. Cigarette smoking among marijuana users in the United States. *Substance Abuse*. 2004; 25(2):35–43. [PubMed: 15982966]

- Rigotti NA, Lee JE, Wechsler H. US college students' use of tobacco products: results of a national survey. *JAMA: The Journal of the American Medical Association*. 2000; 284(6):699–705. [PubMed: 10927777]
- Roberts RE, Roberts CR, Xing Y. Comorbidity of substance use disorders and other psychiatric disorders among adolescents: evidence from an epidemiologic survey. *Drug and Alcohol Dependence*. 2007; 88(Suppl 1)(1):S4–13. [PubMed: 17275212]
- Rose JS, Herman DS, Hagerty C, Phipps MG, Peipert JF, Stein MD. Marijuana use among young women in a primary care setting. *Journal of General Internal Medicine*. 2007; 22(6):826–829. doi: 10.1007/s11606-007-0168-6. [PubMed: 17372785]
- Rosenthal R. The file drawer problem and tolerance for null results. *Psychological Bulletin*. 1979; 86(3):638–641. doi:10.1037/0033-2909.86.3.638.
- Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. *Medicine & Sciences in Sports & Exercise*. 2000; 32:963–975.
- Scal P, Ireland M, Borowsky IW. Smoking Among American Adolescents: A Risk and Protective Factor Analysis. *Journal of Community Health: The Publication for Health Promotion and Disease Prevention*. 2003; 28(2):79–97.
- Shelef K, Diamond GS, Diamond GM, Myers MG. Changes in tobacco use among adolescent smokers in substance abuse treatment. *Psychology of Addictive Behaviors*. 2009; 23(2):355–361. [PubMed: 19586153]
- Sifanek SJ, Johnson BD, Dunlap E. Cigars-for-blunts: Choice of tobacco products by blunt smokers. *Journal of Ethnicity in Substance Abuse*. 2005; 4(3-4):23–42. [PubMed: 16537327]
- Smit F, Monshouwer K, Verdurmen J. Polydrug use among secondary school students: Combinations, prevalences and risk profiles. *Drugs: Education, Prevention & Policy*. 2002; 9(4):355–365.
- Soldz S, Huyser DJ, Dorsey E. The cigar as a drug delivery device: Youth use of blunts. *Addiction*. 2003; 98(10):1379–1386. [PubMed: 14519174]
- Stanton WR, Flay BR, Colder CR, Mehta P. Identifying and predicting adolescent smokers' developmental trajectories. *Nicotine & Tobacco Research*. 2004; 6(5):843–852. [PubMed: 15700920]
- Stephenson MT, Helme DW. Authoritative Parenting and Sensation Seeking as Predictors of Adolescent Cigarette and Marijuana Use. *Journal of Drug Education*. 2006; 36(3):247–270. [PubMed: 17345917]
- Substance Abuse and Mental Health Services Administration, Office of Applied Studies. Results from the 2008 National Survey on Drug Use and Health: National Findings. Office of Applied Studies; Rockville, MD: 2009. NSDUH Series H-36, HHS Publication No. SMA 09-4434
- Substance Abuse and Mental Health Services Administration, Office of Applied Studies. Results from the 2009 National Survey on Drug Use and Health: Volume I. Summary of National Findings. Office of Applied Studies; Rockville, MD: 2010. NSDUH Series H-38A, HHS Publication No. SMA 10-4586Findings
- Suris JC, Akre C, Berchtold A, Jeannin A, Michaud PA. Some go without a cigarette: Characteristics of cannabis users who have never smoked tobacco. *Archives of Pediatric and Adolescent Medicine*. 2007; 161:1042–1047.
- Swift W, Coffey C, Carlin JB, Degenhardt L, Patton GC. Adolescent cannabis users at 24 years: Trajectories to regular weekly use and dependence in young adulthood. *Addiction*. 2008; 103(8):1361–1370. [PubMed: 18855826]
- Taylor DR, Fergusson DM, Milne BJ, Horwood LJ, Moffitt TE, Sears MR, Poulton R. A longitudinal study of the effects of tobacco and cannabis exposure on lung function in young adults. *Addiction*. 2002; 97(8):1055–1061. doi:10.1046/j.1360-0443.2002.00169.x. [PubMed: 12144608]
- Taylor DR, Poulton R, Moffitt TE, Ramankutty P, Sears MR. The respiratory effects of cannabis dependence in young adults. *Addiction*. 2000; 95(11):1669–1677. doi:10.1046/j.1360-0443.2000.951116697.x. [PubMed: 11219370]
- Thomson WM, Poulton R, Broadbent JM, Moffitt TE, Caspi A, Beck JD, et al. Cannabis smoking and periodontal disease among young adults. *JAMA: Journal of the American Medical Association*. 2008; 299(5):525–531.

