



Review of risk and protective factors of substance use and problem use in emerging adulthood

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ARTICLE INFO

Keywords:

Young adult
Risk factor
Protective factor
Substance use/abuse

ABSTRACT

This review examines the evidence for longitudinal predictors of substance use and abuse in emerging adulthood. Nationally representative data from the 2007 National Survey on Drug use and Health suggest that many substance use problems reach their peak prevalence during emerging adulthood (usually defined as the period from age 18 to age 26). This stage of development is characterized by rapid transitions into new social contexts that involve greater freedom and less social control than experienced during adolescence. Concurrent with this newfound independence is an increase in rates of substance use and abuse. Understanding the risk and protective factors associated with emerging adult substance use problems is an important step in developing interventions targeting those problems. While multiple reviews have examined risk and protective factors for substance use during adolescence, and many of these earlier predictors may predict emerging adult substance use, few studies have focused primarily on the emerging adult outcomes examining predictors from both adolescence and emerging adulthood. This review used the databases PubMed and PsycInfo to identify articles pertaining to longitudinal predictors of substance use problems in emerging adulthood, building from the conceptual framework presented in a review on risk and protective factors for adolescent substance abuse by Hawkins and colleagues (Hawkins, Catalano, & Miller, 1992). Predictors identified as predictors of substance use in adolescence, sometimes decreased in strength and in one case reversed direction. Unique predictors in emerging adulthood were also identified. Implications for prevention science during adolescence and emerging adulthood are discussed as well as suggestions for future research.

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1. Introduction

Prevention science is built on the premise that negative health outcomes can be prevented by reducing risk and enhancing promotive or protective factors in individuals and their environments during the course of development (Coie et al., 1993; Mrazek & Haggerty, 1994; O'Connell, Boat, & Warner, 2009). Over the last 2 decades, the field of adolescent substance abuse prevention has grown dramatically through the identification of longitudinal precursors that predict an increased likelihood of problems (risk factors), those that mediate or moderate exposure to risk (protective factors) (Hawkins, Catalano, & Miller, 1992), or directly have an impact on decreasing the likelihood of problems (promotive factors, Sameroff, 2000). The term “protective factors” will be used in this article to refer to factors that decrease the risk of substance misuse (promotive and protective).

During the adolescent years, many youth experiment with drugs. For instance, 2011 data from the Monitoring the Future study report that one fifth (20%) of 8th graders, and approximately 38% of 10th graders have tried an illicit drug. That number rises to 50% by 12th grade (Johnston, O'Malley, Bachman, & Schulenberg, 2011). Prospective longitudinal studies demonstrate that there are a variety of risk and protective factors for adolescent substance abuse (Beato-Fernandez, Rodriguez-Cano, Belmonte-Llario, & Pelayo-Delgado, 2005; Belcher & Shinitzky, 1998; Beyers, Toumbourou, Catalano, Arthur, & Hawkins, 2004; Branstrom, Sjostrom, & Andreasson, 2008; Challier, Chau, Predine, Choquet, & Legras, 2000; Costa, Jessor, & Turbin, 1999; Donovan 2004; Hawkins, Arthur, & Catalano, 1995; Hawkins et al., 1992; Kandel, Davies, Karus, & Yamaguchi, 1986; Kliwer & Murrelle, 2007; Labouvie & McGee, 1986; Newcomb & Felix-Ortiz, 1992; Oman et al., 2004; Ostaszewski & Zimmerman, 2006; Thompson & Auslander, 2007; White, Pandina, & LaGrange, 1987). Over the past two plus decades this information has been useful to the design and testing of a

number of substance use prevention programs. As a result, there is now a growing evidence base of tested, effective prevention programs and policies to address risk and protection across childhood and adolescence.

1.1. Why is a review of risk and protective factors needed for emerging adulthood?

The trajectories of lifetime prevalence of substance use and misuse peak in young adulthood, to 49% among 19- and 20-year-olds and 72% by age 27 (Johnston, O'Malley, Bachman, & Schulenberg, 2009; SAMHSA Office of Applied Studies, 2009). Data from the Monitoring the Future study indicates that problem levels of alcohol use—daily use, binge drinking, and daily drunkenness—are highest during young adulthood (Johnston, O'Malley, Bachman, & Schulenberg, 2008). Among young adults, substance use has been linked to deaths, injuries, and among college students, academic problems, fighting, and sexual behavior problems. Using a nationally representative cross-sectional survey of college students from a sample of 119 public and private colleges, Wechsler, Lee, Kuo, and Lee (2000) found that frequent binge drinkers were over eight times more likely to get hurt or injured than non-binge drinkers, 17 more times more likely to have missed classes, seven times more likely to have engaged in unplanned sexual activity, and 8 times more likely to have gotten into trouble with campus or local police (Wechsler et al., 2000). Beyond injury, substance use is also associated with mortality among young adults. A recent study examining death rates revealed three quarters of all deaths among 20- to 24-year-olds are the result of that injuries. Poisoning was the third leading cause of injury-related death, behind motor vehicle/traffic-related deaths, and firearm-related deaths, all three of which are often substance involved. For example, of the deaths due to poisoning, the percent attributed to unintentional drug-

related poisoning has increased from 59% in 1999 to 76% in 2005 (Fingerhut & Anderson, 2008).

Not only is emerging adulthood (usually defined as the period from age 18 to age 26) an important developmental period characterized by peak prevalence of substance use problems and problems related to use, it also sets the stage for later adult development (Arnett, 2005; George, 1993; Hogan & Astone, 1986; Shanahan, 2000). Many researchers (e.g., Osgood, Foster, Flanagan, & Ruth, 2004; Schulenberg & Maggs, 2002; Schulenberg, O'Malley, Bachman, & Johnston, 2004; Shanahan, 2000) have identified this stage as a key developmental time period characterized by rapid transitions in social context, contexts that involve greater freedom and less social control than experienced during adolescence. Thus while some of the predictors of adolescent substance use will no doubt still influence emerging adult substance use, the changes in context, experience of greater freedom and less social control during emerging adulthood will undoubtedly become important new predictors of substance use and abuse. By the end of this period many young people begin to accomplish the developmental tasks of emerging adulthood and assume adult roles and responsibilities, including the establishment of strong relationships, marriage and family responsibilities, completion of school, beginning of career employment, and financial responsibility. Successful transition into adult roles is associated with decreasing drug use, and decreasing criminal and antisocial behavior (Schulenberg et al., 2004). However, for some, failing to achieve the developmental tasks of this period is associated with continuing risky sexual activity, acute as well as increasing drug use characterized by misuse, abuse, and dependence, financial instability, failure to establish meaningful relationships, and deteriorating mental health. Successful assumption of adult roles can have long-term implications for positive life trajectories, health, and wellbeing, making understanding of the adolescent and emerging adult predictors of emerging adult substance use and problems an important undertaking in understanding etiology as well as the development of preventive interventions.

Understanding both earlier predictors, as well as emerging adult predictors, will assist in the development of substance abuse prevention programs by increasing our understanding of why some substance abuse prevention programs begun prior to age 18 have had long term effects into young adulthood (e.g., Mason et al., 2009), while others that intend to impact those under 18 as well as those over 18 have only affected those over 18 (e.g., Wagenaar et al., 2000). Further, understanding of the predictors of emerging adult substance use may provide new targets for preventive intervention (Mason et al., 2009).

Finally, there is a growing body of longitudinal research that follows children and adolescents into emerging adulthood as well as longitudinal studies during emerging adulthood. In the early 1990s, Hawkins et al. (1992) conducted a comprehensive review of studies that examined risk and protective factors associated with adolescent substance use. Since that time, much research has focused on the young adult developmental period, providing new information on risk and protective factors associated with problem substance use. The journal *Addiction* (2008: 103 [suppl.1]) recently devoted a supplement to basic research examining adolescent predictors of adult alcohol use. In addition, several reviews have summarized correlates of college student drinking and intervention effectiveness within the college attending population (Baer, 2002; Borsari & Carey, 1999; Brady & Sonne, 1999; Carey, Scott-Sheldon, Carey, & DeMartini, 2007; DeJong, 2002; Ham & Hope, 2003; Hingson & Howland, 2002; Hunter Fager & Mazurek Melnyk, 2004; Larimer & Crouce, 2002; Martens, Dams-O'Connor, & Beck, 2006; Neighbors et al., 2007; Presley, Meilman, & Leichter, 2002; Toomey, Lenk, & Wagenaar, 2007; Walters & Neighbors, 2005). While this is impressive, the majority of young adults are not college students (National Center for Education Statistics (NCES) (NCES) 2007). Finally, as noted by Baer (2002), many studies examining risk factors associated with

young adult outcomes are cross-sectional, limiting our ability to distinguish causal order.

2. Methods

This paper reviews the literature related to risk and protective factors that are specific to young adult alcohol, tobacco, and other drug (ATOD) use and problems, and discusses the utility of analyzing individual risk factors versus risk pathways that address the interplay between multiple factors in influencing outcomes. Our discussion is guided by the MacArthur approach to examining moderators and mediators (Kraemer, Kazdin, Offord, & Kessler, 1997; Kraemer, Kiernan, Essex, & Kupfer, 2008; Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001). Kraemer et al. (2001) advocate for the classification of risk and protective factors into those that are fixed and those that are variable, and emphasize the benefits of examining factors in relation to dichotomized outcomes. When evaluating risk factors, binary outcomes are beneficial because they allow researchers to “evaluate potency in a way that most clearly establishes clinical and policy significance” (Kraemer et al., 2008, page 854). As such, this review will highlight the potency of risk factors in relation to outcomes via reporting on potency when effect sizes (odds ratios (OR)) have been reported.

Literature for this review was identified through PubMed and PsycInfo databases, as well as by searching dissertation abstracts for the past 10 years. Database searches included a variety of combinations of the terms: young adult, emerging adult, college, alcohol, tobacco, nicotine, marijuana, cannabis, drug, substance, risk, abuse, and dependence. When highly relevant articles were identified, the “related articles” links were also explored to further expand our search. Articles were considered for inclusion in this review if they met the following criteria: a) published prior to September 2010, b) included a substance use outcome during the young adult years, defined as between the ages of 18 to 26, c) included a longitudinal study design assessing at least one predictor of young adult substance use outcomes (an exception was made for several cross-sectional articles to address fixed/contextual factors), d) were not articles designed solely to assess intervention or treatment outcomes, e) were not studies designed solely for the purpose of assessing measurement scale/tool formation, and f) were not articles that solely assessed prevalence/incidence of substance use or trajectories without assessment of possible predictors of young adult outcomes. After applying these criteria, the resulting pool of literature specific to predictors of young adult substance involvement consisted of 114 peer-reviewed research articles.

In this article *young adulthood* is defined to include individuals between the ages of 18 and 26 because this grouping encompasses conventions used by nationally recognized data sources such as the 18- to 25-year-old grouping used by the National Survey on Drug Use and Health (SAMHSA Office of Applied Studies, 2008), while expanding slightly to encompass other notable longitudinal studies of young adult substance use (Brook, Balka, Ning, & Brook, 2007; Casswell, Pledger, & Hooper, 2003; Jackson, Sher, & Wood, 2000; Zhou, King, & Chassin, 2006).

This review will be organized into fixed markers of risk (i.e., factors that cannot demonstrate change), and variable risk/protective factors (those that may be manipulated through intervention). Consistent with Hawkins et al.'s (1992) review of risk and protective factors, the variable factors will further be divided into two sections: contextual and interpersonal factors. Contextual factors refer to “broad societal and cultural” factors, while individual factors “lie within individuals and their interpersonal environments” (Hawkins et al., 1992, p. 65).

3. Results

3.1. Fixed markers of risk

Table 1 provides information on the studies that include fixed marker of risk for young adult substance use.

Table 1
Fixed markers of substance use risk.

