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Gender Differences in Factors Influencing Alcohol Use and Drinking Progression Among Adolescents

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Abstract

While prevalence rates for alcohol use and related disorders differ widely between adult men and women, male and female adolescents do not exhibit the same disparity in alcohol consumption. Previous research and reviews do not address the emergence of differences in drinking patterns that occur during late adolescence. Therefore, a developmental perspective is presented for understanding how various risk and protective factors associated with problematic drinking affect diverging alcohol trajectories as youth move into young adulthood. This review examines factors associated with risk for developing an alcohol use disorder in adolescent girls and boys separately. Findings indicate that certain biological (i.e., genetic risk, neurological abnormalities associated with P300 amplitudes) and psychosocial (i.e., impact of positive drinking expectancies, personality characteristics, and deviance proneness) factors appear to impact boys and girls similarly. In contrast, physiological and social changes particular to adolescence appear to differentially affect boys and girls as they transition into adulthood. Specifically, boys begin to manifest a constellation of factors that place them at greater risk for disruptive drinking: low response to alcohol, later maturation in brain structures and executive function, greater estimates of perceived peer alcohol use, and socialization into traditional gender roles. On an individual level, interventions which challenge media-driven stereotypes of gender roles while simultaneously reinforcing personal values are suggested as a way to strengthen adolescent autonomy in terms of healthy drinking decisions. Moreover, parents and schools must improve consistency in rules and consequences regarding teen drinking across gender to avoid mixed messages about acceptable alcohol use for boys and girls.

Keywords

Alcohol; Gender; Adolescent; Risk factors

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Gender differences in alcohol use and associated problems have been the focus of much prior research. It has been consistently shown that adult males consume more alcohol and have more alcohol-related problems than females (Substance Abuse and Mental Health Services Administration, 2008), which has led the majority of early alcohol research to focus primarily on alcoholism among men (e.g., Curran & Booth, 1999) and their male offspring (e.g., Holguin, Porjesz, Chorlian, Polich, & Begleiter, 1999; Schuckit & Gold, 1988). However, the same discrepancy in prevalence rates for alcohol involvement observed in adults is not mirrored in adolescents. Rates of experimental drinking among American youth ages 12 to 18 do not differ by gender (Center for Disease Control and Prevention, 2006; Johnston, O'Malley, Bachman, & Schulenberg, 2008). In fact, boys and girls only begin to diverge in rates of AUDs around age 18, with symptom profiles demonstrating gender-specific patterns (Young et al., 2002). Given this, the developmental periods of late adolescence through early adulthood should be an important focus of efforts to explain why more adult men develop problems in drinking than women. Currently, no theoretical model speaks to which risk and protective factors account for this shift from relatively similar drinking patterns in youth, to the considerable gap in alcohol use and related problems which emerges in late adolescence and persists into adulthood.

Problematic alcohol use has increasingly been identified as a developmental problem (Brown, 2001; Helzer, Burnam, & McEvoy, 1991). While various endogenous and exogenous risk factors have been developmentally linked to underage drinking (Masten, Faden, Zucker, & Spear, 2008), and problematic drinking in adulthood (Zucker, 2008), there is not a clear understanding of how risk factors may differentially influence drinking from late adolescence into early adulthood to account for the drastic changes in rates of drinking and alcohol use disorders between genders. The present review uses a developmental, biopsychosocial perspective to examine gender differences in relationships between known risk factors for drinking and problematic drinking from adolescence into young adulthood.

Studies examining gender differences in the risk factors, course, and recovery of problematic drinking patterns have historically considered alcohol use disorders among adults. Nolen-Hoeksema's (2004; Nolen-Hoeksema & Hilt, 2006) reviews of the adult alcohol literature suggest that although the same risk factors may be in place for men and women, men are more likely to carry the endogenous vulnerabilities and exogenous risks that increase their likelihood of meeting criteria for an alcohol use disorder (AUD). Specifically, the review points to women's physiological sensitivity to lower doses of alcohol, greater social sanctions against drinking, and increased risk for physical and sexual assault resulting from alcohol consumption as factors which serve to prevent female drinkers from engaging in heavier alcohol use.

Our goal in the present review is to identify which of the risk factors for drinking are specifically operating from adolescence into adulthood. As such, we have not attempted to give an exhaustive review of the literature on risk factors for AUDs, as this has been done previously (e.g., Hasin, Hatzenbuehler, Keyes-Wild, & Ogburn, 2007; Nolen Hoeksema, 2004; Nolen Hoeksema & Hilt, 2006). Rather, we are critically evaluating the research in risk factors to determine which are most critical during the developmental period from adolescence (approximately age 13–18) into early adulthood (approximately age 18–25) to explain discrepancies in problematic drinking in adulthood. A clearer understanding of the factors facilitating and inhibiting male and female drinking patterns through early and late adolescence will inform both prevention with youth and intervention with adults.

We will first place the issue of gender differences in alcohol use disorder in the context of a developmental, biopsychosocial model. We will then discuss the clinical and practical definitions associated with alcohol use and misuse for youth and rates of alcohol use and disorders of use for adults and adolescents by gender. Third, we will explore the shared

biological and psychosocial risk factors contributing to alcohol use for both male and female adolescents. Fourth, we will address the factors which differentially affect boys and girls' risk for progression into more maladaptive drinking patterns as they enter into adulthood. Finally, this paper will consider clinical implications of gender differences in drinking patterns, and recommend ways future studies can further investigate alcohol involvement for male and female youth.

A Developmental, Biopsychosocial Model

In order to understand how boys and girls can move from similar patterns of experimentation in adolescence to such differing rates of AUDs in adulthood, it is important to take a developmental approach. While normal patterns of experimental use with alcohol may be similar for male and female adolescents, as boys enter into early adulthood, their repeated use increases and places them at greater risk for abuse or dependence. Conversely, the manifestation of symptoms and alcohol-related consequences experienced by girls may serve a protective function that carries into adulthood. The diverging patterns of alcohol involvement and consequences for men and women signify a need for examining these trajectories separately.

Theoretical and empirical literature describing the risk and protective factors for AUDs can also be explicated through a biopsychosocial approach. This approach, originally described by Engel (1977, 1980), argued that in order to fully understand and treat any type of disease, health professionals should consider cultural, social, and psychological factors in addition to biological indices that tended to be the primary markers of diagnosis and treatment. It has since been argued that problematic alcohol use has to be approached from this perspective as a means of fully understanding this complex set of problems (Zucker, 2006). We have used this approach to guide our understanding of developmental processes and gender differences discussed in this review. Although the majority of studies reviewed here examine specific factors based in a biological, psychological, or social/environmental perspective, the culmination of research suggests that a complete picture of the "heritability" of risk for AUDs must incorporate multiple internal and external components.

We examined known risk factors for alcoholism by searching PsychINFO databases using keywords: 'gender differences'; 'alcohol'; 'adolescent'. Findings were then evaluated to determine whether the risk factor was "shared" or "different" across gender. Additional studies were sourced from recent reviews from the adolescent and adult literature (Amaro, Blake, Schwartz, & Flinchbaugh, 2001; Nolen-Hoeksema, 2004).