- Timberlake DS, Haberstick BC, Hopfer CJ, Bricker J, Sakai JT, Lessem JM, Hewitt JK. Progression from marijuana use to daily smoking and nicotine dependence in a national sample of U.S. adolescents. *Drug and Alcohol Dependence*. 2007; 88(2-3):272–281. doi:10.1016/j.drugalcdep.2006.11.005. [PubMed: 17174040]
- Trudeau L, Spoth R, Randall GK, Azevedo K. Longitudinal effects of a universal family-focused intervention on growth patterns of adolescent internalizing symptoms and polysubstance use: Gender comparisons. *Journal of Youth and Adolescence*. 2007; 36(6):725–740.
- Tullis LM, DuPont R, Frost-Pineda K, Gold MS. Marijuana and Tobacco: A Major Connection? *Journal of Addictive Diseases*. 2003; 22(3):51–62. doi:10.1300/J069v22n03_05. [PubMed: 14621344]
- U.S. Department of Health and Human Services, USDHHS. Preventing tobacco use among young people: a report of the Surgeon General. CDC, Office on Smoking and Health; Atlanta, GA: 1994.
- Upadhyaya HP, Brady KT, Wharton M, Liao J. Psychiatric disorders and cigarette smoking among child and adolescent psychiatry inpatients. *The American Journal on Addictions*. 2003; 12(2): 144–152. [PubMed: 12746089]
- van Ours JC. Cannabis use when it's legal. *Addictive Behaviors*. 2007; 32(7):1441–1450. [PubMed: 17097818]
- Vaughn M, Wallace J, Perron B, Copeland V, Howard M. Does marijuana use serve as a gateway to cigarette use for high-risk African-American youth? *American Journal of Drug and Alcohol Abuse*. 2008; 34(6):782–791. [PubMed: 19016184]
- Victoir A, Eertmans A, Van den Bergh O, Van den Broucke S. Association of substance-use behaviours and their social-cognitive determinants in secondary school students. *Health Education Research*. 2007; 22(1):81–94. [PubMed: 16807377]
- Viveros MP, Marco EM, File SE. Nicotine and cannabinoids: Parallels, contrasts and interactions. *Neuroscience & Biobehavioral Reviews*. 2006; 30(8):1161–1181. [PubMed: 17049986]
- Voisine S, Parsai M, Marsiglia FF, Kulis S, Nieri T. Effects of parental monitoring, permissiveness, and injunctive norms on substance use among Mexican and Mexican American adolescents. *Families in Society*. 2008; 89(2):264–273. [PubMed: 20668660]
- Wade TJ, Pevalin DJ. Adolescent Delinquency and Health. *Canadian Journal of Criminology and Criminal Justice*. 2005; 47(4):619–654.
- Werch C, Moore MJ, DiClemente CC, Bledsoe R, Jobli E. A Multihealth Behavior Intervention Integrating Physical Activity and Substance Use Prevention for Adolescents. *Prevention Science*. 2005; 6(3):213–226. [PubMed: 16133900]
- White HR, Jarrett N, Valencia EY, Loeber R, Wei E. Stages and sequences of initiation and regular substance use in a longitudinal cohort of black and white male adolescents. *Journal of Studies on Alcohol and Drugs*. 2007a; 68(2):173–181. [PubMed: 17286335]
- White HR, Violette NM, Metzger L, Stouthamer-Loeber M. Adolescent risk factors for late-onset smoking among African American young men. *Nicotine & Tobacco Research*. 2007b; 9(1):153–161. [PubMed: 17365746]
- Wittchen HU, Frohlich C, Behrendt S, Gunther A, Rehm J, Zimmermann P, et al. Cannabis use and cannabis use disorders and their relationship to mental disorders: a 10-year prospective-longitudinal community study in adolescents. *Drug and Alcohol Dependence*. 2007; 88(Suppl 1):S60–70. doi:10.1016/j.drugalcdep.2006.12.013. [PubMed: 17257779]
- World Health Organization. WHO Report on the Global Tobacco Epidemic, 2009: Implementing Smoke-free Environments. 2009. Retrieved from World Health Organization website: http://whqlibdoc.who.int/publications/2009/9789241563918_eng_full.pdf

