Subpopulations of Older Foster Youths With Differential Risk of Diagnosis for Alcohol Abuse or Dependence*

THOMAS E. KELLER, PH.D.,[†] JENNIFER E. BLAKESLEE, M.S.W., STEPHENIE C. LEMON, PH.D.,[†]
AND MARK E. COURTNEY, PH.D.[†]

School of Social Work, Portland State University, P.O. Box 751, Portland, Oregon 97207

ABSTRACT. Objective: Distinctive combinations of factors are likely to be associated with serious alcohol problems among adolescents about to emancipate from the foster care system and face the difficult transition to independent adulthood. This study identifies particular subpopulations of older foster youths that differ markedly in the probability of a lifetime diagnosis for alcohol abuse or dependence. **Method:** Classification and regression tree (CART) analysis was applied to a large, representative sample ($N = 732$) of individuals, 17 years of age or older, placed in the child welfare system for more than 1 year. CART evaluated two exploratory sets of variables for optimal splits into groups distinguished from each other on the criterion of lifetime alcohol-use disorder diagnosis. **Results:** Each classification tree yielded four terminal groups with different rates of lifetime alcohol-use disorder diagnosis. Notable groups in the first tree included one characterized by high levels of both delinquency

and violence exposure (53% diagnosed) and another that featured lower delinquency but an independent-living placement (21% diagnosed). Notable groups in the second tree included African American adolescents (only 8% diagnosed), White adolescents not close to caregivers (40% diagnosed), and White adolescents closer to caregivers but with a history of psychological abuse (36% diagnosed). **Conclusions:** Analyses incorporating variables that could be comorbid with or symptomatic of alcohol problems, such as delinquency, yielded classifications potentially useful for assessment and service planning. Analyses without such variables identified other factors, such as quality of caregiving relationships and maltreatment, associated with serious alcohol problems, suggesting opportunities for prevention or intervention. (*J. Stud. Alcohol Drugs*, 71, 819-830, 2010)

THE TRANSITION TO ADULTHOOD is a developmental stage when older adolescents enjoy new freedoms and opportunities but also face challenges that can test coping skills, exacerbate pre-existing difficulties, and derail developmental trajectories (Schulenberg et al., 2004). In general, adolescents who enter this developmental period with problematic alcohol use are more likely than others to demonstrate negative outcomes in young adulthood, such as higher drug use, lower educational and occupational attainment, and greater aggressive and violent behavior (Duncan et al., 1997; Newcomb and Bentler, 1988; Sher and Gotham, 1999; Tarter et al., 1999). Individuals who meet diagnostic criteria for alcohol abuse or alcohol dependence (AA/AD) suffer adverse symptoms and experience life difficulties as a direct result of their excessive use of alcohol. A history of AA/AD during adolescence is of concern because alcohol use tends to escalate and reach high levels in early adulthood

(Grant et al., 1994; Johnston et al., 2004; Schulenberg and Maggs, 2002).

Problems with alcohol use are likely to heighten the risk for poor adult outcomes among adolescents aging out of the foster care system. These adolescents face particular challenges because their transition to independent adulthood is both accelerated and compressed (Courtney, 2009; Stein, 2006). Emancipation from state care, typically at age 18, represents an abrupt discontinuity in caregiving. Youths leaving the child welfare system are forced to negotiate the transition to adulthood suddenly, with a dramatic reduction in access to services, and without guarantees of continuing support (Collins, 2001; Courtney et al., 2001; Geenen and Powers, 2007; Leathers and Testa, 2006; McCoy et al., 2008). Furthermore, their risk for developmental difficulties is high due to elevated rates of past maltreatment, inadequate and inconsistent parenting, and unstable living conditions in this population (Harden, 2004). Consequently, many adolescents leaving foster care are ill prepared for adult roles, are limited by low educational and occupational attainment, and are especially vulnerable to homelessness, victimization, or incarceration (Courtney and Dworsky, 2006; Courtney et al., 2001, 2005; McMillen and Tucker, 1999; Pecora et al., 2006; Reilly, 2003).