Risk and/or protective factors	Risk (R) or Protective (P)	Study authors and date	Study population	n =	Predictor age ^a	Young adult age	Location	Substance				Outcome			Findings
								Tobacco	Alcohol	Marijuana	Substance or drug	Use, frequency	Problem, regular or heavy use/binge	“Use” disorder/abuse/dependence	
1. Sex/gender	R	Brook et al., 1999	Community	481	From birth	19–23 24–32	NY			X		X			Young adult males more likely to initiate marijuana use.
	R	Chassin et al., 2002	Child of alcoholic	446	From birth	20	AZ		X		X		X		Males more likely to be alcohol dependent in emerging adulthood.
	R	Flory et al., 2003	Community	481	From birth	19–22	KY		X	X		X			Males had higher alcohol and marijuana use curves (more).
	R	Hicks et al., 2007	Twins	1014	From birth	24	MN	X	X		X				Men had more alcohol and nicotine dependence.
	R	Hussong & Chassin (2004)	Child of alcoholic	340	From birth	18–23	AZ		X		X	X			Heavy drinking in young adulthood associated with being male.
	R	Jackson et al., 2001	College	443	From birth	18,21,24	US Midwest		X				X		Men had more severe initial use status, and had less downward transition.
	R	King & Chassin, 2007	Child of alcoholic	365	From birth	20	AZ				X		X		Being male independently predicted substance dependence.
	R	Maggs et al., 1997	Community	693	From birth	18–20	MI		X	X	X	X			Male gender associated with more drug and alcohol use.
2. Race/ethnicity	R	Poikolainen et al., 2001	Community	611	From birth	20–24	Finland		X				X		Male gender associated with higher alcohol intake.
	R	Steinhausen et al., 2008	Community	593	From birth	20	Switzerland	X	X	X				X	Male gender predicted young adult substance use problems.
		Arria et al., 2008	College	1253	adolescent	18	US		X			X	X		White first year college students more likely to consume alcohol than non-white.
		Gil et al., 2002	Community	643	Adolescent	19–21	FL		X	X				X	Substance use in 8–9th grade more predictive of marijuana use disorder for Caucasian than African Americans.
		Gil et al., 2004	Community male	942	Adolescent	20	FL		X	X	X			X	Non-Hispanic Whites, African American, and Hispanics were more likely to have substance use disorders if transitioned from abstaining to regular use between adolescence and young adulthood.
		Jackson et al., 2005	National	32,087	Adolescent	18–26	US	X	X			X	X		Being in Caucasian or Hispanic race/ethnicity group predicted chronic high drinking more so than chronic high smoking.
		McMorris & Uggen, 2000	Community	780	Young adult	22	MN		X			X	X		After controlling for other variables, White individuals more likely to use alcohol than non-White.
		Merline et al., 2008	Community Cross-sectional	21,137	Adolescent	22, 26	US		X				X		At age 22, Caucasians were more likely than non-White to use alcohol and had higher “heavy drinking” scores after controlling for other variables.
	Scribner et al., 2008	National College students	17,051	Young adult	“College-age”	US		X			X	X		White college students, vs. other race/ethnicity groups, consumed a larger number of drinks per occasion.	

3. Biological indicators	R	Habeych et al., 2005	Son of drug user	233	Child	19	US					X		X	Ages 10–12 P300 auditory wave predicted age 19 substance use disorder.
	R	Hill et al., 2009	Child of drug user	133	Child-adolescent	Mean 23	US					X	X		Below median ages 8–18 P300 auditory wave linked to increased risk of ages 19–29 substance use disorder.
	R	Malone et al., 2004	Twin study												Ages 17–24: “specific genetic variance in alcohol dependence” remained constant. Alcohol dependence and antisociality may share genetic vulnerability.
4. Prenatal and post-natal indicators	R	Schmid et al., 2009	Birth cohort	291	Birth	19	Germany	X	X					X	Early heavy or regular or heavy alcohol use moderates the role of DAT1 gen on young adult alcohol abuse.
		Al Mamun et al., 2006	Birth cohort	3058	In-utero	21	Australia	X					X		Young adults whose moms smoked during pregnancy were more likely to smoke regularly.
	R	Alati et al., 2006	Community	2555	In-utero	21	Australia					X		X	In utero alcohol exposure of 3 + glasses per day associated with young adult alcohol disorder.
		Alati et al., 2009	Birth cohort	2370	Post-natal	21	Australia					X			Babies who were weaned 2-weeks post birth and fed at scheduled times rather than on demand more likely to develop alcohol use disorder by age 21.
	R	Batstra et al., 2004	Community	682	Perinatal	20–26	Netherlands	X	X		X	X			Perinatal obstetric situation (obstetric optimality score (OOS)) predicted young adult substance use.
5. Income/SES	R	Baer et al., 2003	College	433	In-utero	21	WA					X	X	X	Prenatal alcohol exposure associated with age 21 alcohol problems.
	R	Buu et al., 2009	Community	220		18–20	MI	X	X	X				X	Childhood low SES associated with young adult nicotine and marijuana disorder.
	R	Casswell et al., 2003	Birth cohort	969		18, 21, 26	New Zealand					X			Higher income associated with higher drinking frequency (not quantity).
6. Parent education	R	Hayatbakhsh et al., 2006	Birth cohort	3008		21	Australia					X		X	Children who had depressed low income moms at age 5 more likely to use by 21.
	R	McMorris & Uggen, 2000	Community	780		22	MN					X		X	Higher income in young adult-hood associated with more drinking.
	R	Jackson et al., 2000	National	32,087		18–26	US	X	X					X	Low parent education was associated with heavy drinking among smokers.
	R	Maggs et al., 1997	Community	693		18 and 20	MI			X	X	X	X		Those whose mom's had higher education were more likely to use alcohol and drugs.
7. Parental marital status	R	Merline et al., 2008	Community	21,137		22, 26	US					X		X	Having parents level of education positively associated with age 22 heavy drinking.
	R	Hayatbakhsh et al., 2006	Birth cohort	3008	Child-adolescent	21	Australia					X		X	

(continued on next page)

Table 1 (continued)

Risk and/or protective factors	Risk (R) or Protective (P)	Study authors and date	Study population	n =	Predictor age ^a	Young adult age	Location	Substance				Outcome			Findings	
								Tobacco	Alcohol	Marijuana	Substance or drug	Use, frequency	Problem, regular or heavy use/binge	“Use” disorder/abuse/dependence		
8. Family substance history	R	Hope et al., 1998	Birth cohort	9498	Child-adolescent	23, 33	England		X			X	X		Maternal marital status change when child aged 5 and 14 predicted age 21 cannabis use. Link between parent separation and young adult alcohol use weak at age 23, significant at 33. Even moderate maternal drinking when child is at age 14 increased risk of age 21 alcohol disorder. Parent alcohol (AD), marijuana (MD), or nicotine disorder (ND) predicted same disorder in offspring. Parent ND predicted offspring MD. Family history of alcoholism predicted heavy drink/heavy drug use in young adulthood. Especially for females: parent alcoholism predicted bingeing. Offspring with 2 parents with drug use disorders and early onset use and neurobehavioral disinhibition had higher drug use. Family history of alcoholism predicted alcohol use and alcohol problems in young adulthood. Relationship between parent alcoholism and child alcohol problems mediated by adolescent alcohol expectancies. Age 21 marijuana use linked to mom smoking at child age 14 and mom alc use at aged 5 and 14. Part moderated by age 14 tobacco and externalizing.	
	R	Alati et al., 2005	Birth cohort	2551	Adolescent	21	Australia		X				X			
	R	Buu et al., 2009	Community	220	Child	18–20	MI	X	X	X				X		
	R	Chassin et al., 2004	Child of alcoholic	586	Adolescent	20, 25	AZ		X		X	X	X	X		
	R	Chassin et al., 2002	Child of alcoholic	446	Adolescent	20	AZ		X		X		X			
	R	Clark et al., 2005	Child of drug user	560	Child-adolescent	18–21	US	X	X	X	X	X	X	X		
		Early, 2005	Child of alcoholic	196	Adolescent	Mean 21	US		X			X	X			
		Handley & Chassin, 2009														
R	Hayatbakhsh et al., 2007	Birth cohort	3176	Child-adolescent	21	Australia	X	X	X		X					

	R	Hayatbakhsh et al., 2006	Birth cohort	3008	Child-adolescent	21	Australia			X		X			Maternal illicit drug use when child age 5 and 14 predicted young adult cannabis use.
	R	King & Chassin, 2007	Child of alcoholic	586	Adolescent	20, 25	AZ		X		X		X		Parent alcoholism a stable and independent predictor of child alcohol and drug dependence.
	R	Maalouf, 2010	Community	4489	Child-adolescent	Mean 18									Individuals (aged 15–21) whose moms used marijuana when child aged 10–14, more likely to have initiated marijuana use, mediated by poor parenting.
	R	Mezzich et al., 2007	Son of drug users	63	Child-adolescent	19	US				X		X		Mom's drug use disorder predicted son's drug use and nicotine use disorders.
	R	Trim et al., 2006	Child of alcoholic	169	Adolescent	20, 25	AZ		X			X			Young adult alcohol use predicted by older sibling use, especially if siblings close in age.
9. Parent Psychopathology	R	Alati et al., 2005	Birth cohort	2551	Adolescent	21	Australia		X				X		Maternal depression during adolescence increased risk of young adult alcohol disorder.
	R	Buu et al., 2009	Community	220	Child	18–20	MI	X	X	X			X		Parent depression predicted young adult nicotine disorder.
	R	Caywood, 2007	Community	456	Child-adolescent	Young adult	US		X				X		Parental depression predicted higher level of young adult offspring use when childhood behavior problem present.
	R	Chassin et al., 2002	Child of alcoholic	446	Adolescent	20	AZ		X		X		X		Females more so than males, parent antisociality linked to binge alcohol.
	R	King & Chassin, 2004	Child of alcoholic	365	Adolescent	20	AZ				X		X		No link between parent antisociality and young adult substance disorder when control for parent discipline and child behavioral undercontrol.

^a In-utero: exposure during embryonic/fetal development; from birth: biological indicator; present from birth; perinatal: around time of birth; child: birth through age 11; adolescence: ages 12–17 (or 12th grade); young adult: ages 18–26.

3.1.1. Gender

During young adulthood, males are more likely than females to experience substance use and substance use problems (Brook, Kessler, & Cohen, 1999; Flory, Milich, Lynam, Leukefeld, & Clayton, 2003; Jackson, Sher, Gotham, & Wood, 2001; Maggs, Frome, Eccles, & Barber, 1997; Poikolainen, Tuulio-Henriksson, Aalto-Setälä, Marttunen, & Lonnqvist, 2001). According to research by Brook et al. (1999), boys were 1.4 times more likely than girls to initiate marijuana use by young adulthood. Men are also more likely to transition into heavy use (Hussong & Chassin, 2004), and develop substance abuse/dependence (Chassin, Pitts, & Prost, 2002; Hicks et al., 2007; King & Chassin, 2007; Steinhausen, Eschmann, Heimgartner, & Metzke, 2008). Poikolainen and colleagues (Hussong & Chassin, 2004), suggested that male gender increased the odds of young adult heavy alcohol intake by nearly six times over females (OR 5.9, 95% CI 4.1, 8.6), and King and Chassin (2007) found a threefold increase risk of alcohol dependence for young adult men when compared to women (OR 3.03, $p < 0.001$).

3.1.2. Race/ethnicity

A number of studies support an association between race/ethnicity and young adult substance use outcomes. One of the most commonly observed associations is an increased risk of alcohol use or problem use among White young adults (Arria et al., 2008; Gil et al., 2004; McMorris & Uggen, 2000; Merline, Jager, & Schulenberg, 2008; Scribner et al., 2008). In addition to finding increased risk for Caucasians, Gil, Wagner, and Tubman (2004) also found increased risk of experiencing a variety of substance use disorders in young adulthood for other race/ethnicity groups, particularly if they transitioned from abstaining in early adolescence to regular use in young adulthood. For example, while Non-Hispanic Whites were 4.3 times more to experience any substance use disorder if they transitioned from abstaining in early adolescence to regular use in young adulthood (in comparison to abstainers at both time points) (95% CI: 2.0, 9.3), African American respondents experience 6.6 times increased risk (95% CI: 2.5, 17.5), and Hispanics experienced 2.8 times increased risk (95% CI: 1.2, 6.5) (Gil et al., 2004).

The association between variable risk factors and young adult substance use outcomes may also be moderated by race ethnicity. For example, grade 6–7 psychosocial factors (related to well-being and affect) may be more associated with age 21 alcohol dependence among African Americans (OR 3.8, $p < 0.001$) than among European Americans (OR 1.0, p not statistically significant) (Chassin, Forst, & King, 2004; Gil, Vega, & Turner, 2002). Further, Gil et al. (2002) provided evidence that drug models during the 8–9th grade was more predictive of marijuana use disorder among European Americans (OR 2.1, $p < 0.001$), than among African Americans (OR 1.3, p not statistically significant).

3.1.3. Biological indicators

P300 Event-Related Potentials (ERPs) are a biological marker that has been linked to a history of familial alcoholism, and may serve as a predictor of drinking problems for high-risk adolescents and young adults (Courtney & Polich, 2009; Hill, Shen, Lowers, & Locke, 2000). ERPs indicate cognitive reaction time in response to auditory or visual stimulus, and a low ERP is generally indicative of increased risk (Hill et al., 2000). In comparison to young adults who had P300 scores above the median at age 9, those with scores below the median experienced nearly 3 times the risk of developing a substance use disorder by age 23 (OR 2.8, 95% CI: .99, 7.87) (Hill, Steinhauer, Locke-Wellman, & Ulrich, 2009). Further, when adolescent postural sway, an additional risk marker, was included in the model, those with low childhood P300 scores experienced 8 times the risk of developing a young adult substance use disorder (OR 8.08, 95% CI: 1.52, 42.8) (Hill et al., 2009). However Habeych, Charles, Sclabassi, Kirisci, and Tarter (2005) found that while low P300 auditory ERPs

at age 10–12 years were predictive of age 19 substance use disorder, the association was mediated by childhood neurobehavioral disinhibition (ND; incorporated emotion, behavior, and cognition), with associations between ERPs and substance use disorders being more pronounced for those with more severe ND.