Definitions and Prevalence Rates for Alcohol Use Disorders (AUDs)

Definitions and Operationalizations

According to the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR; American Psychiatric Association, 2000), *Alcohol use disorders* are the alcohol-related disorders that are encompassed by the generic criteria used to define and describe abuse and dependence across all substances. More specifically, *Alcohol dependence* refers to a severe and persistent pattern of alcohol use which results in psychosocial or medical impairment. Symptoms can include physiological dependence, such as tolerance and withdrawal, and/or an inability to control the amount of drinking, inability to cut down even when one is experiencing problems, spending a lot of time drinking, and giving up relationships and activities in order to drink. *Alcohol abuse* also involves the consumption of alcohol despite the psychosocial problems resulting from use; however, abuse does not include the same compulsive drinking pattern or physical symptoms of alcohol tolerance and withdrawal that are observed in dependence.

Binge drinking, although not a diagnostic term formally included in the DSM-IV-TR, is often highlighted in research due to the diverse physical and social ramifications specifically associated with heavy, episodic drinking. This term has garnered some debate due to gender, weight, and age differences in the absorption of alcohol (Wechsler, Dowdall, Davenport, & Rimm, 1995). We define *binge drinking* in accordance with the 2004 guidelines approved by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) as the consumption of alcohol sufficient to elevate blood alcohol concentration to .08; commonly, this level of consumption is considered five or more drinks in men and four or more drinks in women within two hours. The NIAAA council recognizes in their formal statement that some individuals may require fewer drinks than those described for the “typical adult” to experience a binge-level blood alcohol concentration, but alternative amounts or distinctions are not made (NIAAA, 2004).

Adult Drinking Patterns

Multiple epidemiological studies have estimated prevalence rates for alcohol use and related disorders among adults using nation wide samples. For example, the Substance Abuse and Mental Health Services Administration (SAMHSA)’s National Survey on Drug Use and Health (NSDUH; SAMHSA, 2008) indicates that 61.2% of those aged 18 to 25 and 54.1% of adults over 25 are “current drinkers” (i.e., reported drinking at least one alcoholic beverage in the past month). When 18 to 25 year olds are examined by gender, 65.3% of men compared to 57.1% of women reported some current alcohol use. Approximately 60.8% of men and 47.9% of women aged 26 years or older endorsed current drinking. Thus, the gender disparity in drinking rates is considerable in an adult population.

Among adults, drinking patterns differ by age and gender. Diagnoses of abuse and dependence peak at approximately 16.8% for individuals ages 18–25. Prevalence rates for AUDs decrease with age, with 6.2% of adults 26 years or older and only 1.3% of those over age 64 meeting criteria for abuse or dependence (SAMHSA, 2008). Many purport that this rise in problematic use during early adulthood is related to increased autonomy and fewer environmental restrictions (e.g., Chen & Kandel, 1995). Further, the decline in problematic drinking observed by the mid-20s is largely impacted by increased responsibility due to life transitions, such as regular employment, marriage, and parenthood (Zucker, Fitzgerald, & Moses, 1995).

Surveys and studies have repeatedly demonstrated that male drinkers are at higher risk than female drinkers for developing AUDs (WHO, 1999). For example, the National Comorbidity Survey (NCS) estimates that during the course of their life, approximately 12.5% of men and 6.4% of women will meet diagnostic criteria for alcohol abuse. Furthermore, 20.1% of men will meet full criteria for dependence, while only 8.2% of women will endorse symptoms necessary for diagnosis (Kessler et al., 1994). Results from the National Longitudinal Alcoholic Epidemiological Survey (NLAES) mirror the gender discrepancies for lifetime prevalence rates with 18.6% of men versus 8.4% of women meeting criteria for alcohol dependence (Grant, 1997). Similar to theories suggested for age-related differences, consistent differences in alcohol use for men and women are believed to result from the culmination of social and biological factors related to drinking and drunkenness described in detail elsewhere (Nolen-Hoeksema, 2004; Nolen-Hoeksema & Hilt, 2006).

Adolescent Drinking Patterns

National surveys examining prevalence rates for alcohol use and misuse among adolescents tend to describe alcohol involvement by any lifetime or current drinking and rates of binge drinking rather than diagnostic criteria. By the time youth have reached adolescence (6th grade), almost 30% have had some experience with alcohol (29.4%; Donovan et al., 2004). Monitoring the Future (MTF) data (Johnston et al., 2008) for U.S. students indicate a large increase in any

past 30-day use when youth move from 8th to 10th grade (15.9% to 33.4%), and rates jump again in 12th grade (44.4%). Although the prevalence rates for regular drinking escalate into young adulthood, past 30-day alcohol use among boys and girls do not foretell the significant differences in AUDs observed later in male and female adults. For instance, recent SAMHSA (2008) data indicate that female and male adolescents (12–17 years) report remarkably similar rates for current drinking, 16.0% and 15.9% respectively.

Among youth, reported number of binge drinking episodes is considered a marker for dangerous or hazardous use. Prevalence rates for U.S. high school student binge drinking are estimated to be approximately 10.3%, 21.9%, and 25.9 % for 8th, 10th, and 12th grade students, indicating an increase in dangerous drinking behaviors with age (Johnston et al., 2008). Moreover, information gained from 8th, 10th, and 12th grade students through the annual MTF survey (Johnston et al., 2008) shows that although more 12th grade boys than girls report binge drinking (30.7% versus 21.5%), this difference is considerably less among 10th grade adolescents (23.4% versus 20.4%), and in the case of 8th graders, the difference is negligible (10.4% versus 10.0%).

Although not a nation-wide sample, Young et al. (2002) conducted a study with a community-based sample of 3072 adolescents to determine rates for youth meeting abuse and dependence criteria. Interestingly, results revealed distinct cohort effects in which rates of AUDs were not statistically different for girls and boys aged 12 to 17. For participants in the 18-year cohort, however, males showed significantly higher rates of substance use disorders relative to females in the same age group. It appears that prevalence rates for early use among teens may be similar for girls and boys, but as youth enter into young adulthood, boys become increasingly more at risk for problematic drinking and AUDs.

Shared Risk Factors for Alcohol Use and Related Disorders

In order to better understand which factors contribute to the disparity in adult AUDs, it is necessary to first examine which risk factors appear to be shared in early adolescence.

Biological Influences

Research aimed at understanding biological influences of the etiology of AUDs has investigated the role of genetics and physiological response to alcohol.

Genetic Risk—Research consistently demonstrates an intergenerational transmission of risk for some forms of problematic drinking (e.g., McGue, 1999). Strong evidence for genetic risk is best illustrated by studies examining the probability of developing an AUD for children of alcoholics (COA) versus those with non-diagnostic parents (McGue, 1997; Schuckit, 1998; Slutske et al., 2008), and research with twin pairs and adopted children (Grant et al., 2006; Zuckerman, 1999). Unfortunately, however, most genetic research interested in discovering heritable components in the emergence of AUDs has focused on adult populations.