The extent to which older adolescents exiting the child welfare system have serious, diagnosable problems associated with use of alcohol or other substances has received little investigation. In two samples of youths in foster care with

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[†]Correspondence may be sent to Thomas E. Keller at the above address or via email at: kellert@pdx.edu. Stephenie C. Lemon is with the Division of Preventive and Behavioral Medicine, University of Massachusetts Medical School, Worcester, MA. Mark E. Courtney is with the School of Social Service Administration, University of Chicago, Chicago, IL.

larger age ranges (e.g., 13-18 years), the prevalence estimates for alcohol-use disorders were roughly 12% (Pilowsky and Wu, 2006) and 17% (Aarons et al., 2001). In the large, multistate sample of 17-year-olds in care on which the current study is based, the lifetime prevalence for AA was 9.8%, and for AD it was 4.2% (Keller et al., 2010). These findings suggest rates of alcohol-use disorder among adolescents in foster care are at the upper ranges of AA (0.4%-9.6%) and AD (0.6%-4.3%) reported for community samples of adolescents between 12 and 19 years of age (Chung et al., 2002).

Identifying factors associated with alcohol problems among older adolescents in care has implications for targeting services to those most likely to need treatment before and after emancipation from state custody. Furthermore, prevention and intervention may be improved with greater specificity about how individual circumstances and life events operate in conjunction to predict the likelihood of diagnosable alcohol problems in this high-risk population (Cicchetti and Luthar, 1999; Sher and Gotham, 1999; Tarter et al., 1999). Initial investigations of substance use among maltreated youths and youths in the child welfare system have found evidence for factors such as maltreatment type, placement type, comorbid behavioral problems, and psychiatric diagnoses (Aarons et al., 2008; Clark et al., 1997; Harrison et al., 1997; Moran et al., 2004; Pilowsky and Wu, 2006; Vaughn et al., 2007; Wall and Kohl, 2007).

Although research has begun to suggest factors associated with alcohol problems in the foster care population, only a few studies have focused on older adolescents or used diagnostic interviews to distinguish AA/AD from occasional or experimental use. Furthermore, no studies of this population have investigated how multiple factors combine and interact to affect the probability of diagnosis for alcohol-use disorders. A probabilistic perspective on development implies that a single factor is rarely a necessary or sufficient cause of difficulties (Cicchetti and Cohen, 1995; Sroufe, 1997). Instead, each factor derives its meaning and significance from its relations to others, and the interaction of factors governs behavior and adaptation (Magnusson, 1998). Thus, it is important to explore configurations of factors that distinguish qualitatively different groups of individuals (Bergman et al., 2003). Identification of distinct subpopulations characterized by specific multifactor profiles has implications for generating hypotheses about developmental processes, refining assessment approaches, and providing appropriately tailored services.

To reveal subpopulations of older foster youths with differential likelihood of AA/AD, this study uses classification and regression tree analysis (CART; Breiman et al., 1984) to model the probability of lifetime AA/AD diagnosis. CART is a decision tree procedure that classifies a target population into risk categories for a particular outcome based on a set of variables. The method systematically searches for ways to split each independent variable into two subsets and

then selects the split that best discriminates on the criterion variable. CART programs construct a classification tree by continuing to select splits that create successively more homogeneous subsets. The hierarchical yet flexible nature of CART permits consideration of different variables within each subgroup, resulting in more complex interactions than are modeled in linear, additive methods such as logistic regression. CART has been used to model medical diagnosis (Mair et al., 1995), adolescent smoking (Kitsantas et al., 2007), and adult alcohol use (Barnes et al., 1991).

In this study, CART is applied to data from a large, representative sample of adolescents approaching the age of emancipation from the child welfare systems of three midwestern states. Previous research suggests significant heterogeneity in this population, indicating that some youths have a higher likelihood to experience mental health and substance-use disorders (Keller et al., 2007). The objective is to reveal particular subpopulations that differ markedly in the probability of a lifetime diagnosis for AA/AD according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 2000).