Substance dependence has been associated with a number of genetic variations (Kreek, Nielsen, Butelman, & LaForge, 2005). While a number of genetic factors affecting the dopaminergic, serotonergic, gabaergic and other alleles have been implicated, a single allele variation has not been identified to account for individual variation in the risk of substance dependence. However research does support a genetic vulnerability for substance dependence among young adults. Malone, Taylor, Marmorstein, McGue, and Iacono (2004) presented findings from a study that assessed genetic influence on alcohol dependence in a sample of young adult twins. They found that the “specific genetic variance in alcohol dependence symptoms” between ages 17 and 24 remained constant, and there may be shared genetic vulnerability between alcohol dependence and adult antisocial behaviors (Malone et al., 2004). Genetic risk may also interact with other behavioral and social risk factors in imparting risk for young adult substance use. Research by Schmid et al. (2009) suggested that early heavy (or early regular) alcohol use moderated the path between the DAT1 gene and the development of young adult alcohol abuse. There are likely many such interactions between genetics and social risk factors that explain increased risk of developing substance use disorders in young adulthood.

3.1.4. Prenatal and postnatal indicators

Exposure to alcohol and other drugs during pregnancy has been studied extensively in relation to developmental outcomes such as Fetal Alcohol Spectrum Disorders. Although there was much attention and concern in the late 1980s and early 1990s regarding the epidemic of “crack babies,” research has failed to support a robust association between maternal use of cocaine or crack cocaine and developmental problems for children after controlling for other potentially contributing factors (for reviews, see Frank, Augustyn, Grant Knight, Pell, & Zuckerman, 2001; Richardson, Day, & McGauhey, 1993). However, negative young adult substance use outcomes have been reported in relation to parents' use of alcohol and tobacco during pregnancy (Alati et al., 2006; Baer, Sampson, Barr, Connor, & Streissguth, 2003). Prenatal alcohol exposure, particularly if experienced early during pregnancy, has been associated with a 3 fold increased risk of alcohol problems/disorders at age 21 (95% CI: 1.62, 5.36) (Alati et al., 2006; Baer et al., 2003), and young adults whose mothers smoked regularly during pregnancy were more likely to be regular smokers at age 21 (OR range: 1.7–2.5) (Al Mamun et al., 2006).

Other researchers have focused on postnatal infant health and maternal activities in relation to young adult substance use. Using a 74-item scale designed by Touwen et al. (1980) to examine the association between general obstetric neurological optimality and the use of substances during young adulthood, Batstra, Hadders-Algra, Ormel, and Neeleman (2004) found evidence that experiencing a poor prenatal neurological optimality was predictive of substance use during young adulthood. Length of maternal breastfeeding has also been studied in relation to young adult substance use outcomes. Research by Alati, Van Dooren, Najman, Williams, and Clavarino (2009) focused on young adult alcohol use disorders in relation to two methods of breastfeeding: feeding on demand, or weaning after two weeks followed by breastfeeding only at regular intervals. Membership in the early weaning group was associated with 1.7 times greater risk of developing an alcohol use disorder by age 21, even after controlling for child intelligence and developmental disorders (Alati et al., 2009).

3.1.5. Income/socioeconomic status (SES)

Associations between low income and problem behaviors are robust, but evidence specific to substance use in young adulthood is less clear (Hawkins et al., 1992). Buu et al.'s (2009) longitudinal

research suggests that low SES during childhood may increase the risk of nicotine and marijuana disorder during the young adult years. On the other hand, longitudinal studies of community samples in the United States and abroad suggest that higher income is associated with higher young adult drinking frequency (Casswell et al., 2003; McMorris & Uggen, 2000). It may be that income is related to use in a curvilinear pattern, with poverty and higher income associated with higher use and middle income associated with comparatively lower use. Although numerous authors have reported the link between low SES and ATOD use in youth (Brook, Brook, Gordon, Whiteman, & Cohen, 1990; Hawkins et al., 1992), further research is needed to disentangle the relationship between SES and substance use in young adulthood.

3.1.6. Parental education

Research pertaining to associations between parental education and substance use by their offspring during the young adult years is mixed. According to research by Jackson et al. (2000), young adults in a low drinking/chronic smoking trajectory, compared to young adults in a low on both substances trajectory, were more likely to have parents with low education (OR 0.7), whereas young adults in the chronic drinking/low smoking trajectory were more likely to have higher parent education (OR 1.2). Maggs et al. (1997) suggested that young adults whose mothers achieved higher levels of education were more likely to use drugs and alcohol, and Merline et al. (2008) found a positive association between parental education and age 22 heavy drinking. Further longitudinal research is required to better understand the role of parental education on substance use in young adulthood and whether there may be different relationships for different substances.

3.1.7. Parental marital status

Research assessing the association between parental marital status and substance use during the young adult years has been mixed. Hope, Power, and Rodgers (1998) suggested that the association between experiencing a parental divorce and using alcohol was weak for young adults (age 23), but was significant later in adulthood (age 33). Hayatbakhsh et al. (2006) found that children whose mothers were in a de facto relationship rather than married at age 5 were 1.5 times more likely to have used cannabis by young adulthood, and offspring who experienced three or more changes in maternal marital status between the ages of 5 and 14 were at 3.5 times more likely to have used cannabis by age 21 than those whose mother's marital status remained stable.

3.1.8. Family substance use history

There is substantial evidence that individuals who are children of alcoholics are at an increased risk of heavy alcohol use, binge drinking (Chassin et al., 2002, 2004), or having an alcohol use disorder during their young adult years (Alati et al., 2005; King & Chassin, 2007). Using data from a study of children of alcoholics, Chassin et al. (2004) found that children of alcoholics were over two times more likely to be in the "heavy drinking/heavy drug use" trajectory from adolescence into young adulthood than in the "moderate drinking/experimental drug use" group (OR 2.24, $p < 0.01$), and three times more likely to be in the heavy use trajectory than the "light drinking/rare drug use" group (OR 3.1, $p < 0.01$). Focusing on the outcome of alcohol abuse and dependence rather than trajectory groups, Alati et al. (2005) found a twofold risk of a young adult alcohol use disorder when comparing individuals whose moms drank daily when the child was 14, compared to those whose moms were abstainers (OR 1.8 and 1.9 for women and men respectively). King and Chassin (2007) likewise found that parent alcoholism increased the risk of young adult alcohol dependence nearly twofold (OR 1.9, $p < 0.05$).

Maternal tobacco smoking, alcohol use, and illegal drug use have also been linked to young adult marijuana and other illegal drug use

disorders (Buu et al., 2009; Hayatbakhsh et al., 2006, 2007; Maalouf, 2010; Mezzich et al., 2007). Hayatbakhsh et al. (2007) found evidence that maternal cigarette smoking when the child was age 5 and/or age 14, increased the risk of young adult occasional marijuana use (OR range 1.3–1.6) and if the mother smoked when the child was at ages 5 and 14, the child was at 1.7 times the risk of being classified as a young adult frequent marijuana user (95% CI: 1.3, 2.3). The association between maternal drinking and young adult marijuana use was only statistically significant when assessing maternal drinking when the child was at age 14 (OR 1.4, 95% CI: 1.0–1.9 for young adult occasional marijuana use, and OR 1.5, 95% CI: 1.0, 2.3 for frequent marijuana use) (Hayatbakhsh et al., 2007). The association between parental and young adult substance use may be compounded if both parents experience substance use disorders and the young adult experiences both early substance use as well as neurobehavioral disinhibition (Clark, Cornelius, Kirisci, & Tarter, 2005).

While the association between parent substance use and subsequent substance use by their offspring during the young adult years is robust, recent research emphasizes the importance of examining potential mediators of this relationship. For example, the relationship between parent alcoholism and subsequent offspring alcohol problems may be mediated by other child variables such as sensation seeking (Early, 2005) or adolescent alcohol expectancies (Handley & Chassin, 2009). Further, Maalouf (2010) provides support for the mediational role of parenting practices when examining the path from maternal marijuana use to offspring marijuana initiation.

Siblings of young adults may also play a role in influencing young adult alcohol use behaviors. Trim, Leuthe, and Chassin (2006) found that alcohol use in young adulthood (mean age 25) was predicted by an older sibling's use when they were in emerging adulthood. This was particularly true when the siblings were close in age.

3.1.9. Parental psychopathology

Chassin et al. (2002) noted that the association between parent antisocial personality and offspring binge drinking at age 20 is stronger for female young adults than for males. This association was reduced when controlling for the interaction between offspring behavioral undercontrol and parenting practices (OR prior to control for interaction 3.2, after control for interaction 1.8–2.4) (King & Chassin, 2004).

Buu et al. (2009) found that parental depression is predictive of young adult nicotine use disorders. Similarly, Alati et al. (2005) found a link between maternal depression during an offspring's adolescent years and increased risk of experiencing an alcohol use disorder during young adulthood (OR 1.37 for males, not statistically significant for females). However the association between parental depression and young adult substance use may be stronger in certain subpopulations. Dissertation research by Caywood (2007) suggested that parental depression predicts greater offspring alcohol use only among subpopulation of youth experiencing childhood behavioral problems. Further research is necessary to explore other such moderating effects.

3.1.10. Neighborhood instability

Hawkins et al.'s (1992) review also included a contextual factor called "neighborhood disorganization" as a risk factor for substance use. The reviewed research linked neighborhood factors such as population density, physical neighborhood deterioration, and low attachment to neighborhoods to juvenile crime and illegal drug trafficking (Fagan, 1988; Hawkins et al., 1992; Herting & Guest, 1985; Murray, 1983; Wilson & Herrnstein, 1985). While neighborhood disadvantage has also been linked to adverse adult substance use outcomes such as death due to drug use (Hannon & Cuddy, 2006), few studies have focused on young adult substance use outcomes specifically. Buu et al. (2009) provided an exception by examining the link between neighborhood disorganization and young adult substance use problems. Their research suggests that childhood neighborhood

instability may pose a risk for young adult alcohol, nicotine, and marijuana use disorders.

3.2. Contextual risk factors

Society and culture play a crucial role in influencing the use of substances. Substance use is regulated both through formal mechanisms, such as price controls, taxation, access laws, or marketing, and through informal mechanisms such as social norms. Contextual factors are external to individuals, therefore many of the studies that examine contextual changes used repeat measure cross-sectional data related to the constructs of interest (e.g., changes in the level of tobacco tax, or in the minimum legal drinking age), rather than longitudinally following individuals. For this reason, several studies that use cross-sectional data were utilized in the contextual factor sections. Table 2 provides information regarding studies that assessed contextual factors in relation to young adult substance involvement.

3.2.1. Social norms

Perceived drinking norms may be a risk factor for drinking behaviors, but the research is inconsistent. Research by Perkins, Haines, and Rice (2005) examined the odds of negative drinking behaviors on campus in relation to information being provided to students about drinking on campus, and whether or not there are misconceptions about drinking on campus. The research provided evidence that when information contributes to greater misconceptions about student drinking, there is an increased risk in engaging in deleterious drinking behaviors (OR range 1.32–1.55). In a cross-sectional study of college freshman (mean age 18), perceived peer drinking norms were positively correlated with both alcohol consumption and alcohol problems, particularly for male participants (Read, Wood, Davidoff, McLacken, & Campbell, 2002). A separate cross-sectional study involving college students (mean age 20.6) failed to find an association between peer drinking norms and alcohol use behaviors once controlling for age at first use (Weintraub Austin & Chen, 2003).

Many college campuses have adopted social norms marketing campaigns aimed at decreasing inflated beliefs regarding what is “normal” drinking behavior. However a review assessing the efficacy of social norms marketing failed to find consistent positive results (Wechsler et al., 2003). Wechsler and Kuo (2000) suggested that the lack of consistent positive outcomes may be due to the fact that an individual's drinking behavior is more closely related to the behaviors of a close peer group than to college-wide norms (Wechsler et al., 2003).

3.2.2. Laws and taxation

State-level alcohol control policies include lowering the acceptable driving blood alcohol level to under 0.08%, placing restrictions on “happy hours,” and restricting the sale of beer in pitchers. These laws have been associated with lower levels of binge drinking by college students. A nearly 40% decreased risk of binge drinking in college was associated with going to college in a state with low levels of overall binge drinking (OR 0.63, 95% CI: 0.41, 0.97), or with going to college in a state with stricter alcohol control policies (OR 0.57, 95% CI: 0.33, 0.97). However, findings from a nationally representative cross-sectional study of college students suggest that while strict drinking and driving policies predicted lower drinking and binge drinking among male participants, strict laws were not predictive of decreased binge drinking among females (Chaloupka & Wechsler, 1996).

Coate and Grossman (1988) found that the frequency of drinking beer is inversely associated with the minimum legal drinking age (MLDA). Research by Voas, Tippetts, and Fell (2003) attributed an 18.9% decrease in the number of fatal motor vehicle crashes between 1982 and 1997 to age 21 MLDA laws, and a 24.4% reduction attributable to zero-tolerance laws that accompany age 21 MLDA laws. Wagenaar and Toomey (2002) published a comprehensive review of research relating to the changes in MLDA laws during the 1970s and 1980s. Their

summary suggested that raising the MLDA to 21 has coincided with an overall decrease in negative outcomes for young people (Wagenaar & Toomey, 2002).

Studies that assess the association between pricing and alcohol consumption show that effects may differ for men and women. Using repeated cross-sectional data assessing changes in taxation and drinking from 1976 to 1980, Coate and Grossman (1988) concluded that taxation may be more potent than drinking age policy in reducing alcohol consumption among 16- to 21-year-olds. However, using cross-sectional research from the 1993 Harvard College Alcohol Study in conjunction with alcohol pricing data, Chaloupka and Wechsler (1996) suggested that higher beer pricing is correlated with less underage drinking and binge drinking among female college students but not among males. Wagenaar, Salois, and Komro's (2009) meta-analyses examining 112 studies indicated a significant negative relationship between alcohol tax or price and indices of sales or consumption. This was also true, to a lesser extent with regard to heavy drinking (Wagenaar et al., 2009).