Studies addressing genetic risk during adolescence, which have made use of data from sibling, twin and adopted pairs (Rhee et al., 2003), as well as multiple longitudinal twin samples (Pagan et al., 2006) have found that although the initiation of alcohol use and social drinking were only minimally related to genetic risk, problematic use in this age range appears highly heritable. Rose and colleagues' (2001) work further signifies the importance of investigating the impact of age on heritability. The authors report that the genetic contribution to problem drinking in youth is only modest in mid-adolescence, but this biological risk actually increases as teens mature into late adolescence. A recent study has demonstrated that the genetic risk for alcohol use is highly correlated with friends' alcohol use, highlighting the complicated interaction of genetic and environmental variables in explaining teen alcohol use (Fowler et

al., 2007). Although twin and adoption studies offer some of the most compelling evidence for genetic risk, interpretation of findings should always consider that an assumption of equal environments is being made in terms of the influence of environmental factors on a trait for twin or sibling pairs. Also, as previously mentioned, adolescents represent a distinct group of drinkers, inasmuch as studies evaluating diagnostic levels of alcohol involvement may be limited in their ability to adequately identify problematic drinkers due to the criteria being less appropriate for youth.

To date, researchers have identified and studied the variants of three genes associated with the encoding of alcohol-metabolizing enzymes, ADH1B, ADH1C, and ALDH2 (e.g., Edenberg, 2007; Eng, Luczak, & Wall, 2007). These genes help explicate large disparities in prevalence rates of AUDs among different ethnic groups, with East Asian populations exhibiting the greatest protection against alcohol dependence (Edenberg, 2007; Eng et al., 2007; Grant et al., 2004) and people of European American and Native American descent displaying increased alcoholism risk (Edenberg, 2007). Recent research has identified other promising candidates specifically among adolescents: polymorphisms in the DRD2 receptor, the DRD4 receptor, the dopamine transporter (DAT1; SLC6A3), and the serotonin transporter (5HTT; SLC6A4; Hopfer et al., 2005)

Some twin studies suggest that heritability is higher among men than women (Cloninger, 1987; Zuckerman, 1999). Zuckerman's (1999) investigation of concordance rates in male and female twin pairs shows that male monozygotic twins have the highest rates (68–76%), with female monozygotic twins demonstrating significantly lower rates (32–47%). However, results from studies utilizing larger samples of adult male and female twin pairs counter these results. Here, genetic risk factors are equally influential on the development of AUDs in men and women (Heath et al., 1997; Prescott, Aggen, & Kendler, 1999). There is also some work with adult samples suggesting that there are gender differences in the effects of various candidate genes in explaining AUDs (Wodarz et al., 2003). One possible explanation for inconsistent findings in genetic risk across genders is that genetic effects may interact differently with environmental factors such as parenting factors across genders (Miles, Silberg, Pickens, & Eaves, 2005). However, more research is needed to explore this further. Clearly, the impossibility of parsing out the environmental factors in research examining heritability of AUDs in adolescents, as well as the limitations of diagnostic criteria when assessing men versus women (Searles, 1988) suggest findings should be interpreted with caution.

It is difficult to discern which of the aforementioned findings with adult samples best translates to an adolescent population. Silberg, Ritter, D'Onofrio, and Eaves (2003) conducted a prospective follow-up study to examine genetic risk factors for substance abuse in same-sex twin pairs ages 12 to 17. Since the study was targeting the progression of alcohol use in youth, the authors considered alcohol use to be present if either the parent or child endorsed at least one alcohol drink in the past three months without parental permission. Results indicated that girls' alcohol involvement, both the initiation and continuation of use, was largely influenced by genetic factors. Conversely, environmental factors were more influential on the continuation of boys' drinking over time. The effect of genes on use for male teens was limited to early use of alcohol.

Taken together, these findings provide evidence for a genetic contribution in the heritability of alcohol use and AUDs for men and women. More recent studies with increased sample size and female participants suggest that the degree to which genes predict disordered drinking is more similar than originally thought (Prescott, 2002). What remains uncertain, however, is the manner in which genetic risk operates for each gender and to what extent other biological, psychosocial, and cultural factors differentially impact boys and girls' genetic alcoholism risk.

Thus, future studies should not only examine various risk and protective together, but also investigate how these interact and influence drinking patterns over time.

Neurobiological Risk—Another physiological vulnerability for the development of AUDs is neurocognitive and neurophysiological abnormalities in COAs (see Tapert & Schweinsburg, 2005 for a review). For example, attention and cognitive processing are assessed by measuring brain-evoked potentials, electrical signals produced by the brain in response to a stimulus. Studies investigating the link between the P300 event-related potential (ERP) and risk for AUDs in youth have found reduced amplitudes in children with a family history of alcoholism (e.g., Begleiter, Porjesz, Bihari, & Kissin, 1984; Hill & Steinhauer, 1993). Cloninger (1987) purports that these reduced amplitudes are indicative of an inability to distinguish novel stimuli from a set of common stimuli. Moreover, they are associated with stimulation of the dopaminergic pathways and reflective of novelty-seeking and impulsivity, heritable traits often associated with risk for alcoholism (Cloninger 1987).

In addition, children and adolescents from alcoholic families demonstrate reduced right amygdala volumes (Hill et al., 2001). Parts of the limbic system, and specifically the amygdala, have been identified as critical in P300 generation. Since the amygdala is involved in the execution and inhibition of emotional behavior, it is hypothesized that these neurophysiological differences are indicative of vulnerability for alcohol use and dependence because of cortical disinhibition, or hyperexcitability, in the central nervous system (Begleiter & Porjesz 1999). Although the National Institute on Alcohol Abuse and Alcoholism (NIAAA; 1997) notes that these abnormalities may be indicative of more global neurological and cognitive developmental differences, some research does show that low P300 amplitude in young children is predictive of alcohol and other substance abuse in adolescence (Berman, Whipple, Fitch, & Noble, 1993; Hill, Steinhauer, Lowers, & Locke 1995).

The existing neurobiological literature investigating alcohol use and abuse provides interesting, albeit limited, evidence regarding the P300 amplitude as a potentially important factor in understanding gender differences in drinking patterns during the transition from adolescence to adulthood. Since the P300 amplitude naturally increases throughout adolescence and into adulthood, the gap between COAs and controls lessens in adulthood (Polich, Pollock, & Bloom, 1994). Further, most research examining electrophysiological responses and risk for alcoholism have looked primarily at boys and men. Research with daughters of alcoholics also shows significantly reduced P300 amplitudes in comparison to daughters of controls. Although the disparity observed between groups is smaller for daughters than for sons of alcoholics (Hill & Steinhauer, 1993; Hill, Muka, Steinhauer, & Locke, 1995), the overall patterns are similar. As in genetic risk, the P300 amplitude as a risk factor changes with age (Polich et al., 1994). Thus, although a potentially important area of study for understanding the emergence of gender differences in alcohol involvement during adolescence, at present this neurobiological risk measure has not consistently demonstrated gender specific or increasing gender differences with age.

Individual Factors

Within the biopsychosocial framework of AUDs, individual factors on adolescent drinking behavior include alcohol expectancies and personality characteristics.