The classification variables selected for this exploratory study fall under two general headings. The first set is composed of variables considered likely to represent individual and environmental risk and protective factors potentially associated with the occurrence of alcohol-use disorders, such as demographic characteristics, social support and relationship quality, maltreatment history, foster care placement experiences, and environmental factors (Hawkins et al., 1992). The second set includes variables that could indicate issues possibly attributable to, symptomatic of, or comorbid with alcohol-use problems, such as school difficulties, employment status, physical and mental health status, and delinquency. CART is applied initially to all variables (i.e., both sets) to determine the profiles that best identify subpopulations with distinctly different probabilities of alcohol-use disorders. The initial analysis is intended to reflect a comprehensive assessment of risk for alcohol problems based on combinations of multiple personal, behavioral, environmental, and historical factors. A second analysis removes from consideration potential concurrent indicators of diagnosable alcohol-use disorders by restricting CART to the first set of variables representing risk and protective factors for problems with alcohol use. The second analysis is intended to suggest particular patterns of factors that may contribute to or sustain alcohol-use disorders.

Method

Sample

The data are from the baseline interview of a longitudinal panel study tracking a cohort of youths exiting the public

child welfare systems of three midwestern states and making the transition to independent living (Courtney and Dworsky, 2006). The population of interest consisted of adolescents who (a) were in out-of-home care supervised by the public child welfare agencies of the three states, (b) were 17 years of age or older, and (c) had been in out-of-home care for at least 1 year. Exclusion criteria were developmental disability, current in-patient psychiatric institutionalization, or current incarceration.

A representative sample was obtained using a systematic sampling procedure (Henry, 1990). In April–June 2002, the public child welfare agencies in the three states identified all cases from their active caseloads meeting the inclusion criteria. The sampling frame included all eligible youths in two states and a random selection of 67% of eligible youths in the most populous state. The foster care providers of the identified youths were informed of the study through letters and verbal communications from the adolescent's caseworker. Youth participants were sent letters regarding the study and were contacted for in-person interviews at which time written informed consent was obtained. Recruitment and data collection activities followed institutional review board–approved protocols.

As described, potential participants were identified from state child welfare records, but these records were sometimes outdated. Consequently, initial contacts with some potential subjects revealed they were ineligible. Of the 880 adolescents identified for recruitment, 110 were excluded for the following reasons: physically or mentally incapable of participation ($n = 33$); incarcerated or in a lock-down facility (e.g., psychiatric hospital; $n = 40$); runaway status or missing from assigned home before start of field period ($n = 16$); out of state before the start of field period ($n = 13$); or ineligible for other reasons (e.g., adopted; $n = 8$). Of the remaining 770 cases, 732 consented to participate and completed an in-person baseline interview, for a response rate of 95%.

The sample was evenly divided among males (48.5%) and females (51.5%). The mean age at the time of the interview was 17.4 years ($SD = .50$). Most respondents were 17 years old (59.0%), and the remainder were 18 years old (41.0%). The mean age at which respondents entered the child welfare system was 10.8 years ($SD = 4.0$). A majority of the sample was African American (57.0%), followed by White (30.9%), mixed race (9.7%), American Indian/Native Alaskan (1.4%), and Asian/Pacific Islander (0.5%). Of those identifying Hispanic ethnicity (8.6%), most were of mixed race (50.8%), White (23.8%), or African American (19%). At the time of the baseline interview, 30.5% were in kinship foster homes (with relatives), 35.8% in foster homes with non-relatives, 18.1% in group care or residential treatment facilities, 8.6% in independent-living arrangements, 0.7% in an adoptive home (prefinalization), and 6.3% in some other situation.

Measures

Criterion variable. Lifetime diagnosis of AA/AD was derived using the Composite International Diagnostic Interview, CIDI (World Health Organization, 1997). The CIDI is a highly structured interview that renders diagnoses according to definitions and criteria of the DSM-IV. The CIDI elicits information about the pattern of symptoms, as well as functional impairments and collateral factors to substantiate the severity of the condition. The CIDI is designed for use by nonclinicians trained as research interviewers, and its validity and reliability have been established through extensive research (Cottler and Compton, 1993; Wittchen, 1994).