The relationship between pricing/taxation and young adult alcohol and tobacco use may not apply to all groups equally. For tobacco use, Tauras (2005) suggested that increased tobacco pricing is associated with decreases in the escalation of tobacco use, and increases in tobacco cessation among young adults. Paradoxically, repeated measures cross-sectional data from a nationally representative sample of U.S. residents age 18 and older suggests that increased cigarette cost may be correlated with decreases in use only among higher income individuals and not among lower income adults (Franks et al., 2007).

3.2.3. Availability

A number of studies have used the number of liquor retailers within a predefined area (the area's liquor outlet density) to infer availability for liquor purchases in that area. Liquor outlet density has been an important area of study for some researchers, but we found no longitudinal study that assessed changes in density in relation to changes in drinking behaviors of young adults. Cross-sectional research supports a correlation between higher density of alcohol outlets within a close radius of college campuses and a number of problem-drinking indicators, including frequent drinking, frequent drunkenness, more drinks per drinking occasion, and heavy drinking (Scribner et al., 2008; Weitzman, Folkman, Folkman, & Wechsler, 2003). There is a lack of research assessing these correlations in non-college attending populations.

3.3. Individual and interpersonal risk and protective factors

Table 3 presents data regarding studies that have assessed the association between individual and interpersonal risk factors in relation to youth adult substance involvement.

3.3.1. History of abuse/neglect

Individuals who experience abuse or maltreatment in childhood are at an increased risk of experiencing negative young adult outcomes, including psychopathology (van der Vegt, van der Ende, Ferdinand, Verhulst, & Tiemeier, 2009), perpetration of intimate partner violence (Fang & Corso, 2007), and substance use (for a review, see Simpson & Miller, 2002). However, few studies have focused solely on the young adult years. Results of a study focusing on sons of alcoholics suggest that paternal, but not maternal, neglect was associated with an increased risk of the sons developing a substance use disorder by early adulthood (Tarter, Kirisci, Habeych, Reynolds, & Vanyukov, 2004). Al Mamun et al. (2007) reported that sexual abuse prior to age 16 (by individuals at least 5 years older than the victim) was associated with a 2 to 3 fold increased risk of nicotine dependence during young adulthood.

3.3.2. Family relations

Family relations may be examined by assessing either conflict or connectedness in relation to young adult substance use outcomes.

Table 2
Contextual variable markers of substance use risk.

Risk and/or protective factors	Risk (R) or protective (P)	Study authors and date	Study population	n =	Predictor age ^a	Young adult age	Location	Substance				Outcome			Findings
								Tobacco	Alcohol	Marijuana	Substance or drug	Use, frequency	Problem, regular or heavy use/ binge	"Use" disorder/ abuse/ dependence	
1. Social norms	R	Perkins et al., 2005	Cross-sectional College students	76,145		College	US		X						Students overestimate "normal" peer use. Perceived college drinking predicts better than actual campus norms. In males more so than females, perceived norms associated with alcohol use/ problems. Positive advertising predicts norms, but norms did not predict alcohol behavior once controlling for age at first use. Strong drink and drive policies predicted lower male drinking and bingeing, not female bingeing. Beer prices did not predict male drinking, but predicted less female under-age drink and binge. Beer use frequency inversely related to Minimum Legal Drinking Age. Beer use frequency inversely related to price. Tax may be more potent predictor than MLDA. Increased cigarettes price linked to lower rates of smoking among high (but not low) income. At state-level, strict alcohol control policies associated with less student bingeing.
	R	Read et al., 2002	Cross-sectional College students	311		Mean 18 Freshmen	US		X		X	X			
	R	Weintraub Austin & Chen, 2003	Cross-sectional College students	300		18-33 mean: 21	WA?		X				X		
2. Laws and taxation	P	Chaloupka & Wechsler, 1996	Cross-sectional College students	16,277		83% <24	US		X		X	X			
	P	Coate & Grossman, 1988	Cross-sectional National	1761		16-21	US		X		X				
	P	Franks et al., 2007	Cross-sectional Community	2.5 mil		18+	US								
	P	Nelson, Naimi, Brewer, & Wechsler, 2005	2 Cross-sectional National	22,453 31,042		College and 18-24	US		X			X			
	P	Tauras 2005	Longitudinal National	44,985		MTF young adult	US	X			X				
	P	Voas et al., 2003	Cross-sectional National	State-level		16-21	US		X		X				
3. Availability	R	Scribner et al., 2008	Cross-sectional National College students	17,051		"College-age"	US		X		X	X		Higher alcohol outlet density in a close radius of college campus correlated with drinks per drinking occasion, frequency of drunkenness, 30 day use, and most drinks on an occasion. Alcohol outlet density was positively correlated with heavy drinking, frequency of drinking, and problem drinking.	
	R	Weitzman et al., 2003	Cross-sectional College students	3421		College-age	US		X		X	X			

^a In-utero: exposure during embryonic/fetal development; from birth: biological indicator; present from birth; perinatal: around time of birth; child: birth through age 11; adolescence: ages 12-17 (or 12th grade); young adult: ages 18-26.

Table 3
Individual variable markers of substance use risk.

Risk and/or protective factors	Risk (R) or protective (P)	Study authors and date	Study population	n =	Predictor age ^a	Young adult age	Location	Substance				Outcome			Findings
								Tobacco	Alcohol	Marijuana	Substance or drug	Use, frequency	Problem, Regular or heavy use/binge	"Use" disorder/abuse/dependence	
1. Family relations	R	Engels et al., 2005	Community	301	Adolescent	22	Netherlands	X				X		Women: combo of low parent affection and low parent control predicted problem drinking.	
	P	King & Chassin, 2004	Child of alcoholic	365	Adolescent	20	AZ				X		X	Parent support protective of drug use disorder for young adults who had teen behavioral under-control.	
	P	Locke & Newcomb, 2004	Community	305	Adolescent	25–27	CA	X				X		Women: Good age 17–18 family bond predicted lower young adult alcohol use.	
	P	Maggs et al., 1997	Community	693	Adolescent	18 and 20	MI	X	X	X	X	X		Parental support reduced the risk of young adult drug use for adolescent drug users.	
	P	Morojele & Brook, 2001	Community	686	Adolescent	22	NY	X	X	X	X	X	X	Parent–adolescent relationship moderated the teen personality–early adult drug initiation link.	
	R	Trim et al., 2006	Child of alcoholic	169	Young adult	20, 25	AZ	X				X		Family conflict moderated association between young adult alcohol use and older sibling alc use.	
	R/P	Zhou et al., 2006	Child of alcoholic	678	Adolescent	21, 26	AZ	X			X		X	Family harmony protective of adult alcohol and drug disorder. Moderator: family history AUD.	
2. Family management (monitoring, rewards, etc.)	P	Arria et al., 2008	College	1253	Adolescent	18	US	X				X	X	Teen parent monitoring inversely predicted college alcohol use. Mediated by teen alc use.	
	R	Engels et al., 2005	Community	301	Adolescent	22	Netherlands	X					X	Women: Poor family function predicted age 22 alc problem use. Men: family function moderated child aggression–problem drinking association.	
		Ghandour 2009	Birth Cohort	1012	Child	18–22	US	X				X	X	Males: parent monitoring (PM) predicted young adult problem drinking. Females: PM predicts less binge, but not significant.	
	P	Guo et al., 2001	Community	808	Child	21	WA	X					X	Age 10 parent monitoring and rules linked to less risk of later alcohol abuse and dependence. Low risk of dependence/abuse predicted by appropriate age 10 parental rewards.	
	P	King & Chassin, 2004	Child of alcoholic	365	Adolescent	20	AZ				X		X	Parent discipline mediated parent alcoholism – young adult drug use disorder association.	

3. Individual psychopathology	P	Roche et al., 2008	National	1569	Adolescent	19–21	US						X						Males: Parental behavioral control linked to less problem drinking in young adulthood.
	P	White et al., 2006	Community	319	Adolescent	18.7	US Northwest						X	X					Increased risk of alcohol use associated with leaving the parents' home moderated by grade 12 parent monitoring.
	R	Barkley et al., 2004	Community	220	Child–adolescent	19–25	US					X	X	X					Child hyperactivity linked to young adult alcohol/drug problems only if co-occur CD.
		Bor et al., 2010	Birth Cohort	3173	Child	21	Australia	X	X	X					X				Adolescent, and life course persistent antisocial behavior (not child limited) predicted young adult cannabis use.
	R	Brook et al., 1999	Community	481	Adolescent	19–23, 24–32	NY							X					“Unconventional” youth (rebellious, sensation-seeking) more likely to initiate marijuana use by young adult.
	R	Brook et al., 2006	Non-White	451	Child	19–23	NY	X											Early start continuous tobacco path more likely to have age 1–10 externalizing problems and to have age 1–10 internalizing problems.
	R	Chassin et al., 2004	Child of alcoholic	586	Adolescent	20, 25	AZ					X		X					Trajectory of heavy drinking/heavy drug use associated with adolescent “negative emotions”.
	R	Clark et al., 2005	Child of drug user	560	Child–adolescent	18–21	US	X	X	X		X		X					Higher drug use in offspring with combo of 2 parents with substance use disorders and early onset use and neurobehavioral disinhibition.
	R	Cloninger et al., 1988	Adoption register	431	Child	27	Sweden					X							Age 11 personality deviations predicted young adult alcohol abuse, as did child novelty seeking. Young adult alcohol abuse also linked to low youth harm avoidance.
	R	Copeland et al., 2009	Community	1761	Child–adolescent	19–21	NC							X					Ages 9–12 Conduct Disorder predicted age 19 substance use disorder, but not after controlling for other child psychiatric issues.
	Early 2005	Child of alcoholic	196	Adolescent	Mean 21	US					X			X				Sensation seeking during adolescent predicted use.	
R	Engels et al., 2005	Community	301	Adolescent	22	Netherlands							X					Interaction with social support, and sensation seeking mediated family history, alcohol problem relationship.	
R	Ferdinand et al., 2001	Community	487	Child–adolescent	18–24	Netherlands	X	X			X		X					Men: Strong link between youth aggression and young adulthood problem drinking. Youth's internal thought problems and “delinquency problems” predicted alcohol use.	

Table 3 (continued)

Risk and/or protective factors	Risk (R) or protective (P)	Study authors and date	Study population	n =	Predictor age ^a	Young adult age	Location	Substance				Outcome			Findings
								Tobacco	Alcohol	Marijuana	Substance or drug	Use, frequency	Problem, Regular or heavy use/binge	"Use" disorder/abuse/dependence	
	R	Flory et al., 2003	Community	481	Adolescent	19–21	KY	X	X	X	X	X		X	Youth with co-occurring conduct problems and hyper-activity/impulsivity at increased risk of problem young adult use.
	R	Gil et al., 2002	Community	643	Adolescent	19–21	FL		X	X				X	African American: Teen negative affect linked to later alcohol disorder.
	R	Guo et al., 2001	Community	808	Child	21	WA		X					X	Alcohol dependence and abuse predicted by problem behavior and antisocial acts at age 10. Antisocial/rebellious youth more likely to use cocaine in young adulthood (18–25 peak).
	R	Hamil-Luker et al., 2004	National	2509	Adolescent	19–35	US				X	X			
	R	Hayatbakhsh et al., 2008	Birth cohort	2225	Child-adolescent	21	Australia			X		X			Externalizing at age 5+, age 14, or age 14 alone predicted age 21 cannabis use disorder. Part mediated by age 14 tobacco and alcohol use.
	R	Hussong & Chassin, 2004	Child of alcoholic	340	Adolescent	18–23	AZ		X		X	X	X		Low youth planning and coping predicted young adult drug use.
	R	Jackson et al., 2005	National	32,087	Adolescent	18–26	US	X	X			X	X		Grade 12 delinquency linked to heavy drinking and comorbid drinking/smoking trajectory.
	R	Maggs et al., 2008	Community	16,009	Adolescent	23	UK		X			X			Boys: age 16 truancy predicted higher age 23 drink quantity.
	R	Maggs et al., 1997	Community	693	Adolescent	Mean 20	MI		X	X	X	X			Low adolescent well being predicted drug use.
	R	Maggs et al., 2008	Community	16,009	Child	23	UK		X			X			Age 7 internalizing negatively predicted age 23 drink quantity.
	R	Marmorstein 2009	Community	20,728	Adolescent	Mean 22	US		X				X		Higher adolescent depressive symptoms associated with higher alcohol problems (espec. female), and faster increase in problems among males (espec. those with high initial sympt).
	R	Marmorstein et al., 2010	Community Twin Study	1252	Adolescent	20, 24	US	X			X			X	Adolescent major depressive disorder did not predict young adult drug and alcohol dependence.
	R	Merline et al., 2008	Community	21,137	Adolescent	22, 26	US		X				X		12th grade risk taking predicted age 22 and 26 heavy drinking.