Alcohol Expectancies—Family history of alcoholism as a vulnerability for adolescent alcohol involvement is not limited to genetics. Cognitive social learning theory posits that youth form beliefs and attitudes and model their behavior based on what is observed in the home (Bandura, 1977). It is therefore hypothesized that these cognitive schema regarding the use and effects of alcohol, referred to as alcohol expectancies, represent a learning history

shaped largely by parental modeling (Goldman, Brown, Christiansen, & Smith, 1991). Within a broad community sample of youth, positive alcohol expectancies have been associated with habitual drinking patterns (Christiansen, Goldman, & Inn, 1982), with increased positive expectancies related to increased risk for the development of alcohol abuse and dependence (Brown, Creamer, & Stetson, 1987; Christiansen, Goldman, & Brown, 1985). Moreover, COAs not only expect significantly more cognitive and motor enhancement from drinking than family-history-negative adolescents (Brown et al., 1987), but they also possess an attentional bias, or preoccupation, for alcohol-related stimuli (Zetteler, Stollery, Weinstein, & Lingford-Hughes, 2006). Youth therefore formulate “alcohol schema” by attending to and generating beliefs around parental drinking prior to personal use (e.g., Zetteler et al., 2006; Zucker et al., 1995).

A substantial amount of research has focused on identifying gender differences in perceptions of drinking outcomes among adults. While most studies demonstrate a greater relationship between positive expectancies and alcohol use variables in men than women (Cooper et al., 1992; Johnson & Glassman, 1999), findings regarding the relationship between expectancy domains and degrees of expectancies for men and women are equivocal across gender. Some findings suggest that men have more positive expectancies, especially beliefs regarding alcohol and the reduction of tension and negative affect than women (Brown, Goldman, Inn, & Anderson, 1980). Conversely, women were more likely to expect increased physical and social pleasure (Williams & Ricciardelli, 1996) and assertiveness (Baldwin, Oei, & Young, 1993) than men.

Although less research has been conducted investigating gender differences among youth, some findings among adolescent populations do not parallel adult gender patterns. Chen, Grube, and Madden (1994) assessed the beliefs and drinking patterns of 1,781 high school students to determine whether the structure of alcohol expectancies and their relation to alcohol involvement differed for boys and girls. Results indicated very similar patterns regarding the impact of alcohol expectancies on use across gender. Beliefs about alcohol were most predictive of usual quantity consumed per drinking occasion and less predictive of drinking frequency. More specifically, positive expectancies predicted quantity over frequency for both sexes. Although the factor structure of alcohol expectancies is similar for boys and girls (Chen et al., 1994; Randolph, Gerend, & Miller, 2006), negative expectancies are more predictive of usual quantity consumed than drinking frequency for male adolescents. In contrast, negative expectancies are equally predictive of drinking quantity and frequency among female students.

It appears that among youth, gender differences regarding the overall impact of perceptions about drinking on quantity of alcohol consumption may be negligible. Interestingly, positive expectancies are more similar between genders than negative expectancies, a pattern not mirrored in adults. Furthermore, these negative beliefs about alcohol use differentially impacted drinking frequency for boys and girls. Given that frequency of alcohol consumption is dictated more by availability than cognitions in underage drinkers (Brown et al., 2008), alcohol expectancies serve a similar role in early drinking decisions for both sexes. It is clear that beliefs and expectations regarding alcohol use and cessation are not stagnant. Instead, they are shaped from childhood through adulthood by myriad factors that while dynamic, do not appear to differentially impact males and females in early adolescence. In fact, research examining expectancies, personality, and neuroanatomy suggests that extraversion is associated with greater positive expectancies for drinking in early adolescence (Anderson, Schweinsburg, Paulus, Brown, & Tapert, 2005) while disinhibition yields a stronger relationship with positive alcohol expectancies in college samples (Anderson, Smith, & Fischer, 2003; McCarthy, Kroll, & Smith, 2001). Thus, beliefs about the positive and negative consequences of drinking are shaped and altered by brain and social development.

Personality Characteristics—Personality traits or characteristics reflective of behavioral and emotional dysregulation are associated with increased risk for problematic drinking among adolescents (Caspi, Moffit, Newman, & Silva, 1996; Sher, 1991). While a number of constructs in the dysregulation realm overlap, recent studies suggest that disposition to fast action is comprised of sensation-seeking, lack of planning, lack of persistency, urgency to act in negative emotional states, and urgency to act in positive emotional states (Smith, Fischer, Cyders, Annus, Spillane, & McCarthy, 2007). In particular, sensation-seeking appears to be associated both cross-sectionally and longitudinally with the frequency of engaging in risky behaviors; whereas urgency to act in the face of strong affective states appears more related to problem levels of alcohol involvement. Of note, COAs are more likely than family-history-negative youth to display such personality traits in cross-sectional studies (Sher, 1991; Windle, 1990). A long history of research suggests a strong relationship between this domain of personality traits and multiple types of risk-taking behaviors. Seeking out novel and potentially risky situations offers one explanation as to the role of temperamental style in the etiology of AUDs (e.g., Cloninger & Sigvardsson, 1996; Crawford, Pentz, Chou, Li, & Dwyer, 2003; Zucker & Gornberg, 1986; Zuckerman, 1979, 1987, 1994). Although sensation or novelty seeking is classified as a personality characteristic, evidence indicates that these behavioral patterns are time-varying and can be changed (Bardo, Donohew, & Harrington, 1996; Zuckerman, 1994).

Considering gender differences in personality traits as a risk factor for AUDs, Caspi and colleagues (1996) found that 3-year-old boys who were identified as having problems with behavioral control and impulsivity were at an increased risk for alcoholism and alcohol-related problems at age 21; however, this same pattern was not found for girls. In contrast, Martin, Lynch, Pollock, and Clark (2000) specifically investigated whether behavioral undercontrol and negative affectivity were differentially associated with alcohol use in adolescent boys and girls. Although they found that males scored significantly higher on behavioral undercontrol and significantly lower on negative affectivity, increases in both characteristics were associated with increased alcohol involvement of both boys and girls during adolescence. The authors therefore purport that these personality traits operate similarly in girls and boys during early development. However, as adolescents age, the impact of gender-specific environmental factors (e.g., parental monitoring and gender-specific cultural values) have increased influence over emotional and behavioral regulation (e.g., Hawkins, Catalano, & Miller, 1992; Sher, 1991).

Zucker (2008), in his argument for adopting a developmental perspective to understand the relationship between undercontrol/externalizing symptoms and problem drinking, also considers these traits to be largely non-gender specific. Existing studies have either not found a gender difference in behavioral undercontrol – problem-drinking relationship (3 of 6 studies - examined), or that the relationship between predictor and drinking outcome is strongly influenced by the specific predictor variable used to assess externalizing behavior, the particular developmental stage being investigated, and cognitions associated with the risk behavior (Dubow, Boxer, & Huesmann, 2008; Englund, Egeland, Oliva, & Collins, 2008; Fischer & Smith, 2007; Maggs, Patrick, & Feinstein, 2008; Merline, Jager, & Schulenberg, 2008; Peck, Vida, & Eccles, 2008; Pitkanen, Kokko, & Pulkkinen, 2008). These findings do not provide proof of increased alcoholism risk for one sex, but instead suggest a dynamic relationship between personality factors and alcohol involvement for both male and female adolescents.