Highlights

- This review examined tobacco and marijuana co-use among youth and young adults.
- Most relationships (85%) between TOB and MJ use were significant.
- Ethnicity, health, and school factors were consistently associated with co-use.
- The only consistent consequence of co-use was exacerbation of psychiatric symptoms.
- Few studies examined prevention or cessation interventions for TOB and MJ co-use.

Table 1

Summary of cross-sectional and longitudinal relationships examining tobacco and marijuana use in 100 studies.

Study Type/Location	Association (n[%])			Total relationships (n)	Total studies (n)
	+	-	0		
Cross-sectional					
Cross-sectional co-use					
US & Canada	56 (86%)	0	9 (14%)	65	40
International	22 (100%)	0	0	22	16
Total cross-sectional co-use	78 (90%)		9 (10%)	87	56
Cross-sectional time course					
TOB precedes MJ					
U.S. & Canada	2 (50%)	0	0	2	2
International	3 (75%)	0	1 (25%)	4	4
Subtotal	5 (83%)	0	1 (17%)	6	6
MJ precedes TOB					
U.S. & Canada	4 (100%)	0	0	4	3
International	1 (100%)	0	0	1	1
Subtotal	5 (100%)	0	0	5	4
Total cross-sectional time course	10 (91%)	0	1 (9%)	11	10
Total cross-sectional	88 (90%)	0	10 (10%)	98	65*
Longitudinal					
Concurrent, Co-use over time					
	2 (50%)	0	2 (50%)	4	3
TOB precedes MJ					
U.S. & Canada	11 (79%)	1 (7%)	2 (14%)	14	10
International	24 (92%)	0	2 (8%)	26	14
Subtotal	35 (80%)	1	4	40	24
MJ precedes TOB					
U.S. & Canada	15 (65%)	1 (4%)	7 (30%)	23	13
International	4 (100%)	0	0	4	2
Subtotal	19 (70%)	1 (4%)	7 (26%)	27	15
Total longitudinal	56 (79%)	1 (1%)	7 (10%)	71	37*

TOB = tobacco; MJ = marijuana

–, negative, +, positive; 0, no relation; ?, indeterminate.

Percentages are summed across rows.

* Some studies were coded to fit in multiple subcategories. Totals reflect the number of unique studies within each major category.

Table 2

Summary of studies examining tobacco and marijuana co-use among mental health populations

Study	Population	Association with Co-Use (Finding)	Summary assoc. (% significant positive assoc.)
Haug et al., 2001	Young adult eating disorder inpatients	+	1/1, 100%
Ramsey et al., 2005 Upadhyaya et al., 2005	Teens in psychiatric treatment	+	2/2, 100%
Kuperman et al., 2001	Teens diagnosed with CD and AD	+	1/1, 100%
August et al., 2006 Burke et al., 2005 Lambert, 2005	Teens diagnosed with ADHD	+	3/3, 100%
August et al., 2006	Teens diagnosed with ODD	+	1/1, 100%
Heffner et al., 2008	Young adults diagnosed with bipolar disorder	+	1/1, 100%
Total			9/9, 100%