	R	Morojele & Brook, 2001	Community	686	Adolescent	22	NY	X	X	X	X	X		Adolescent deviance associated with young adult initiation. Parent–youth relations offset the association between youth personality and adult drug use.
	R	Pitkanen, 1999	Community	651	Adolescent	Mean 22	Finland		X			X	X	Teen low well-being linked to young adult problem drinking.
	R	Steele et al., 1995	Community	187	Adolescent	17.8–22.4	US		X	X	X	X		High adolescent externalizing predicted more young adult alcohol use and more male marijuana and other drug use.
	R	Steinhausen et al., 2008	Community	593	Adolescent	Mean 20.2	Switzerland		X				X	Heavy/problem young adult drinking linked to teen externalizing (poor attention, aggressive, etc.).
	R	Steinhausen et al., 2007	Community	593	Adolescent	Mean 20.2	Switzerland	X	X	X			X	Youth externalizing predicted young adult problem substance use.
	R	Tarter et al., 2004	Son of alcoholic	236	Child–adolescent	19	Australia				X		X	Neurobehavioral disinhibition part mediated the link between parent SUD and offspring SUD.
	R	Vida et al., 2009	Community	219	Young adult	25	Canada		X	X	X		X	Age 19 anxious drinkers had higher age 25 drinking than those with age 19 solo disorder.
	P	White et al., 2006	Community	319	Adolescent	18.7	US Northwest		X	X			X	Low sensation seeking offset link between leaving parents' house and heavy alcohol use.
	R	Windle et al., 2005	Community	760	Adolescent–young adult	16–25	NY		X	X			X	High male heavy drinking paths linked with being less task oriented.
	R	Wiesner et al., 2005	High Risk, Males	204	Adolescent–young adult	23–26	OR		X	X	X		X	Poor adolescent to young adult offending path predicted young adult alcohol and drug use.
	R	Yamaguchi & Kandel, 1984	Community	1325	Child	Mean 25	NY	X	X	X	X	X		Child (ages 10–11) depressive symptoms predicted initiation of prescribed drugs by young adults (perhaps on Dr.'s orders).
4. Adolescent substance use	R	Bachman et al., 1984	National	8284	Adolescent	18–21	US	X	X	X	X	X		Grade 12 drug use predicted young adult use.
	R	Brook et al., 2007	Non-white	475	Adolescent	19, 24, 26	NY	X	X		X		X	Early start continuous tobacco smokers more likely to be alcohol and/or drug dependent young adult.
	R	Bachman et al., 1984	National	8284	Adolescent	18–21	US	X	X	X	X	X		Grade 12 drug use predicted young adult use.
	R	Brook et al., 2007	Non-white	475	Adolescent	19, 24, 26	NY	X	X		X		X	Early start continuous tobacco smokers more likely to be alcohol and/or drug dependent young adult.
	R	Brook et al., 1999	Community	481	Adolescent	19–23, 24–32	NY			X			X	Youth who smoke tobacco were more likely to initiate marijuana use by young adult.

Table 3 (continued)

Risk and/or protective factors	Risk (R) or protective (P)	Study authors and date	Study population	n =	Predictor age ^a	Young adult age	Location	Substance				Outcome			Findings
								Tobacco	Alcohol	Marijuana	Substance or drug	Use, frequency	Problem, Regular or heavy use/binge	“Use” disorder/abuse/dependence	
	R	King & Chassin, 2007	Child of alcoholic	586	Adolescent	20, 25	AZ		X		X			X	Early onset drug use steady predictor of young adult alcohol and drug dependence.
	R	Lessem et al., 2006	National	18,286	Adolescent	Mean 22	US			X	X	X			Youth marijuana user more likely to use illegal drugs when young adult.
	R	Morojele & Brook, 2001	Community	686	Adolescent	22	NY	X	X	X	X	X			Late adolescence drug use predicted initiation of more drugs in young adulthood.
	R	Palmer et al., 2009	Twin	1733	Adolescent	17–25	CO	X	X	X		X	X	X	Teen alcohol tobacco or marijuana use linked to higher same drug young adult use.
	R	Patton et al., 2007	National	1520	Adolescent	21, 24	Australia		X	X		X	X		Age 15 weekly cannabis and/or alcohol use predicted adult alcohol and cannabis use. Daily cannabis predicted other drugs.
	R	Roche et al., 2008	National	1569	Adolescent	19–21	US		X				X		Young adult problem drinking associated with alcohol use onset by ages 13–15.
	R	Stein et al., 1987	Community	654	Adolescent	21–24	CA				X	X		X	Teen drug use predicts drug use in young adulthood.
	R	Steinhausen et al., 2007	Community	593	adolescent	mean 20.2	Switzerland	X	X	X			X		Adolescent problems substance use predicted young adult problem substance use.
	R	Swift et al., 2008	Community	1520	Adolescent	24	Australia	X		X			X	X	Teen heavy, persistent, and early-onset cannabis use linked to age 24 cannabis problems.
	R	Wechsler et al., 1994	College	611	Adolescent	18–20	MA		X				X		High school bingers carried the behavior forward into college.
	R	Windle & Wiesner, 2004	Community	760	Adolescent	mean 24	NY		X	X				X	Worse teen marijuana trajectories linked to young adult marijuana use disorder.
5. Positive attitudes or expectancies		Early 2005	Child of alcoholic	196	Adolescent	Mean 21	US		X			X	X		Adolescent alcohol expectancies predicted young adult use and problems.
	R	Guo et al., 2001	Community	808	Child–adolescent	21	WA		X					X	Alcohol disorders predicted by favorable alcohol attitudes.
	R	Jackson et al., 2000	Child of alcoholic	449	Retrospective, adolescent	18–24	US Midwest	X	X					X	Family history of alcoholism predicted chronic alcohol and tobacco disorders. Fully mediated by alcohol expectancy and personality measures.
	R	Jackson et al., 2005	National	32,087	Young adult	18–26	US	X	X			X	X		Alcohol expectancies associated with heavy use and comorbid drinking/smoking trajectory.

	R	Tucker et al., 2003	12grd irreg smoke	1534	Adolescent	23	CA and OR	X						X			Pro-smoking attitudes in 12th grade predicted young adult regular smoking.
6. Living situation	P/R	Bachman et al., 1984	National	8284	Young adult	18–21	US	X	X	X	X	X	X	X			If moved out of parents' (but not married), use increased. If stayed at parents', few changes.
	R	Capone et al., 2007	College	388	Young adult	20	US		X			X	X				Greek involvement at start of college predicted increased alcohol use and problems by end of 2nd year.
	P/R	Chassin et al., 2002	Child of alcoholic	446	Adolescent–young adult	20	AZ		X		X			X			Living with 2 biological parents associated with “non-binging” and “infrequent binging” paths.
	R	McMorris & Uggen, 2000	Community	780	Young adult	22	MN		X			X					Not living with 2 biological parents predicted young adult drug dependence.
	R	Park et al., 2009	College	3099	Adolescent	19–23	MO		X					X			In young adulthood, living with a roommate (opposed to with spouse, parent or alone), associated with more drinking.
	R	White et al., 2006	Community	319	Young adult	18.7	US Northwest		X	X			X				Drinkers pre-college selected into Greek system, which was associated with increased risky drinking and alcohol availability.
	R	White et al., 2008	Community	825	young adult	18–20	WA		X				X				Leaving parents' home a better predictor of increased alcohol use than going to college.
7. Job status	R/P	Bachman et al., 1999	National	27,427	Young adult	1–2 years past high-school	US	X	X				X				Moderators: parent monitoring, low risk seeking, and religiosity.
	R	Casswell et al., 2003	Birth cohort	969	Young adult	18, 21, 26	New Zealand		X				X	X			College goers living away from home drank more than college goers living at home.
	R	McMorris & Uggen, 2000	Community	780	Adolescent	22	MN		X				X				Working men (not in college) had bigger increase in cigarette use than college goers, but smaller increase in alcohol marijuana or drug use.
	P	Oesterle et al., 2008	Community	773	Adolescent	21 and 24	WA		X					X			Unemployed women drank more at ages 18 and 21, but less at age 26.
	R	Power & Estaguh, 1990b	Birth cohort	9337	Young adult	23	Great Britain		X					X			Long teen working hours not linked with more young adult drinking.
	R	Schulenberg et al., 2005	National	19,952	Adolescent	18–24	US			X			X				Low “positive functioning” in youth (includes job) predictive of young adult alcohol disorders.

(continued on next page)

Table 3 (continued)

Risk and/or protective factors	Risk (R) or protective (P)	Study authors and date	Study population	n=	Predictor age ^a	Young adult age	Location	Substance				Outcome			Findings
								Tobacco	Alcohol	Marijuana	Substance or drug	Use, frequency	Problem, Regular or heavy use/binge	"Use" disorder/abuse/dependence	
8. College attendance	R	Bingham et al., 2005	Community	1987	Adolescent–young adult	18–24	MI	X	X	X		X	X	Men college completers had largest teen-to-young adult risky drinking increases. Higher education level related to higher drinking quantity. In young adulthood, college attendance predicted drinking. 12th grade plans to attend college predicted age 22 heavy drinking. College completers less likely to develop alcohol use disorder by end of young adulthood. College attenders had fewer transitions from light to heavy smoking than non-attenders. Increased risk of alcohol use associated with leaving parents' home and going to college. Youth with marijuana using peers more likely to initiate marijuana use by young adult. Youth peer drinking linked to membership in "early heavy" drinking path; in turn linked with young adult alcohol dependence. Youth peer marijuana use did not predict early adult marijuana use, but did predict other drugs. College heavy drinking predicted by pre-college peer drinking norms. 12th grade peer smoking predicted adult regular smoking. Pro-alcohol peers at fall post high school linked to spring post high school alcohol use. Strongest for college goers not living at home. Age 10 belief in moral order predicted lower risk of alcohol dependence/abuse at age 21.	
	R	Casswell et al., 2003	Birth Cohort	969	Adolescent–young adult	18, 21, 26	New Zealand		X			X			
	R	McMorris & Uggen, 2000	Community	780	Young adult	22	MN		X			X			
	R	Merline et al., 2008	Community	21,137	Adolescent	22, 26	US		X			X			
	P	Sher & Gotham, 1999	College	451	Young adult	freshman–3 yrs post sr. year	US Midwest		X				X		
	R	White et al., 2009	Community	990	Young adult	18–20	WA	X				X			
	R	White et al., 2006	Community	319	Young adult	18.7	US Northwest		X	X		X			
9. Peer relations	R	Brook et al., 1999	Community	481	Adolescent	19–23, 24–32	NY			X		X			
	R	Chassin et al., 2002	Child of alcoholic	446	Adolescent	20	AZ		X		X		X		
	R	Morojele & Brook, 2001	Community	686	Adolescent	22	NY	X	X	X	X	X			
	R	Sher & Rutledge, 2007	College	3720	Pre-collg	mean 19	MO		X				X		
	R	Tucker et al., 2003	12grd irreg smoke	1534	Adolescent	23	CA and OR	X					X		
	R	White et al., 2008	Community	825	Young adult	18–20	WA		X			X			
10. Belief in conformity or the moral order		Guo et al., 2001	Community	808	Child	21	WA		X				X		

11. Religious involvement	P	Locke & Newcomb, 2004	Community	305	Adolescent	25-27	CA				X											Ages 17-18 social conformity predict less young adult alcohol use. Lack of social conformity in adolescence predicted young adult drug use and problems. Low age 18-20 religiosity linked to tobacco use, heavy drinking and comorbid drink/smoking path. Religious young adults over-represented in abstaining marijuana path, and under-represented in other paths. Controlling for teen drinking, pro-social involvement (included religiosity), linked to less alcohol use for college goes away from home. Religiosity moderated the link between leaving parents' home and alcohol and marijuana use. High heavy drinking trajectories associated with fewer religious commitments. African Americans: Teen "school problems" predicted alcohol dependence. Teen school bond predicted less young adult dependence. Girls: age 7 teacher-rated ability predicted slightly higher age 23 drink quantity. Higher high school GPA predicted more adult drinking. High high school GPA predicted less age 22 and 26 heavy drinking. Youth "positive functioning" (included school performance and bond), predictive of young adult alcohol use disorder. No direct link from high school GPA or college plans to young adult drug use. Indirect path from GPA to use via teen use. A/B high school grades linked to membership in "abstaining" marijuana trajectory.	
	R	Stein et al., 1987	Community	654	Adolescent	21-24	CA					X	X	X									
	R	Jackson et al., 2005	National	32,087	Young adult	18-26	US	X	X					X	X								
	P	Schulenberg et al., 2005	National	19,952	Adolescent	24	US					X			X								
	P	White et al., 2008	Community	825	Young adult	18-20	WA					X			X								
12. Educational factors	P	White et al., 2006	Community	319	Young adult	18.7	US Northwest				X	X											
	R	Windle et al., 2005	Community	760	Adolescent-young adult	16-25	NY				X	X			X								
	R	Gil et al., 2002	Community	643	Adolescent	19-21	FL				X	X								X			
	P	Guo et al., 2001	Community	808	Child-adolescent	21	WA				X										X		
	R	Maggs et al., 2008	Community	16,009	Child	23	UK				X				X								
	R	McMorris & Uggen, 2000	Community	780	Adolescent	22	MN				X										X		
	P	Merline et al., 2008	Community	21,137		22, 26	US				X										X		
P	Oesterle et al., 2008	Community	773	Adolescent	21 and 24	WA				X										X			
P	Schulenberg et al., 1994	National	3399	Adolescent	21-22	US	X	X	X	X				X									
P	Schulenberg et al., 2005	National	19,952	Adolescent	18-24	US								X									