Delinquency and deviance proneness are two other related traits identified as risk factors for AUDs (Donovan & Jessor, 1985). Among youth, alcohol use has been viewed as a manifestation of a larger spectrum of problem behaviors (Hawkins et al., 1992). Further, delinquent and aggressive behaviors often manifest as externalizing disorders (e.g., conduct disorder, oppositional defiant disorder), and in turn, are associated with increased risk for

developing an AUD (Vaillant, 1983). However, controversy exists regarding gender differences and the conceptualization of conduct problems. Some suggest including measures of relational aggression in order to avoid underestimating aggressive tendencies in young girls (Crick, 1996). Even with consideration of the higher prevalence rate of deviant behavior and conduct disorder among male adolescents compared to female adolescents, Moffitt, Caspi, Rutter, and Silva (2001) found similar results across genders. A diagnosis of conduct disorder during adolescence was predictive of alcohol dependence at age 21 for both boys and girls. In sum, boys may be at increased risk for exhibiting behavioral problems indicative of deviant personality traits or disorder, but the relationship that these characteristics have with alcohol use onset and later progression to dependence appears to operate similarly across gender.

Risk Factors Influencing Divergent Drinking Trajectories

Experimentation with drugs and alcohol during adolescence is considered a normal part of social development for both girls and boys. However, it is also a time during which inherent vulnerability interacts with physiological and social developmental changes that either reinforce or restrict specific behavioral patterns. Monitoring and evaluating alcohol involvement over time is therefore useful in depicting how various biological and environmental changes influence the progression of alcohol involvement from adolescence into adulthood (Chassin, Flora, & King, 2004).

Hormonal and Physiological Change

Due to the multitude of biological changes that occur during adolescence, boys and girls' drinking behaviors are differentially impacted by gender disparities in alcohol sensitivity and neurocognitive development.

Alcohol sensitivity—Alcohol sensitivity refers to both objective (e.g., body sway) and subjective (e.g., self-reports of level of intoxication) measures of alcohol effects. It is hypothesized that low response to alcohol may be indicative of a genetic vulnerability to problem drinking (e.g., Schuckit & Gold, 1988). Due to ethical considerations regarding administering alcohol to youth for research, most of what we know about developmental differences in absorption and elimination of alcohol has been extrapolated from animal studies. Animal models suggest that across species adolescents are less sensitive to the negative consequences of alcohol use, such as loss of motor coordination (White et al., 2002), sedation (Little, Kuhn, Wilson, & Swartzwelder, 1996), and withdrawal symptoms/hangover effects (Acheson, Richardson, & Swartzwelder, 1999), than their more mature counterparts. Although no definitive conclusions have been reached regarding adolescents' reduced sensitivity to the unpleasant effects of alcohol, the developmental status of the GABA and dopamine systems have been implicated as a mechanism responsible for these observed differences (Moy, Duncan, Knapp, & Breese, 1998). GABA_A receptor activation, which promotes neuronal inhibition, is thought to be a primary mechanism of ethanol-induced sedation (Liljequist & Engel, 1982). In rats, ethanol enhances GABA receptor-mediated neurotransmission more powerfully through development (Li, Wilson, & Swartzwelder, 2003; Silveri & Spear, 2002), suggesting that as rats age, they are more sensitive to the inhibitory effects of ethanol such as sedation. While these findings cannot be directly translated to the human experience, changes in alcohol sensitivity as humans age may account for the intense, and quick sedation response seen in adults compared to adolescents (e.g., Little et al., 1996), and cause adults to stop drinking after a short period of time compared to teens. Thus, the neurological and physical growth that occurs over the course of adolescence is a key factor in understanding changes in alcohol sensitivity.

In human adults, research has indicated that sons of alcoholics tend to exhibit lower sensitivity to alcohol ingestion than sons of non-alcoholics (Pollock, 1992; Schuckit & Gold, 1988).

Moreover, men who demonstrate reduced sensitivity to moderate doses of alcohol, both through measures of motor and cognitive performance and subjective feelings of intoxication, are more likely to become alcohol dependent than men with greater reactivity (Schuckit & Smith, 1997). Although a direct causal relationship has yet to be shown, it is hypothesized that in general, men experience lower alcohol reactivity and therefore face increased risk for problematic drinking because they require more alcohol than their female counterparts in order to feel drunk. Over time, this may contribute to tolerance and subsequent increases in consumption.

Alcohol sensitivity has been proposed as a protective factor for women in the development of alcohol use disorders. Adult women appear to suffer more from the negative motor and cognitive deficits resulting from drinking in comparison to men (Nixon, 1994). Dougherty, Bjork, and Bennett (1998) conducted a study in which male and female participants consumed either three placebo or alcoholic beverages on six consecutive days. After ingestion, participants performed a rotary pursuit task. Within the alcohol group, women displayed greater impairment on the task relative to men, even with similar breath alcohol concentration levels. Furthermore, women actually became more sensitive to the negative effects of alcohol on their performance over the course of the experiment, and also reported increased feelings of intoxication. Men, however, were more likely to develop tolerance and fewer subjective intoxicating effects across days. While these findings provide subjective and objective measures of alcohol sensitivity for men and women, the study did not include a clinical sample of drinkers to determine whether the same differences exist for those already at or near meeting diagnostic criteria for alcohol use.

Although studies of alcohol reactivity and sensitivity do not include the administration of alcohol to an adolescent population, recent investigations of level of response to alcohol have utilized a self-rating questionnaire with teens. In a pair of studies by Schuckit and colleagues (2005a,b), adolescents estimated the number of standard drinks needed to obtain up to four effects of intoxication (e.g., slurred speech, falling asleep, stumbling) for the first five drinking occasions. Results mirrored those found within adult alcohol challenges, indicating that level of response to alcohol as a genetically influenced phenotype can be examined ethically and effectively through the use of a self-report questionnaire. Furthermore, the average number of drinks reported by male adolescents was significantly more than that reported by females in order to experience similar effects of drinking. Thus, the greater quantity of alcohol required to achieve intoxication for boys may contribute to increased alcohol involvement as they move into young adulthood.

Additional conclusions can be drawn regarding gender differences in alcohol sensitivity by examining physiological developmental transitions. For instance, the profound physical and hormonal changes during puberty result in increased body fat among girls and increased muscle mass among boys. Girls therefore have a smaller volume of water than boys in which to distribute ethanol. Thus, girls experience a higher blood alcohol concentration (BAC) in comparison to their male counterparts when given a dose of ethanol that is proportionate to body weight (NIAAA, 1993). Young et al.'s (2002) previously discussed study adds a subjective layer to these objective physiological differences. First, consistent with the animal studies, alcohol abusing and dependent teens rarely endorsed symptom items of 'withdrawal' or 'continued use despite physical or psychological problems.' Secondly, gender differences were detected within both the alcohol users (i.e., social drinkers) and abuse/dependence groups. Tolerance rates were significantly higher for male than female youth.

Overall, it appears that there is consistent evidence regarding the variation in reactivity to alcohol consumption and physiological development. The aforementioned gender differences

suggest that sensitivity may be an important factor affecting diverging alcohol use trajectories for boys and girls in later adolescence and early adulthood.