Classification variables. The classification variables selected for this exploratory study cover a wide range of domains, as shown in Table 1. Many reflect individual and environmental risk and protective factors: demographic characteristics, social support, relationship quality, family of origin, foster care placement experiences, maltreatment history, and neighborhood-environment factors. Others may be indicators of alcohol-use problems, such as school and employment difficulties, health and mental health problems, and delinquency and violence experiences. Several items and measures were derived from previous studies of the general adolescent population (e.g., National Longitudinal Study of Adolescent Health) and adolescents aging out of care (e.g., Courtney et al., 2001). Variables in this analysis are based on youth self-report during the structured baseline interviews. Scale reliabilities and citations, as applicable, appear in Table 1.

Analysis

CART analysis employs a nonparametric data search algorithm that evaluates all variables in the analysis for their ability to distinguish two groups with different probabilities of exhibiting the categorical criterion of interest. The procedure also identifies the optimal cutpoint of the best distinguishing variable to maximize between-group differences. CART algorithms can accommodate categorical predictors, continuous predictors, or a combination of these predictors in searching for the most salient variable to create each successive partition. The construction of a tree involves three elements: selection of the splits, determination of when to discontinue splitting, and assignment of classes (Lemon et al., 2003). A tree is “grown” on a learning sample and then undergoes a cross-validation procedure in which randomly selected cases are sorted down the tree to determine its accuracy. A misclassification rate is used to determine which branches of the tree are most predictive of the outcome and should be retained and which others should be “pruned.” The resulting solution indicates not only which variables are most predictive but also yields terminal categories defining groups of individuals that have distinctive profiles on the classifying

TABLE 1. Classification variables used in analysis

Variable	Measurement description ^a
Risk and protective factors	
Demographic variables	Age (17 or ≥18) Race/ethnicity (African American, White, or other heritage) Gender (male or female)
Pre-foster care placement	Maltreatment types: neglect (0-5 count), physical (0-4), psychological (0-5) Parental problems by type (0-7 count) Number of siblings and number of siblings currently in foster care
Foster care placement	Was living with a father or stepfather Placement stability by lifetime number of foster or group homes Foster care re-entry by whether youth ever returned to original home Current placement type: kinship care, nonrelative foster care, group care, and independent living/other Neighborhood quality statements endorsed (0-4 count) Urbanicity by current placement county
Independent-living program services	Services received by type: housing (0-9 count), educational/training (0-8), employment (0-11), financial (0-7), personal health (0-9) Likelihood of future use of seven child welfare services (mean of 1-4 ratings by type, $\alpha = .92$)
Social support and emotional closeness	Social support by total ($\alpha = .96$) and subscale (emotional: $\alpha = .93$; tangible: $\alpha = .80$; social interaction: $\alpha = .83$; affection: $\alpha = .87$) (Sherbourne and Stewart, 1991) Closeness to caregiver (1-4 rating) Avoidance in close relationships scale ($\alpha = .77$) (Fraley et al., 2000) Anxiety in close relationships scale ($\alpha = .86$) (Fraley et al., 2000)
Educational development	Has ever taken special education classes Vocabulary score (Wide Range Achievement Test; Wilkinson, 1993)
Indicators	
School problems	Is currently enrolled in school Problems at school experienced at least weekly (0-4 count by type) Frequency of unexcused absences in last year (0-3 rating) No. of school changes due to moving in the past year (0 to ≥5 count) Has ever repeated a grade/has ever been suspended/has ever been expelled
Employment history	Is currently, formerly, or has never been employed Has ever been fired from a job
Concurrent health and mental health	Health problems experienced at least weekly (0-21 count by type) Meets diagnostic criteria for other psychiatric diagnoses (CIDI) ^b Meets diagnostic criteria for any of nine other substance disorders (CIDI)
Delinquency and violence	Delinquent acts committed in the last year (0-15 count by type) Violence perpetration and violent victimization in last year (0-4 counts by type) Has lifetime history of arrest Has ever run away from foster care

Notes: CIDI = Composite International Diagnostic Interview. ^aWith the exception of urbanicity, all variables are based on youth self-report; ^bincludes diagnosis for posttraumatic stress disorder, general anxiety disorder, social phobia, and dysthymia.

variables. A decision rule in this analysis was that terminal categories had to represent at least 5% of the sample.