Table 3 (continued)

Risk and/or protective factors	Risk (R) or protective (P)	Study authors and date	Study population	n =	Predictor age ^a	Young adult age	Location	Substance				Outcome			Findings
								Tobacco	Alcohol	Marijuana	Substance or drug	Use, frequency	Problem, Regular or heavy use/binge	“Use” disorder/abuse/dependence	
13. Becoming pregnant	R	Tucker et al., 2003	grd 12 irreg smkr	1534	Adolescent	23	CA and OR	X				X		12th grade poor academics predicted adult regular smoking.	
	P	Bailey et al., 2008	Community 3 yr. retrospect	752	Young adult	24	WA	X	X	X		X	X	Men: bingeing and marijuana use unchanged by partner pregnancy. Women reduced all drug use during pregnancy.	
	P	Power & Estough, 1990a	Birth cohort	9337	Young adult	23	Great Britain		X				X	Parenthood associated with lighter drinking among those who were light teen drinkers.	
14. Marriage or committed relationship	P	Bachman et al., 1984	National	8284	Young adult	18–21	US	X	X	X	X	X		Those who married and moved out of parents' home decreased substance use: true regardless of work/school status.	
	P	Duncan et al., 2006	Community	5956	Young adult	19–30	US	X	X	X		X	X	Married (and to lesser extent, cohabitators) decreased bingeing and marijuana use. No cigarette decrease.	
	P	Horwitz & White, 1991	Community	396	Young adult	21,42	NJ		X				X	For women only, becoming married between age 21 and 24 associated with fewer age 24 alcohol problems.	
	P	Power & Estough, 1990a	Birth cohort	9337	Young adult	23	Great Britain		X				X	Marriage associated with lighter drinking among those who were light teen drinkers.	
15. History abuse/neglect	P/R	Sher & Gotham, 1999	College	451	Adolescent	3 yrs post grd 12	US Midwest		X					X	Marriage protective of developing young adult alcohol use disorder. Divorce imparts risk.
	R	Al Mamun et al., 2007	Community	2571	Adolescent	21	Australia	X						X	Sexual abuse prior to age 16 (by someone at least 5 years senior) predicted increased nicotine dependence.
	R	Tarter et al., 2004	Son of alcoholic	236	Child–adolescent	19	US				X			X	Paternal (not maternal) child neglect predicted age 19 substance use disorder.
	R	Hussong & Chassin, 2004	Child of alcoholic	340	Child–adolescent	18–23	AZ		X		X	X	X		Path of stressful events from teen to young adult predicted young adult drug use.
16. Stressful events	R	Steinhausen et al., 2008	Community	593	Adolescent	Mean 20.2	Switzerland		X				X		In young adulthood, heavy/problem drinkers reported more and worse impact of life events.
	R	Windle et al., 2005	Community	760	Adolescent	16–25	NY		X	X		X	X		More sever heavy drinking trajectories associated with having experienced more stressful life events.

^a In-utero: exposure during embryonic/fetal development; from birth: biological indicator; present from birth; perinatal: around time of birth; child: birth through age 11; adolescence: ages 12–17 (or 12th grade); young adult: ages 18–26.

Research by Zhou et al. (2006) found that increased family conflict, parent–parent conflict, and/or increased parent–offspring conflict are associated with an increased risk of drug and alcohol dependence. Research by Trim et al. (2006) suggests that the association between an older sibling's alcohol use and young adult alcohol use was more pronounced in families with high family conflict.

Family bonding and support refer to a close and supportive relationship characterized by high levels of attachment between parents and offspring. High levels of family bonding/support during adolescence predict decreased young adult alcohol involvement (Locke & Newcomb, 2004) and drug use (King & Chassin, 2004; Maggs et al., 1997; Morojele & Brook, 2001). Research by King and Chassin (2004) suggests that parental support was associated with approximately 50% less risk of developing a drug use disorder, even after controlling for age, gender, parent alcoholism, parent antisociality, behavioral undercontrol, and the interaction between parent support and behavioral undercontrol (OR 0.54, $p < .01$). Family bonds/support have been shown to moderate the association between young adult substance use and poor adolescent behavioral control (Engels, Vermulst, Dubas, Bot, & Gerris, 2005; King & Chassin, 2004), adolescent drug use (Maggs et al., 1997), and other adolescent personality risk factors (Morojele & Brook, 2001). For example, Morojele and Brook (2001) found that those with personality problems, but with a favorable relationship, were less likely to experience substance use problems than those with personality problems who did not have a favorable relationship with their parents.

3.3.3. Family management (guidelines, monitoring, discipline, and rewards)

Family management is a broad construct that includes parental monitoring, discipline, and behavioral control, and also the reward system that parents set in place to reinforce good behaviors. Generally, good family management practices are associated with less substance use among young adults. Engels et al. (2005) found that poor “family functioning,” the extent to which family activities and relationships were conducted in an “ordered, structured, and rule governed way” (Gerris et al., 1993) predicted problem drinking by age 22. For men, adequate family functioning moderated the relationship between childhood aggression and young adult problem drinking. Men who exhibited childhood aggression and experienced poor family functioning were at a greater risk of later problem drinking than those with aggressive behaviors who grew up in a household without poor family functioning (Engels et al., 2005).

The construct of parental monitoring has been widely studied in relation to substance use during adolescence, and several studies have extended this research to assess if monitoring remains important into the young adult years. Guo, Hawkins, Hill, and Abbott (2001) found that parental monitoring and rules at age 10 were associated with a decreased risk of alcohol abuse and dependence at age 21 (OR 0.78, $p < 0.05$), as were continued monitoring and rules at age 16 (OR 0.77, $p < 0.05$). Using data from a birth cohort, Ghandour (2009) supported the association between ages 10–12 parent monitoring and ages 18–22 alcohol problem use among males (OR 0.43, $p = 0.02$), but failed to find a statistically significant association among females (OR 0.51, $p = 0.248$). A protective association between adolescent parent monitoring and young adult alcohol use has also been observed among college students (Arria et al., 2008). In addition, research suggests that parental monitoring during high school may reduce the risk of marijuana use among college students; however this association was not seen among those not attending college (White et al., 2006).

Discipline and behavioral control, particularly if consistent, may predict young adult substance use. Viewed on a continuum ranging from low levels of discipline or control (parental permissiveness) up to harsh or unreasonably high levels of discipline or control, excess risk of problem behaviors has been reported at both ends of the continuum. King and Chassin (2004) suggest that parental discipline

mediates the relationship between parent alcoholism and young adult drug use disorder, accounting for 34% of the variance in the relationship between parental alcoholism and drug use disorders in young adults. Parental alcoholism predicted low perceived parental discipline, which in turn predicted drug use disorders. Further, young women who experienced low parental behavioral control in addition to low parental affection may be more likely to engage in problem drinking (Engels et al., 2005). Increased parental behavioral control has also been found to reduce the risk for problem drinking among young adult males (Roche, Ahmed, & Blum, 2008).

Guo et al. (2001) examined the construct of family management in relation to young adult substance involvement, finding that parental rewards for positive behavior at age 16 were predictive of a lower risk of alcohol dependence at age 21 (OR 0.68, $p < 0.01$).

3.3.4. Internalizing and externalizing behavior

A variety of constructs have been used to assess internalizing problems, including negative emotions or affect (Chassin et al., 2004; Gil et al., 2002), lack of well-being (Maggs et al., 1997; Pitkanen, 1999), depressive symptoms or disorders (Marmorstein, 2009; Marmorstein, Iacono, & Malone, 2010; Yamaguchi & Kandel, 1984), anxiety (Vida et al., 2009), “thought problems” (Ferdinand, Blum, & Verhulst, 2001), and broadly labeled “internalizing” (Brook, Ning, & Brook, 2006).

Indicators of the presence of internalizing problems have been operationally defined as depressive symptoms only (Marmorstein, 2009; Marmorstein et al., 2010), depression and low self-satisfaction (Maggs et al., 1997), and by a measure that included neurotic and immature defenses, anxiety, and somatic symptoms (Pitkanen, 1999). High levels of adolescent depressive symptoms have been associated with steeper alcohol problem use curves, especially for males (Marmorstein, 2009). However, when using a diagnosis of major depressive disorder at age 17 as a predictive indicator, Marmorstein et al. (2010) failed to find an association with subsequent young adult drug and alcohol dependence. While not a clinical diagnosis, exhibiting a low level of wellbeing during adolescence has been associated with alcohol and drug use during young adulthood (Maggs et al., 1997), as well as alcohol use problems (Pitkanen, 1999).

Research assessing the association between broad indicators of internalizing and young adult substance involvement has produced mixed results. In a study assessing trajectories of tobacco smoking, Brook et al. (2006) concluded that young adults classified in an early-start-continuous smoking trajectory were more likely than other participants to experience internalizing problems between ages 1 and 10. However, according to results from Maggs, Patrick, and Feinstein (2008), age 7 internalizing was negatively associated with age 23 drinking quantity. Further study is needed to examine whether discrepancies are due to differences in measures of internalizing, population studied, or the type of substance used during young adulthood.

Vida et al. (2009) examined substance use, psychiatric symptoms, and co-occurrence of substance use and psychiatric problems at age 19 as predictors of substance use at age 25. Results suggested that participants with co-occurring anxiety and alcohol use disorders at age 19 had a greater number of heavy drinking days at age 25 than those who at age 19 were classified with no disorder, a single disorder, or with co-occurring depression and drug abuse. The only group identified as having more heavy drinking days at age 25 than the anxious drinkers were those classified at age 19 as antisocial drinkers.

Abundant evidence suggests links between various measures of externalizing during childhood and/or adolescence and young adult substance use behaviors and problems. Measures include broad “externalizing” (Brook et al., 2006; Hayatbakhsh et al., 2008; Steele, Forehand, Armistead, & Brody, 1995; Steinhausen, Eschmann, & Metzke, 2007; Steinhausen et al., 2008), unconventionality (Brook et al., 1999), delinquency or deviance (Ferdinand et al., 2001; Jackson, Sher, & Schulerberg, 2005; Morojele & Brook, 2001), aggression (Engels et al., 2005), antisocial or conduct problems (Bor, McGee, Hayatbakhsh,

Dean, & Najman, 2010; Copeland, Shanahan, Costello, & Angold, 2009; Flory et al., 2003; Guo et al., 2001; Hamil-Luker, Land, & Blau, 2004), hyperactivity (Barkley, Fischer, Smallish, & Fletcher, 2004), and offending (Wiesner, Kim, & Capaldi, 2005).

The association between externalizing constructs and substance use holds for tobacco use (Bor et al., 2010) (OR range 1.8–5.5) alcohol use and problem use (Engels et al., 2005; Ferdinand et al., 2001; Guo et al., 2001; Jackson et al., 2005; Maggs et al., 2008; Steele et al., 1995; Steinhausen et al., 2008; Wiesner et al., 2005), marijuana use (Bor et al., 2010) (OR range 2.7–8.4); (Brook et al., 1999; Hayatbakhsh et al., 2008; Steele et al., 1995), cocaine use (Hamil-Luker et al., 2004), and the use or problem use of substances in general (Flory et al., 2003; Morojele & Brook, 2001; Steinhausen et al., 2007; Wiesner et al., 2005). It is important to note, however that youth who experienced early externalizing problems such as conduct disorder may also be experiencing other symptoms that contribute to the development of later substance use problems. In fact, some research suggests that after controlling for other childhood psychiatric symptoms such as anxiety, depression, and oppositional defiant disorder, conduct disorder alone may not predict young adult substance use disorders (Copeland et al., 2009).

Research suggests an association between deviations from personality norms in childhood and young adult alcohol problems (Cloninger, Sigvardsson, & Bohman, 1988). Increased risk of substance use has been attributed to both sensation seeking and low harm avoidance (Cloninger et al., 1988; Early, 2005; Merline et al., 2008). White et al. (2006) also suggested that sensation seeking was positively related to heavy alcohol use only among young adults that leave their parents' household.

Other personality traits may also serve as risk factors for substance use problems in young adulthood. According to research by Windle, Mun, and Windle (2005), males with low levels of task orientation are at an increased risk of heavy drinking (OR range 0.32–0.61). In addition, low levels of planning and coping, or poor neurobehavioral disinhibition (ND) may be predictive of young adult substance involvement (Clark et al., 2005; Hussong & Chassin, 2004). ND has been associated with the use of tobacco, alcohol, and other drugs (Clark et al., 2005; Habeych et al., 2005; Tarter et al., 2004), and may be particularly predictive among those who have two substance-abusing parents (Clark et al., 2005). In addition, ND may partially mediate the association between parental substance use disorder and offspring young adult substance use disorder (Tarter et al., 2004).