Neurocognitive Development—Neurocognitive characteristics have been posited as both a risk factor preceding the development of an AUD (Giancola & Tarter, 1999; Peterson & Pihl, 1990; Pihl, Peterson, & Finn, 1990), as well as a consequence of protracted drinking in adults (e.g., Sullivan, Rosenbloom, & Pfefferbaum, 2000) and teens (e.g., Brown et al, 2008; Brown, Tapert, Granholm, & Delis, 2000). Specific attention has been given to the role of executive functioning as a precursor to problematic alcohol use because of the potential relationship between neurocognitive deficits and diminished decision-making capacity. Executive functioning refers to a higher-order cognitive construct involving the organization and regulation of cognition and goal-directed behavior. It includes such abilities as working memory, attentional control, problem-solving, abstract reasoning, and response suppression/behavioral inhibition (Stuss & Benson, 1984).

The prefrontal cortex has been identified as the primary neural substrate necessary for the aforementioned cognitive processes (Fuster, 2002). From a developmental perspective, it has been noted that the ability to perform executive functions increases parallel to the development of the prefrontal cortex from childhood, through adolescence, and into adulthood (Luciana, 2003; Sowell, Thompson, Holmes, Jernigan, & Toga, 1999). Although adolescent brains are no longer increasing in size, synaptic connections are made more efficient through axon myelination and synaptic pruning (see Brown & Tapert, 2004; Clark & Tapert, 2008 for review). This ongoing process of structural and functional development suggests that differences in neuroanatomical development could then impact the cognitive processes subsumed by this brain region.

Nigg and colleagues' (2004) prospective study investigated high-risk boys prior to the onset of substantive drinking problems. Results revealed that adolescent males from families with high levels of AUD demonstrated significantly lower scores on executive functioning tasks representative of response regulation and suppression than matched controls. In contrast, examination of female adolescents indicates that the relationship between low executive functioning and increased substance use was only supported for girls classified as having a good temperament, whereas this relationship was near-zero for girls with a difficult temperament, exemplified as one standard deviation below the overall mean on the Dimensions of Temperament Survey - Revised (Giancola & Mezzich, 2003). Thus, it appears that not only does level of executive functioning differentially impact male and female adolescents, but temperamental style plays an important mediating role in linking neurobiology to alcohol involvement. While the aforementioned study is limited by its exclusion of male participants, it highlights the importance of considering how personality characteristics, especially those involved in emotional self-regulation and inhibiting inappropriate behaviors, are related to and influenced by executive function processes.

Since these findings appear somewhat divergent, neurocognitive functioning can be elucidated by considering normal prefrontal cortical development. Hooper, Luciana, Conklin, and Yarger (2004) found that among a group of healthy boys and girls, adolescents ages 14 to 17, performed better on tasks targeting the ventromedial prefrontal cortex than younger adolescents. Furthermore, average scores for only 17-year-old participants were still significantly lower than those reported for adults on the same tasks, offering further evidence that brain maturation occurs through adolescence and into young adulthood (Giedd, 2008; Hooper et al., 2004). Of interest are the gender differences in this maturation. Girls demonstrated a greater preference for infrequent punishment over possibly advantageous choices in a computerized card task. Also, female adolescents outperformed their male counterparts on a go/no-go task, indicating better sustained attention and inhibition of a prepotent response (Hooper et al., 2004).

Recent imaging data of adolescent male and female brains also indicate gender differences in anatomical development. Gray matter volumes tend to peak in nearly all cortical and subcortical brain regions for girls an average of 1–3 years earlier than boys (Lenroot et al., 2007). For example, gray matter volume in the frontal lobes peaks at age 9.5 for girls and 10.5 for boys (Geidd, 2008). As discussed, executive functioning abilities are believed to rely on the development of frontal lobe circuitry. Moreover, the basal ganglia, a group of subcortical nuclei comprised of the caudate, putamen, globus pallidus, subthalamic nucleus, and substantia nigra, are also involved in higher cognitive functions as well as the mediation of affective states and attention. Preliminary MRI data parallel the cortical gender differences, with gray matter in the caudate peaking at 10.5 years in girls and 14.0 years in boys (Geidd, 2008). Geidd (2008) purports that these differences in the trajectories of adolescent brain development for boys and girls has immediate utility for establishing endophenotypes, biomarkers used to divide behavioral symptoms into genetically based phenotypes. Since structural brain development is marked by varied maturation rates for cognitive and emotional neuronal systems, which is then further complicated by the observed differences in male and female neurological trajectories, endophenotypes provide greater insight into biological risk and protection for AUDs.

Overall then, there appears to be support for a relationship between executive functioning and AUDs for both boys and girls; however, the nature of this relationship appears to differ across gender. An examination of normal development suggests that in general, the brain regions responsible for improved attention to stimuli and reduced risky decision-making develop earlier in young girls than in boys (Giedd, 2008). Since these cognitive processes are implicated in maladaptive drinking patterns, together these findings suggest that these neurocognitive differences may be involved in the diverging trajectories for male and female adolescent drinkers. It is important to note that brain development does not occur in isolation from the rest of the body. For both boys and girls, the plasticity of the adolescent brain means that neuronal connections being formed are largely influenced by experience; thus, environmental factors, such as socialization processes discussed below, assist in generating either increased risk or protection (White, 2004).

Socialization Processes

As adolescents move beyond their family environment, the socialization process presents pronounced influences that affect teens' beliefs and attitudes towards drinking. Social roles and relationships can serve to guard against or increase the likelihood of problematic drinking.

Family Environment/Parental Monitoring—Families influence adolescent drinking in a number of important ways. Parents can model alcohol use, which has a direct effect on children's alcohol use and misuse (Chassin, Curran, Hussong, & Colder, 1996; Eitle, 2005; White et al., 2000). Conversely, some studies have found that the effect of parent alcohol use is mediated through parenting behavior (Barnes et al., 2000).

There are gender differences in the extent to which parental variables influence adolescent drinking. Parental monitoring tends to affect substance use in both boys and girls over time (Schinke, Fang, & Cole, 2008; Webb et al. 2002), and has been shown to influence boys' alcohol use more strongly than girls (Barnes et al, 2000). Recent longitudinal research with younger children has suggested that there is also a stronger direct relationship between parental alcohol use and children's intentions to drink in boys than in girls over time, meaning that boys may be more directly influenced by parental drinking than are girls (Tildesley & Andrews, 2008). However, there is also a demonstrable relationship between parental monitoring behavior and girls' alcohol use (Schinke, Fang, & Cole, 2008), and girls' intentions to use (Tildesley & Andrews), suggesting that this monitoring may be a more strong protective factor

in girls than in boys while boys may be more strongly influenced by a combination of social factors.

Peer Relationships—Peer relationships have been identified as a key risk factor in the progression of alcohol use among adolescents (Bates & Labouvie, 1995; Curran, Stice, & Chassin, 1997). Social context influences drinking behaviors through both proximal and distal perceptions of peer behavior. For instance, affiliation with a deviant peer group provides more opportunity to drink and increases consumption through the promotion of heavy alcohol use (Hawkins et al., 1992). Additionally, deviant affiliations have been found to increase alcohol use by modeling drinking as a way to cope with stress for youth lacking adaptive skills for emotional self-regulation (Richter, Brown, & Mott, 1991; Wills, Vaccaro, & McNamara, 1992). Hawkins et al. (1992) have proposed that poor parental monitoring links emotional dysregulation in teens with a deviant peer network, which in turn, promotes substance use as a coping strategy. Since cultural norms dictate a double standard for the monitoring and punishment of deviance for girls and boys, this discrepancy between genders serves as a protective factor against risk-taking for female adolescents (Byrnes, Miller, & Schafer, 1999), whereas boys have more freedom to interact with peers that teach and reinforce alcohol use.