CD = Conduct disorder; AD = Alcohol dependence; ADHD = Attention-deficit hyperactivity disorder; ODD = Oppositional defiant disorder

–, negative, +, positive; 0, no relation; ?, indeterminate;

Table 3

Summary of Studies Examining the Predictors/Correlates of Tobacco and Marijuana Co-use

Predictor/Correlate	Study	Association with Co-Use (Finding)	Summary Association	
			Assoc.	% Significant Findings ^b
Genetic/Environmental Contribution to Co-use			—	3/4, 75%
Genetic overlap strongest contributor	Young et al., 2006 Han et al., 1999 Sartor et al., 2009 Neale et al., 2006	+ — — —		
Demographic characteristics				
Sex (male)	Aung et al., 2004 Suris et al., 2007 Victoir et al., 2007 Guxens, et al., 2007 Ohene et al., 2005 Penetar et al., 2005	0 — + + — +	??	3/6, 50%
Age (older)	Aung et al., 2004 Suris et al., 2007 Victoir et al., 2007	0 + +	+	2/3, 66%
Ethnicity (African-American)	Young & Harrison, 2001 Guerra et al., 2000 Aung et al., 2004 Vaughn et al., 2008 White et al., 2007a Vega & Gil, 2005	+ + + + + —	++	5/6, 83%
Mental and physical health			++	10/15, 66%
Sensation-seeking personality characteristics	Stephenson & Helme, 2006	0		
High-intensity pleasure temperament	Creemers et al., 2009	+		
Externalizing symptoms/delinquency	Helstrom, et al., 2004	+		
CD diagnosis	J. Taylor et al., 2002 Korhonen et al. 2010 Ernst et al., 2006 Riehman et al., 2009	+ + + 0		
ADHD diagnosis	Riehman et al., 2009	—		
Anxiety symptoms	Bonn-Miller et al, 2005	+		
Depression symptoms	Bonn-Miller et al, 2005	0		
Mood disorder diagnosis	Riehman et al., 2009	0		
History of being drunk	Suris et al., 2007	+		
Perceived general health	Bonn-Miller et al, 2005	+		
Perceived early pubertal timing	Suris et al., 2007	+		
Self-control	Wills et al., 2008	— ^a		
Parenting characteristics			+	2/2, 100%
Authoritative parenting style	Stephenson & Helme, 2006	— ^a		
Live with both parents	Suris et al., 2007	— ^a		
School characteristics			++	4/4, 100%
Education (vocational)	Victoir et al., 2007	+		
Education (currently enrolled)	Suris et al., 2007	— ^a		

Predictor/Correlate	Study	Association with Co-Use (Finding)	Summary Association	
			Assoc.	% Significant Findings ^b
Good grades	Suris et al., 2007	– ^a		
Participation in high school sports	Wichstrom & Wichstrom, 2009	– ^a		
	Suris et al., 2007	– ^a		
Other environmental characteristics			+	2/2 100%
Childhood sexual abuse	Nelson et al., 2006	+		
Exposure to violent television	Brook et al., 2008	+		

CD = Conduct disorder; ADHD = Attention-deficit hyperactivity disorder

–, negative, +, positive; 0, no relation; ?, indeterminate;

^a Relationship counted as positive in summary association because correlate is protective.

^b Summary association calculated as percentage of significant positive relationships divided by the total number of relationships studied.