3.3.5. Adolescent substance use and expectancies

Consistent evidence suggests that those who use a given substance during adolescence are more likely to use and have problems with the use of the same substance as young adults. This is supported by research on alcohol use (Flory, Lynam, Milich, Leukefeld, & Clayton, 2004; Gil et al., 2004; Guo, Collins, Hill, & Hawkins, 2000; Roche et al., 2008; Wechsler, Isaac, Grodstein, & Sellers, 1994), tobacco (Palmer et al., 2009), and the use of illegal drugs including marijuana (Bachman, O'Malley, & Johnston, 1984; Flory et al., 2004; Gil et al., 2004; King & Chassin, 2007; Stein, Newcomb, & Bentler, 1987; Steinhausen et al., 2007; Swift, Coffey, Carlin, Degenhardt, & Patton, 2008; Windle & Wiesner, 2004). In a study examining early adolescent substance use in relation to subsequent young adult substance use disorders, Gil et al. (2004) found that young adult regular substance users who began using substances in early adolescence were 1.5 times more likely to experience alcohol abuse (95% CI: 1.0, 2.2), two times more likely to abuse marijuana (95% CI: 1.2, 2.9), 1.7 times more likely to be dependent on marijuana (95% CI: 1.1, 2.6), and two times more likely to be classified as having any substance use disorder (95% CI: 1.4, 2.7) compared to abstainers in adolescence. Research by King and Chassin (2007) resulted in similar findings, suggesting that youth who began substance use at or prior to age 13 were 3.16 times more likely to develop drug dependence

during the young adult years ($p < 0.01$). There is abundant evidence suggesting that the association between adolescent substance use and young adult substance use problems is amplified when the youth begin substance involvement at an early age (Brook et al., 2007; Clark et al., 2005; Flory et al., 2004; Gil et al., 2004; Guo et al., 2000; King & Chassin, 2007; Roche et al., 2008).

Research suggests that adolescents who use tobacco or alcohol are more likely to transition to illegal drugs as they enter young adulthood. Brook and colleagues report that youth who smoke tobacco are 2 times more likely than nonsmoking youth to use marijuana by young adulthood (Brook et al., 1999) and to be dependent on alcohol or illegal drugs in young adulthood (Brook et al., 2007). The researchers concluded that youth who begin cigarette smoking early, in comparison to late onset, were at a threefold increased risk of developing young adult alcohol dependence, at 2.3 times the risk of developing dependence on illegal substances, and at 5 times the risk of developing both alcohol plus illegal drug dependence (Brook et al., 2007). Heavy alcohol use during adolescence has also been associated with heavy drug use in young adulthood (Chassin et al., 2004). Research by Lessem et al. (2006), found that adolescents who use marijuana are approximately 2 times more likely than non-using peers to use other illegal drugs as young adults. Other researchers have provided further evidence for an association between adolescent marijuana use and a variety of other illegal substances (Morojele & Brook, 2001; Patton et al., 2007). Patton et al. (2007) examined the association between adolescent marijuana use and the use of specific illegal drugs in young adulthood. Their research concluded that adolescent marijuana users were six times more likely than non-users to use amphetamines as a young adult (95% CI 3.6, 10.0), 7.2 times more likely to use ecstasy (95% CI 4.3, 12.0), and nearly five times more likely to use cocaine (OR 4.7, 95% CI 2.3, 9.7) (Patton et al., 2007).

3.3.6. Favorable attitudes and expectancies

Having favorable attitudes or expectancies relating to drug or alcohol use may incur excess risk of young adult substance use or problem use (Early, 2005; Guo et al., 2001; Jackson et al., 2005; Tucker, Ellickson, & Klein, 2003). In a study by Guo et al. (2001) that assessed various youth predictors of young adult "alcohol abuse and dependence" or "alcohol dependence" only, the authors found that "pro-alcohol use beliefs" at age 10 and at age 16, predicted age 21 "alcohol abuse and dependence" (OR 1.2 and 1.7, respectively) and "alcohol dependence" only (OR 1.3 and 2.2, respectively). Jackson et al. (2005) examined alcohol expectancies in relation to developmental trajectories of alcohol and tobacco use from adolescence through young adulthood. The authors found that expressing positive alcohol expectancies increased risk of membership in the chronic drinking and/or chronic smoking trajectories by 1.6 to 2.2 times (Jackson et al., 2005). Alcohol expectancies may also mediate the relationship between other childhood/adolescent predictors and young adult substance use. For example, Jackson et al. (2000) tested a mediational model where childhood stressors, alcohol expectancies, depression, and a vulnerability index score (based on intellectual functioning, personality/behavioral undercontrol, etc.) partially mediated the relationship between family history of alcoholism and young adult alcohol use disorder (AUD) and tobacco dependence (TD). Alcohol expectancies were the most powerful mediators of the relation between family history of alcoholism and AUD and TD, and comorbid AUD/TD (Jackson et al., 2000).

Tobacco use expectancies appear to increase the probability of poor young adult outcomes in a similar fashion. In a sample of youth that were followed from the 8th grade into young adulthood, grade 12 beliefs regarding the positive effects of smoking (i.e., relaxes you; makes you feel at ease with others) were associated with a 1.7 fold increase in the risk of transitioning to regular smoking by age 23 (95% CI 1.2, 2.4) (Tucker et al., 2003).

3.3.7. Living situation

A number of studies suggest that the move out of the parents' home brings with it increased risk of substance use problems for young adults (Bachman et al., 1984; Chassin et al., 2002; McMorris & Uggen, 2000; Weitzman & Chen, 2005; White, Fleming, Kim, Catalano, & McMorris, 2008; White et al., 2006). The type of living arrangement may also be predictive of substance involvement, as young adults living with a roommate (other than a spouse) tended to be at greater risk of alcohol involvement than those living alone (McMorris & Uggen, 2000). There is also evidence that social living arrangements such as fraternities and dorm residences are associated with problems (Bachman et al., 1984; Capone, Wood, Borsari, & Laird, 2007; Park, Sher, Wood, & Krull, 2009). As noted by Park et al. (2009), it is important to remember that there are pre-college factors, such as college attendance motives, and additional college factors, such as peer drinking norms and alcohol availability, that may be important in understanding the association between living arrangement and young adult substance use.

3.3.8. Job status

Working during young adulthood may serve both positive and negative functions in relation to substance use. Oesterle, Hill, Hawkins, and Abbott (2008) found that working was protective against alcohol use disorders in young adulthood. Bachman, Freedman-Doan, O'Malley, Johnston, and Segal (1999) also found that, when compared to men in college, men with jobs were less likely to increase alcohol, marijuana, or other illegal drug use during the transition from high school into young adulthood, but were more likely than college-attending peers to increase cigarette use (Bachman et al., 1999).

The number of hours per week spent on the job may predict increased risk of substance use during adolescence, but may be less predictive of young adult problems. McMorris and Uggen (2000) found an association between hours worked and substance use during the adolescent years, but the association did not persist into young adulthood. On the other hand, Schulenberg et al. (2005) found that working 16 for more hours per week during high school may be associated with chronic marijuana use trajectories from adolescence into young adulthood.

Young adults who are unemployed and not in school may also experience an increased risk of substance use. Longitudinal research by Casswell et al. (2003) suggested that young adult women who were unemployed at ages 18 and 21 engaged in more alcohol consumption than their employed counterparts. This association, however, was no longer evident at age 26. Among males, research by Power and Estayh (1990a) concluded that, after controlling for early alcohol use, men with six or more months of unemployment post high school were 1.4 times more likely to be heavy drinkers by age 23 than employed males.

3.3.9. College attendance

College attendance has been associated with both increased and decreased risk of substance use. Merline et al. (2008) found that having plans to attend college in the 12th grade was associated with an increased risk of heavy drinking at age 22. College plans have also been associated with increased drinking quantity (Bingham, Shope, & Tang, 2005; Casswell et al., 2003; McMorris & Uggen, 2000). White et al. (2006) noted that college attendees who remain in their parents' home experienced notably lower alcohol use frequencies than their counterparts living off campus. While college attendance may serve as a risk factor in relation to alcohol use during young adulthood, college completers were less likely than non-college completers to develop an alcohol use disorder (Sher & Gotham, 1999). Further, while college attendance may serve as a risk factor for alcohol use outcomes, those attending college smoked less tobacco than those not attending college (White, Bray, Fleming, & Catalano, 2009).

3.3.10. Peer relations

Youth with alcohol-using peers may be more likely to belong to an early heavy drinking trajectory into young adulthood, which may in turn be associated with an increased risk of alcohol dependence (Chassin et al., 2002). Similarly, Tucker et al. (2003) suggested that young adults who had tobacco-using peers in the 12th grade were 1.5 times more likely to transition to regular smoking by age 23 than young adults who did not have smoking peers in the 12th grade.

Whether or not peer marijuana use predicts problem marijuana use in young adulthood is less clear. Brook et al. (1999) found that after controlling for other potential risk factors such as parenting and personality, individuals who had marijuana using peers between late adolescence and young adulthood were 1.6 times more likely to initiate marijuana use by age 26. Other research failed to find this relationship, but did find an association between adolescent peer marijuana use and the use of other drugs during the young adult years (Morojele & Brook, 2001).

Two longitudinal studies look at the association between peer substance involvement and young adult substance use among college students. A two-wave longitudinal study assessing precollege characteristics and college drinking status suggested that precollege peer pro-drinking norms predicted heavy alcohol use by the end of the first college semester (Sher & Rutledge, 2007). White et al. (2008) found that young adults whose close friends are heavy drinkers are more likely to increase drinking within the year post graduation from high school, regardless of college attendance. The level of pro-alcohol peer influence was higher among young adults who moved away from home to attend college than among either college students living at their parents' home, or young adults who did not attend college (White et al., 2008).

3.3.11. Belief in conformity or the moral order

Locke and Newcomb (2004) found that social conformity in late adolescence predicted lower levels of involvement with alcohol in the young adult years (age 25–27). In addition, belief in the moral order in pre-adolescence and adolescence (age 10, OR 0.71, $p < 0.05$, age 16 OR range 0.56–0.63, $p < 0.001$), may predict lower risk of alcohol abuse and dependence at age 21 (Guo et al., 2001). Conversely, the absence of conformity may impart risk. Stein et al. (1987) found that lack of social conformity in adolescence is associated with problem drug use during young adulthood.

3.3.12. Religious involvement

Schulenberg et al. (2005) found that older adolescents who indicated that religion was important to them were over-represented in a trajectory class that abstained from marijuana use during young adulthood and under-represented in all marijuana using trajectories (Schulenberg et al., 2005). Conversely, low religiosity has been associated with increased risk of substance involvement such as chronic tobacco use trajectories (OR 0.59) (Jackson et al., 2005), heavy/chronic alcohol use trajectories (OR range 0.48–0.63) (Jackson et al., 2005; Windle et al., 2005), and over a twofold risk of membership in a co-occurring drinking and tobacco smoking trajectory (OR 0.49) (Jackson et al., 2005).

Religious commitment and participation may also moderate the risk associated with other factors. For example, there is evidence that religiosity moderates the increasing risk of substance use associated with leaving the parents' home and going to college (White et al., 2006), even after controlling for level of teen drinking (White et al., 2008).

3.3.13. Educational factors

School bonding has been assessed by examining indicators such as liking school, striving to perform well in school, and having high expectancies for educational achievement (Fothergill & Ensminger, 2006; Oesterle et al., 2008). According to research by Guo et al.

(2001), a youth's positive bond to school in childhood (age 10) and adolescence (age 14 and 16) is associated with decreased risk of alcohol use disorders in young adulthood (OR age 10 range 0.56–0.64, $p < 0.01$, OR age 14 range 0.63–0.68, $p < 0.05$, OR age 16 range 0.51–0.67, $p < 0.01$). This association also holds true when viewing educational bond as a part of a larger construct such as positive functioning (Oesterle et al., 2008). It is important to note that this association appears to be stable.

School performance has been defined by high school grades (McMorris & Uggen, 2000; Merline et al., 2008; Schulenberg et al., 2005), teacher-rated ability (Maggs et al., 2008), problems with school or academics (Gil et al., 2002; Tucker et al., 2003), and as a component of broader constructs such as positive functioning (Oesterle et al., 2008). Research by Gil et al. (2002) suggests that for young African Americans poor schoolwork in grades 8–9 was associated with a threefold increase in the risk of alcohol dependence at age 19–20 (OR 2.9, for African Americans, $p < 0.05$), and approximately a twofold risk for marijuana use disorders (OR 2.1, for African Americans, $p < 0.05$; OR 2.2 for European Americans, $p < 0.001$). Poor grades have also been used to demonstrate an increased risk of transition to regular smoking between grade 12 and age 23 (OR 1.14, $p < 0.05$) (Tucker et al., 2003).

Consistent with the finding that poor grades impart excess risk of substance involvement, research also suggests that good grades may predict lower substance use. In an assessment of marijuana use trajectories, Schulenberg et al. (2005) concluded that youth who achieved As and Bs in high school were more likely to belong to a trajectory class that abstained from marijuana use during the transition from adolescence to young adulthood. In addition, positive school performance may also be viewed as protective against young adult alcohol disorder when assessed as a component of a broader construct called positive functioning (Oesterle et al., 2008).