A closer look at the role of parental support and consistency of discipline as a moderator in the relationship between peer affiliations and alcohol use further complicates this issue. Marshal and Chassin (2000) longitudinally examined the differential impact these parenting variables had on adolescents ages 10 ½ to 15 ½ to determine whether increased support and discipline was associated with increased ability for youth to resist pressure from alcohol-using peers. Although this was the case with girls, boys were more susceptible to peer influence with increased parental support and discipline. The authors suggest that boys may increase peer affiliation when they perceive parental control as a threat to their independence (Marshal & Chassin, 2000). Boys may be asserting their autonomy as a way to remain congruent with traditional gender roles (see the following section on “Socialization and Gender Roles” for more detail).

Normal social development is marked by increased independence from the home as adolescents move towards adulthood. As such, extended peer groups and affiliation become increasingly influential in drinking decisions. Teens often overestimate the quantity and frequency with which other adolescents consume alcohol (e.g., Baer, Stacy, & Larimer, 1991; Thombs, Wolcott, & Farkash, 1997; Jacobs & Johnston, 2005); moreover, misperceptions about the collective norm have been shown to impact age of drinking onset and the escalation of use (e.g., Graham, Marks, & Hansen 1991; Marks, Graham, & Hansen, 1992; Thombs et al., 1997; Jacobs & Johnston, 2005). In particular, perceived same-sex peer drinking norms are more strongly associated with problem drinking than gender-nonspecific norms (Lewis & Neighbors, 2004). Lewis and Neighbors (2004) assessed a group of young college students to determine gender differences in same- and opposite-sex peer estimates for alcohol use, and subsequently, whether these perceptions differentially impacted personal use for male and female students. They found that male participants provided significantly higher estimates for both genders, and that all students perceived girls to drink less often and consume fewer alcoholic drinks per week than boys. Moreover, they found that same-sex perceptions of drinking norms were more predictive of personal alcohol consumption for girls than boys. As older adolescents enter into young adulthood, they perceive the “typical” female to consume less alcohol than her male counterpart; this belief is likely interacting with gender role conformity (discussed below) and thus serving as a protective factor against the escalation of use in women.

In sum, both immediate deviant peer groups and more distal beliefs about the drinking behaviors of a “typical” peer are important factors in predicting alcohol involvement among youth. Gender differences emerge, however, in both the availability and acceptability of deviance; increased monitoring by parents and perceptions of discrepancies between male and female alcohol consumption serve as protection against more problematic use for girls.

Socialization and Gender Roles—Related to the influence of peer group affiliation is the process of socialization and gender identification. In fact, Landrine, Bardwell, and Dean (1988) found that attitudes and expectations regarding the acceptability of drinking and drunkenness were influenced by beliefs subsumed in traditional gender roles. It is hypothesized that men in part drink more often than women in order to accede to an aspect of masculinity. Conversely, girls and women endorsing stereotypical female characteristics (virtue, nurturance, emotionality) are likely to report reduced alcohol involvement (e.g., Ricciardelli, Connor, Williams, & Young, 2001; Wilsnack & Wilsnack, 1978). Huselid and Cooper (1992) found that adolescent attitudes towards traditional gender roles substantially mediated the relationship between gender and drinking patterns, with the greatest mediation effects for drinking to intoxication. Although the effects of gender role ideology on alcohol use were found for both genders, the effects were stronger among adolescent males. Just as parental monitoring, deviant peer groups, and the media influence perceptions of peer use (Perkins, 2003), these same factors shape beliefs regarding gender roles and the relationship of these roles to drinking (Maccoby, 1988). The same message linking masculinity to drinking and intoxication is therefore repeated by multiple sources. Thus, gender-specific attitudes are constantly reinforced for boys, making them especially reliable predictors of alcohol use as they move through adolescence.

Research in gender role identity indicates that youth differ in the degree to which they internalize gender-specific constructs and expectations, thereby making gender identity rather than biological sex a better predictor for alcohol involvement (Chomak & Collins, 1987). Socialization process models argue that girls and boys face different punishment and reinforcement from parents and teachers across adolescence, which in turn, shape their gender-appropriate attitudes and behavior (Maccoby, 1988). Adolescents then internalize these beliefs and encourage each other to behave in accordance. For instance, girls are more likely than boys to pressure same-sex friends not to drink (Keefe, 1994). Over time, it appears that the continued reinforcement across contexts of these drinking-related gender roles may contribute to the diverging trajectories observed later in young men and women. In a study examining adolescent beliefs about stopping or reducing alcohol use, girls had more positive cessation expectations than boys, even when controlling for drinking frequency and quantity (Metrik, McCarthy, Frissell, MacPherson, & Brown, 2004). These gender differences may contribute to the diverging drinking trajectories in late adolescence; girls start to believe in the positive outcomes of quitting drinking whereas boys maintain or increase use because they are not socialized to see the benefits of reducing or stopping.

Psychiatric and Polysubstance Comorbidity

Polysubstance Use—Another critical factor in the divergent paths of alcohol use between boys and girls is the concurrent use of multiple substances. Patterns of use parallel those found for alcohol, in that teen boys and girls demonstrate similar rates of drug use in adolescence, and males start to show higher quantity and frequency of use in late adolescence which maintains throughout adulthood (SAMHSA, 2008). Among adults with alcohol problems and also those without, men are more likely to currently use drugs and be diagnosed with a drug use disorder (Hanna & Grant, 1997). While there is not a definitive causal relationship between alcohol and drug use disorders, problematic use of one substance is strongly associated with use of other substances (SAMHSA, 2008), and thus the gender difference in rates of drug use

may help to explain some aspect of the gender difference in AUDs as men and women age into young adulthood.