As described earlier, two CART analyses were conducted in the current study. The first includes all selected variables to mirror the process of assessing or identifying

the probability of alcohol-use disorders based on multiple relevant factors, including behavioral indicators and current circumstances. Because distinguishing variables in the first model could be symptomatic of alcohol-use disorders—for example, delinquency behaviors, such as lying or stealing,

may be the result of alcohol use, or youths may be in independent-living situations because their drinking disrupted a more structured placement—a second classification tree is restricted to risk and protective factors, such as variables related to youths' characteristics and foster care history.

Results

An initial classification tree solution was generated using all variables selected for investigation. This tree, depicted in Figure 1, began with the total sample, 14.07% of whom met criteria for lifetime diagnosis of AA (9.8%) or AD (4.2%). The CART program first split the sample by the degree of recent delinquency, based on youth report of types of delinquent acts committed in the previous year (0-15 count, $M = 4.74$, $SD = 3.24$). This variable was dichotomized as seven

or fewer types (80.74% of total sample, $n = 591$) or more than seven types (19.26% of total sample, $n = 141$). Within the relatively low to moderate delinquency subgroup, 8.29% ($n = 49$) met diagnostic criteria, whereas 38.30% ($n = 54$) of the relatively high-delinquency subgroup met the criteria. This first split best distinguished the sample on diagnosis; youths in the high-delinquency subgroup were 4.62 times more likely than in the lower delinquency subgroup to meet diagnostic criteria.

Within the lower delinquency subgroup, the next level of classification was based on current placement status, distinguishing youths in relative and nonrelative foster homes, group homes, or residential treatment ($n = 501$, 85% of lower delinquency subgroup) from youths primarily in independent-living arrangements but also other situations ($n = 90$, 15% of lower delinquency subgroup). Youths with

FIGURE 1. Classification tree of lifetime alcohol abuse/alcohol dependence diagnosis based on analysis with all variables

lower delinquency residing in foster or group homes were diagnosed at a rate of 5.99% ($n = 30$), whereas youths residing in independent-living or other situations had a 21.11% ($n = 19$) rate of diagnosis. This split by placement type best distinguished diagnosis within the lower delinquency subgroup; youths in independent-living situations were 3.52 times more likely to meet diagnostic criteria than youths in foster or group homes.

Within the high-delinquency subgroup, the next classification was by degree of violent victimization (0-4 count, $M = 0.78$, $SD = 1.03$), dichotomized as zero or one type of victimization ($n = 66$, 47% of higher delinquency subgroup) versus more than one type of victimization ($n = 75$, 53% of higher delinquency subgroup). High-delinquency youths with zero or one type of victimization were diagnosed at 21.21% ($n = 14$), and high-delinquency youths with more than one type were diagnosed at 53.33% ($n = 40$). This split best distinguished diagnosis within the higher delinquency subgroup; youths with more than one type of victimization in the last year were 2.51 times more likely to meet diagnostic criteria.

After two levels of branching, the tree ended in four classification profiles, none of which was subdivided further because no other independent variables improved the classification rate for diagnosis within the subgroups. Of these, only one profile indicated a subpopulation with a reduced risk of diagnosis relative to the overall sample proportion: Youths with low to moderate delinquency in foster or group homes comprised 68.44% of the total sample and only 29.13% of the total diagnoses. The remaining three profiles had higher than expected representation of diagnosed youths. Youths in the lower delinquency subgroup who were in independent-living or other situations comprised 12.30% of the sample and 18.45% of the diagnoses. Youths in the higher delinquency and lower victimization subgroup comprised 9.02% of the sample and 13.59% of the diagnoses. Last, youths in the higher delinquency and higher victimization profile comprised 10.25% of the sample and 38.83% of diagnoses.