It is interesting to note that research assessing the association between adolescent grades and young adult substance use outcomes is inconsistencies. Some research suggests that a high grade point average (GPA) in high school is associated with a higher risk of young adult drinking (McMorris & Uggen, 2000), but this finding may be due to higher alcohol use frequencies among young adults who attend college compared to their non-college attending peers. In contrast, Merline et al. (2008) found that having a high GPA in high school was associated with less heavy drinking at ages 22 and 26, and other researchers have failed to find an association between high school GPA and young adult substance use (Schulenberg, Bachman, O'Malley, & Johnston, 1994). These inconsistencies may contribute to the observation that college attenders exhibit increased use but college completers have reduced problem associated with use.

3.3.14. Becoming pregnant

In 2005, the average age of women at the birth of their first child was 25.2 years (Center for Disease Control and Prevention, 2005). Becoming pregnant and becoming a parent are common, life-changing events for young adults. Women who become pregnant during young adulthood may reduce their use of alcohol, tobacco, and marijuana during the gestational period (OR 0.09, 95% CI 0.04, 0.20), although as demonstrated by Bailey, Hill, Hawkins, Catalano, and Abbott (2008), consumption may rise again after giving birth. Power and Estaugh (1990b) suggested that such decreases in use may be more likely when the women were light teen drinkers in comparison to heavier teen drinkers. It is interesting to note that men's binge drinking and marijuana use did not decrease significantly when their partners became pregnant, nor at the advent of parenthood (OR 0.82, 95% CI 0.44, 1.52) (Bailey et al., 2008).

3.3.15. Marriage or committed romantic relationship

As noted by Arnett (2005), the average age for a first marriage is 4 years later than it was 30 years ago. This shift may play a role in

understanding the relationship between marriage and young adult substance use because many individuals do not currently enter marriage until after the young adult timeframe.

Sher and Gotham (1999) suggest that marriage is protective, and conversely, divorce imparts risk of developing a substance use disorder. However, it seems that associations between marriage and substance involvement may be more complex. Marriage is capable of both moderating the risk of other variables in relation to substance use outcomes, and is also itself subject to moderation by other variables. Bachman et al. (1984) found that if young adults are married when they moved away from home, then they are at a decreased risk of substance use regardless of their school or work status (Bachman et al., 1984). Horwitz and White (1991) found few drinking problems for women who became married between the ages of 21 and 24, but Power and Estaugh (1990b) found that marriage was associated with lighter drinking during the young adult years only if the young adult was a light drinker during the teen years.

Researchers have also examined other variables indicating relational commitment such as cohabitation. Longitudinal research on individuals aged 19–30 suggests that lower rates of binge drinking and marijuana use are seen for cohabitators in comparison to single individuals, although cohabitation is not as protective as marriage (Duncan, Wilkerson, & England, 2006).

3.3.16. Stressful life events

Examples of stressful life events include the death of a parent, changes in appearance, ending a committed relationship, and so forth (Windle et al., 2005). Individuals who experience a greater number of stressful events during adolescence and into young adulthood are more likely to use substances as young adults (Hussong & Chassin, 2004), and for those who use alcohol, are more likely to engage in heavier drinking (Steinhausen et al., 2008; Windle et al., 2005). Windle et al. (2005) incorporated a measurement of "stressful life events" into models predicting heavy drinking trajectory groups for men and women separately. In comparison to men in the stable non-heavy drinking group, men who endorsed more stressful life events were 3.7 times more likely to be in the "high heavy drinking stable" group, and 6.6 times more likely to be in the "very high heavy drinking" group (Windle et al., 2005). Women who endorsed more stressful life events were 1.8 times more likely to be in the "very high heavy drinking" group than the "non-heavy drinking stable" group (Windle et al., 2005).

3.4. Areas requiring further longitudinal research

Many cross-sectional studies were not included because cross-sectional research does not allow time ordering of the risk and protective factors in relation to later substance misuse. This section includes areas of research offering interesting leads but suffering from limitations because only cross-sectional research is available, or only one longitudinal study was found.

3.4.1. Parental attitudes

Parental attitudes toward substance use have been studied extensively during adolescence, but have received little attention during the young adult years. A cross-sectional study of college juniors suggests that perceived parental norms favorable to young adult alcohol use were positively correlated with underage college drinking (Kuther & Higgins-D'Alessandro, 2003). A longitudinal study following children of alcoholics suggests that there does not appear to be an intergenerational transmission of alcohol expectancies from parents to their children, but that paternal behaviors were predictive of offspring expectancies (Handley & Chassin, 2009).

3.4.2. Constructive engagement and volunteerism

Young adults who engage in prosocial activities within their communities may be at a decreased risk of poor substance use outcomes;

however longitudinal research on this topic is scarce. Weitzman and Chen (2005) used cross-sectional data to suggest an association between alcohol use and college volunteerism. The authors' reasoned that volunteerism should reflect the student's dedication to the "public good," or "the group" or "collective," and thus relate to lower levels of prospective alcohol problems (Weitzman & Chen, 2005). Oesterle et al. (2008) created a *positive functioning* construct that incorporated social roles including work status, citizenship, family of origin, peer relations, and romantic relations. Their research suggested that positive functioning in early young adulthood (mean age 21) is negatively associated with alcohol abuse and dependence by age 24 (Oesterle et al., 2008).

3.4.3. Military

Few longitudinal studies assessed associations between military status and substance use outcomes specific to individuals between the ages of 18 and 24. Cross-sectional research by Bray, Marsden, and Peterson (1991) suggests that young adults entering the military may have higher rates of heavy drinking and cigarette use compared to civilian young adults, but it is unclear whether this is a selection effect or one produced by military involvement. We found one longitudinal study that assessed the relationship between being in the military at 1 to 2 years post high school and substance use (Bachman et al., 1999). The authors concluded that military men were more likely to increase cigarette use compared to those entering college, and also increased alcohol consumption relative to working or unemployed men. However men entering the military were less likely than college goers to increase illegal drug use.

3.4.4. College athletes

Two review articles discuss the extensive cross-sectional research suggesting an association between participation in college athletics and young adult substance use (Martens et al., 2006; Turrise, Mallett, Mastroleo, & Larimer, 2006). Longitudinal research examining the mechanisms behind this association is lacking.

4. Discussion

Using the Hawkins et al. (1992) standard of two longitudinal studies for a predictor to be a risk or protective factor, this review reveals that many of the risk and protective factors associated with problem substance use in young adulthood are the same as those that predict adolescent substance use. Predictors from childhood and adolescence appear to predict young adult substance use. In addition, some of these same predictors measured in young adulthood also affect young adult substance use including peer use and favorable attitudes and norms toward use. Substantial evidence suggests that young adults are at an increased risk of problems if they are male, have substance-dependent parents, experience externalizing behaviors during adolescence, have favorable attitudes toward substance use, exhibit a lack of belief in conformity or the moral order, have low commitment to school, or if they use substances during adolescence, particularly if they are "early" users. Peer substance use, school achievement, and family factors also are predictive of young adult substance use problems.

We have also identified unique factors during young adulthood that predict problem substance use in young adults. Some of this research points to the importance of social contexts that involve greater freedom and less social control than experienced during adolescence. Specifically, moving out of the parental home and attending college are related to increased substance use. Other young adult social contexts may be predictive of lower levels of substance involvement such as engaging in work, marriage and cohabitation, and graduating from college. Other evidence that is intriguing, but not yet fully supported, suggests that some social contexts such as being in the military or being a college athlete may increase use.

Cross-sectional evidence for community factors such as norms, laws, price and tax on alcohol, and liquor outlet density is also present in the literature reviewed.

Several implications can be drawn from this review including those for research methodology and gaps in current research. The most appropriate research designs for examining the predictive relationship between risk and protective factors and substance use outcomes in young adulthood are longitudinal or experimental. These designs are expensive and logistically difficult due to the occupationally diverse nature of young adults and the fact that young adults are highly mobile. Currently, the most successful longitudinal studies have followed community or representative samples into young adulthood representing high cost, high return studies. However due to the high cost of these longitudinal studies, many published studies examining substance use in young adulthood use cross-sectional data or more easily captured college students, while ignoring non-college attending young adults. Moving forward, researchers should strive to develop more efficient and effective techniques to carry out longitudinal research on representative samples of young adults. This may involve adaptation of research protocols to use internet-based study recruitment and web-based interview tools, as well as data collection via cell phones.

Examples of research that incorporates new technology are becoming more plentiful. Neighbors, Lee, Lewis, Fossos, and Walter (2009) and others have demonstrated the utility of using the internet to conduct research and preventive interventions targeting young adults. The use of the internet for research on young adult alcohol and other drug use offers several benefits, including lower research costs and potential reductions in biases in participant reporting (Kypri, Gallagher, & Cashell-Smith, 2004; McMorris et al., 2009; Thomas & McCambridge, 2008).

While new technologies may provide benefits, they also pose some new potential challenges. For example, the methodology for sampling households based on telephone landlines does not work when utilizing cell phones because cell phone numbers are not geographically restricted. Related factors such as caller I.D. and a trend toward cell phone-only households may also impede research. A 2007 survey by the Division of Health Interview Statistics at the Centers for Disease Control (CDC) estimated that approximately 16% of U.S. households have at least one wireless phone and do not have landline service (Blumberg & Luke, 2008). This seems to be particularly true for young adults, making it difficult to attain a representative sample of young adults using traditional landline-based, random-digit-dialing methods.

This review also has implications for prevention science. Substance use and abuse peak during the young adult phase of the lifecycle, as do the attendant harms. However, the longitudinal research reviewed here suggests that opportunities to ameliorate these harms through risk and protective factor modification may begin prior to birth and continue through young adulthood. Interventions in childhood and adolescence, for example, targeting mother's prenatal substance use, parents' family management skills, and children's and adolescent's academic performance and social, cognitive, and emotional skills, and reducing negative peer influence may impact young adult substance abuse. Preventive interventions that address these factors have reduced adolescent substance use and some in long term follow-up studies have shown impact into young adulthood, and have been described extensively elsewhere (Hawkins et al., 1992; Hawkins et al., 1995; Spoth, Greenberg, & Turrise, 2008).

Further research regarding the effectiveness of preventive intervention specifically targeting young adults is also warranted. Currently college campuses provide the backdrop for the majority of interventions targeting young adults due to the convenience of these settings to implement interventions (see the Journal of Studies on Alcohol 2002 (Supp. 14) for reviews of several intervention methods aimed at college alcohol problems).

Abundant research suggests that campus interventions that incorporate motivational feedback (e.g., brief motivational intervention, normative feedback interventions) produce more favorable drinking outcomes relative to control groups or groups that receive drug education alone (Carey et al., 2007; Hunter Fager & Mazurek Melnyk, 2004; Walters & Neighbors, 2005). Further, campus interventions that focus on risk reduction or harm reduction may produce more favorable results than programs with an abstinence-only focus (Marlatt & Witkiewitz, 2002). A good example is an intervention with students just prior to their 21st birthday in which the students who received normative information and personalized web-based feedback consumed a smaller quantity of alcohol on their birthday than did controls (Neighbors et al., 2009).

In contrast to the convenient samples of young adults available on college campuses, the occupationally diverse and often highly mobile population of young adults *not* in college makes it difficult to develop effective interventions for this population. However, as this review highlights, there are a number of risk factors that could indicate potential targets for interventions. Such strategies might aim to reduce access to alcohol to those under 21, increase taxes, and reduce community norms favorable to substance use have been effective (Wagenaar & Toomey, 2002; Wagenaar et al., 2000, 2009). Further new interventions may be suggested by some reviewed young adult risk factors. For example, being neither employed nor in school is a risk factor. Thus, parents, employers, and community agencies that support work involvement may also have a role in reducing substance use. There are indications that the number of hours worked is associated with higher rates of drinking. Employers could be motivated to develop and test programs to prevent alcohol abuse as a means to improve productivity and reduce absenteeism. It may also be useful for preventive interventions to be developed that target young adults in the military. Like college students, these young adults are a convenient sample that may be at increased risk of alcohol and tobacco misuse.

5. Conclusion

This is the first comprehensive review of risk and protective factors that affect substance use and problem use in young adulthood. Risk and protective factors in this review span the life course to young adulthood, starting with factors that may play a role in utero. Many of the risk and protective factors pertinent to childhood and adolescence remained important in young adulthood. Several of the risk and protective factors that were specific to the young adult years pertained to the changing social contexts of young adulthood. These factors may include college attendance, job attainment, living arrangement, and marital status. A complete picture of the mechanisms that lead to problem substance use in young adulthood would benefit from further research. More longitudinal studies are needed, as well as more studies of non-college attending young adults to develop a clearer picture of predictors.

Role of funding sources

Funding for this study was provided by a Department of Health and Human Services, SAMHSA, CSAP grant (5U79SP011193-95) provided to the Washington State, Department of Social and Health Services, Division of Behavioral Health and Recovery. SAMHSA had no role in the study design, literature collection, analysis or interpretation, writing the manuscript, or the decision to submit the paper for publication.

Contributors

Andrea Stone prepared initial first draft of the manuscript. Linda Becker conducted supplemental literature searches and provided summaries of included dissertation results. Alice Huber provided organization for content including substantial restructuring of final draft. Richard Catalano provided the initial foundation and structure for this manuscript and contributed significantly to the introduction, discussion, and layout of the article. All authors contributed and have approved the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

Acknowledgments

The authors would like to thank the Washington State, Department of Social and Health Services, Division of Behavioral Health and Recovery, for providing the resources necessary to conduct this review.

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