Depression—Psychiatric comorbidity is another factor that contributes to our understanding of gender differences in alcohol use across the lifespan. Most notably, major depression is one of the most common comorbid conditions with AUDs, and is also a disorder that shows one of the strongest gender effects along with AUDs. In childhood, girls are no more likely than boys to evidence depression, but by about age 13, girls' rates of depression begin to increase sharply, whereas boys' rates of depression remain low, and may even decrease. By late adolescence, girls are twice as likely as boys to be depressed, and this gender ratio remains more or less the same throughout adulthood (Nolen-Hoeksema & Girgus, 1994). Among adults, it has been consistently shown that men are more likely to have an AUD without depression and women are more likely to have depression without an AUD (e.g. Kessler et al., 1994). However, the gender difference is less pronounced in those who have both disorders concurrently (Grant, Hasin, & Dawson, 1996). Depression and alcohol use is complex, but a clear conclusion is that depressive symptoms are a vulnerability factor for the development of an AUD in both women and men (Hanna & Grant, 1997). Research has identified various developmental factors which may underlie the emergence in depressive symptoms among girls, including stress experiences and stress reactivity (Nolen-Hoeksema, 2001). Some work has suggested that the depression and ruminative processes which often accompany depression in girls may make them more vulnerable to coping with alcohol and other drugs in early and mid-adulthood (Nolen-Hoeksema & Harrell, 2002; Harrell & Karim, 2008). Conversely, there is also a stronger relationship between substance use and depression among adolescent girls than boys (Hallfors, Waller, Bauer, Ford, & Halpern, 2005). Others have argued that higher rates of alcohol use among men are reflective of underlying depression which is masked by alcohol use (see, for example, Cooper, Frone, Russell, & Peirce, 1997). Additionally, some research suggests that the relationship between depression and elevated drinking for adolescent girls is associated with greater reported symptoms of anxiety (Poulin, Hand, Boudreau, & Santor, 2005) and incidents of sexual trauma (Champion, Foley, DuRant, Hensberry, Altman, & Wolfson, 2004). Depression clearly influences the emergence of AUDs differentially for young men compared to women; however, the exact nature of this relationship is as yet unclear.

Clinical Implications

Alcohol abuse and dependence are most often diagnosed during early adulthood when substance use peaks; however, it is fundamental to consider age and development when conceptualizing AUDs because the precursors that place individuals at risk for such clinical trajectories emerge and expand throughout adolescence. Unfortunately most treatment models and interventions utilize information gathered from an adult population and thus fail to include developmentally appropriate subject matter and skills (Brown, Mott, & Myers, 1990; Brown & Ramo, 2006). Such universal treatment approaches may ignore important gender differences in the values, beliefs, and behaviors associated with alcohol use through adolescence into young adulthood.

When exposure to alcohol is limited and prevalence rates for drinking are similar across gender, certain strategies (i.e., challenging positive alcohol expectancies, increasing parental monitoring, and teaching healthy coping responses) are equally useful for boys and girls to problematic drinking. As boys and girls move from experimentation into more regular drinking, intervention approaches need to incorporate risk factors that differentially contribute to development of AUDs for male and female youth. Since boys may be facing fewer physical consequences due to drinking (e.g., vomiting, hangover), experience tolerance more quickly (Schuckit, 2005a,b), and demonstrate delayed executive function and emotional regulation compared to female adolescents (Geidd, 2008), positive expectancies are being reinforced

while simultaneously negating the negative effects of drinking. Although motivational interviewing (MI; Miller & Rollnick, 1991) is generally utilized with populations already diagnosed with an AUD, the basic tenets of this approach (e.g., pros and cons of drinking, normative feedback) can also be used with male youth at risk for problematic drinking (Brown, Anderson, Schulte, Sintov, & Frissell, 2005). Boys may benefit more from learning basic decision-making strategies since their executive functioning skill set appears to be developing at a slower pace than that of girls. While both genders could benefit from such prevention/intervention efforts, male adolescents may require increased therapeutic dosage in order to attain the cognitive schema and skills that protect adolescent females from a trajectory of escalated alcohol involvement.

Gender-role development during youth provides a unique, and currently untapped, opportunity to shape adolescents' cognitions about what constitutes "typical" drinking behaviors for "typical" men and women. Interventions targeting teens could benefit from challenging media fostered stereotypes about masculinity and drinking. Similar to the positive impact non-using social supports have on abstinence rates of adolescent drinkers (Brown et al., 1990), the identification of positive non- or moderately-using adult male role models in the lives of young boys could counter conventional beliefs, while girls could strengthen their autonomy and reinforce decisions against drinking as a personal choice. Both individual role models and more formal alcohol interventions could therefore utilize expectancy challenging to help teens identify their expectations about drinking and abstinence, understand the factors that influence those beliefs, and provide ways in which to challenge the validity of drinking perceptions. Teens who view their drinking decisions as based on individual ideals, values, and competencies are less likely to succumb to drinking pressure presented by either immediate peers or distal concepts of gender-specific traits.

No matter how much risk is present, drinking is only possible when alcohol is made available. Since adolescents cannot purchase alcohol themselves, parents keeping alcohol in the home gives boys and girls access to alcohol that they would not otherwise have. Laws cannot prohibit adults from purchasing and possessing alcohol, but parents can be aware of the message they send to their children regarding underage drinking. For example, parents allowing "home parties" believe they are preventing dangerous drinking consequences (e.g., drunk driving, risky sexual behavior, fighting). Providing alcohol to all teens is illegal, but differences in traditional gender roles and parental monitoring would suggest that the "home parties" provided to daughters and sons are likely to differ in prevalence, frequency, and intensity, thus placing boys on a riskier drinking trajectory. It is therefore crucial to communicate through public service announcements the illegality and consequences of providing alcohol to teens.

Finally, prevention and intervention can also take place within the various communities that teens inhabit. For instance, adolescents spend the majority of their time during these developmental years in school or participating in sports or clubs on campus after class. While some extracurricular activities are not traditionally associated with alcohol (e.g., math club), others seem to be intrinsically tied to drinking within American culture (e.g. some sports). Although the schools themselves are not providing students with alcohol, their willingness to "look the other way" may be far different for intoxicated boys versus girls. Strict public policy and consistent, fair punishment for alcohol use by students while on school property could not only assist in preventing additional drinking episodes at school, but may also reduce the discrepancy in heavy drinking between boys and girls in late adolescence.

Conclusions and Future Directions

This review has addressed gender differences in biological and psychosocial risk factors for emerging alcohol problems through the course of adolescence. While adult reviews draw clear

conclusions regarding a gender imbalance in AUD risk (Nolen-Hoeksema, 2004; Nolen-Hoeksema & Hilt, 2006), we assert that the constellation of risk and protection is not set from childhood but rather shifts with age. It appears that the potency and quantity of biological vulnerabilities and socially reinforced maladaptive beliefs about drinking are interacting to explain this process. While the initiation of alcohol use may be strongly influenced by genetics and modeling within the family environment, increased or problematic use is marked by social, affective, and biological factors that operate differently for males and females.

Existing adult studies demonstrate considerable and reliable gender differences in alcohol consumption and alcohol-related problems. Due to the greater prevalence rates for AUDs among men, many studies examining risk factors in an adolescent population have primarily, and sometimes exclusively, utilized a male sample. Differential results within and between the adolescent and adult literature necessitate additional investigations of risk and protective factors in girls. Prospective, longitudinal studies examining multiple factors and large samples of adolescent males and females are needed to understand how genetics and environment interact from early adolescence into young adulthood. Given the importance of gender influence of traditional beliefs on adolescents' decisions about alcohol use, issues related to culture should be examined. There may be more or less leniency for drinking and drunkenness according to conventional male and female roles depending on ethnicity, level of acculturation, and socio-economic status.

Overall, it appears that while girls and boys may be facing similar vulnerabilities for problems with alcohol, boys begin to carry more risk as they move towards young adulthood. This review does not suggest that clinical research and treatment should then focus primarily on the escalation of use in boys, but instead, calls for more gender-sensitive studies in order to provide a clearer picture on what factors are most salient for both sexes. This information can then greatly inform intervention strategies for all youth.

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