Table 4

Summary of Studies Examining Consequences of Tobacco and Marijuana Co-use

Consequence	Study	Association with Co-Use (Finding)	Summary Association	
			Assoc.	% significant relationships ^b
Quit Attempts/Relapse			??	5/12, 42%
Tobacco quit attempt (likelihood)	Aung et al., 2004 Abrantes et al., 2009 Huebner et al., 2005 Ellickson et al., 2001	0 0 – ?		
Need for marijuana treatment programn	Sheer et al., 2009	–		
Willingness to participate in a marijuana treatment program	Sheer et al., 2009	0		
Desire to quit either substance	Amos et al., 2004	?		
Marijuana relapse (liklihood)	de Dios et al., 2009	+		
Substutution of MJ for tobacco	Reiman, 2009	0		
Substitution of tobacco for marijuana	Peters & Hughes, 2010 Shelef et al., 2009	0 –		
Higher breath CO ratings	Moolchan et al., 2005	+		
Risk Behaviors			+	3/3, 100%
Drug driving	Bingham & Shope, 2004	+		
Unsafe sex	Parkes et al., 2007	+		
High school drop-out	McCaffrey et al., 2009	+		
Affective/cognitive			? ^a	3/5, 60%
Positive attitudes towards smoking	Victoir et al., 2007	–		
Marijuana motives	Bonn-Miller et al., 2007	+		
Motivation)	Martin-Soelch et al., 2009	–		
Affect-related effect expectancies	Martens & Gilbert, 2008	0		
Intentions to use either substance	Victoir et al., 2007	0		
Mental health symptoms			++	4/4, 100%
Any Axis I diagnosis (childhood)	Boys et al., 2003	+		
Depressive symptoms	Lee Ridner et al., 2005	+		
Depression diagnosis	Green & Ritter, 2000 Boys et al., 2003	+		
Neurocognitive			+	2/3, 66%
Memory impairment	Jacobsen et al., 2007	+		
Processing speed	Fried et al., 2006	?		
Nicotine reward/reinforcement	Perkins et al., 2009	+		
Health			0	2/8, 25%
Respiratory symptoms/lung function	D. R. Taylor et al., 2000 D. R. Taylor et al., 2002 Hancox et al., 2010	+		
		+		
		0		

Consequence	Study	Association with Co-Use (Finding)	Summary Association	
			Assoc.	% significant relationships ^b
Overall health	Georgiades & Boyle, 2007 Kertesz et al., 2007	0		
		0		
Periodontal disease	Thomson et al., 2008	0		
Lung cancer	Mehra et al., 2006 Hashibe et al., 2005	0		
		?		

–, negative, +, positive; 0, no relation; ?, indeterminate;

^a We coded the Affective/cognitive category as indeterminate due to conflicting results.

^b Percentage of significant relationship were computed as percentage of all significant relationships (both positive and negative) divided by the totally number of relationships studied.

Table 5

Prevention and intervention studies examining tobacco and marijuana co-use

Study	Location	Sample description	Condition	Findings	Coding	Study Finding	Summary Finding
Prevention Studies							
Getson et al., 2005	Montana State University, Bozeman (MSU), Ohio State University (OSU), and University of Rhode Island (URI)	Key informants and archival data	Tobacco-free residence hall policies (no control)	MSU and URI reported decline in tobacco smoking rates among students after policy implementation, improved enforcement of MJ policies at 2 of 3 institutions.	+		+
Trudeau et al., 2007	rural Midwest	383 6 th graders (baseline), followed through 12 th grade	Iowa Strengthening Families Program (universal preventive intervention) vs. minimal contact control	Intervention group showed slower rate of increase in polysubstance use.	+		
Werch et al., 2005	Suburban high school in northeast Florida	232 high school students with past-year alcohol use	Brief, experimental alcohol preventative intervention (Project SPORT) vs. a minimal intervention control (wellness brochure in school, pamphlet mail to the home)	Intervention students experienced less risk for alcohol use and less frequent tobacco, MJ use than controls.	+		
Intervention Studies							
McCambridge & Strang, 2004; McCambridge & Strang, 2005	10 further education colleges (non-traditional schooling) across inner London	200 16-20 year olds with current illegal drug use (	Single session of Motivational Interviewing focusing on alcohol, tobacco, and marijuana use vs. Education-as-usual control	Intervention group reduced their use of cigarettes (ES = .37), alcohol (ES = .34) and cannabis (ES = .75) compared to control group at 3-month follow-up; MI and assessment-only differences gone at 12-month FU. Improvements found in assessment-only group.	+		?