Restricted model

The second, restricted classification model focused just on risk and protective factors, such as variables related to individual youth characteristics and foster care history. As shown in Figure 2, the tree again began with the total sample ($N = 732$), 14.07% of whom met the criteria for lifetime AA/AD diagnosis ($n = 103$). The tree first split the sample by race, distinguishing African American (55.33% of sample, $n = 405$), from White or other race (44.67% of sample, $n = 327$). Within the African American profile, 8.15% ($n = 33$) met diagnostic criteria. Within the White/other subgroup, 21.41% ($n = 70$) met diagnostic criteria. This first split best distinguished diagnosis in the whole sample. Youths in the White/other subgroup accounted for 67.96% of all diagnoses

and were 2.63 times more likely to meet diagnostic criteria than African American youths.

Within the White/other subgroup, the second-level split divided by overall closeness to caregiver (1-4 rating, $M = 2.87$, $SD = 1.47$) into subgroups of youths who reported being somewhat close or very close to their caregiver ($n = 267$, 82% of White/other group) versus youths who reported being not at all close to their caregiver ($n = 60$, 18% of White/other group). Of youths who felt somewhat or very close to their caregiver, 17.23% ($n = 46$) met diagnostic criteria, whereas 40.00% ($n = 24$) of youths not at all close to their caregiver met criteria. The closeness to caregiver variable best distinguished diagnosis within the White/other group, and youths who were not at all close to their caregiver were 2.32 times more likely to meet diagnostic criteria.

Within the subgroup of White/other youths who were somewhat or very close to caregivers, the third-level split classified by the number of types of psychological maltreatment experienced before entering foster care (0-5 count, $M = 0.61$, $SD = 1.03$). This was dichotomized as zero or one maltreatment type ($n = 211$, or 79% of close to caregiver subgroup) or more than one maltreatment type ($n = 56$, or 21% of close to caregiver subgroup). The diagnostic rate was 12.32% ($n = 26$) for the lower maltreatment subgroup and 35.71% ($n = 20$) for the higher maltreatment group. Youths who have experienced more than one type of psychological abuse were 2.90 times more likely to meet diagnostic criteria.

After the three splits, the tree ended in four classification profiles, with no further splits able to improve the classification rate for diagnosis within the subgroups. Two final profiles indicated subpopulations with reduced risks of diagnosis relative to the sample proportion. African American youths, comprising 55.33% of the sample, represented only 32.04% of the diagnoses. White/other youths who were close to caregiver and had lower levels of psychological abuse accounted for 28.83% of the sample and 25.24% of diagnoses. The other two classifying profiles had higher than expected rates of diagnosis. Youths in the White/other subgroup who were not close to caregiver comprised 8.20% of the sample and 23.30% of diagnoses. Last, White/other youths who were close to their caregiver and have experienced more than one type of psychological abuse comprised 7.65% of the sample and 19.42% of diagnoses.

To evaluate the predictive validity of the inductively derived CART classifications, the groups defined by the terminal nodes of each tree were compared on subsequent alcohol-related assessments at age 19. For both trees, the resulting classification groups had statistically significant associations with later use (≥ 12 drinks in previous 12 months) and with meeting diagnostic criteria for AA/AD since baseline. Furthermore, the patterns distinguishing the groups on these indicators were consistent with their relative probabilities for alcohol problems reported in the CART analysis.

FIGURE 2. Classification tree of lifetime alcohol abuse/alcohol dependence diagnosis based on analysis excluding potential indicator variables

Discussion

This study identifies distinct subpopulations of older foster youths with differential rates of AA/AD diagnosis. Adolescent alcohol-use disorders have multiple causes and consequences. The CART analysis reveals how several factors combine to form particular profiles that effectively distinguish the probability of having a history of AA/AD diagnosis in the population under investigation. The first classification tree included several potential markers of alcohol

problems in distinguishing particular profiles and could serve to identify subpopulations more likely to need treatment services before emancipation. The second classification tree points to patterns of individual and contextual factors that define subpopulations with different levels of risk for alcohol diagnoses and could provide clues to factors for prevention or intervention. In reporting the results, emphasis was given to defining the groups into which the sample was divided. The following discussion addresses the factors involved in the classification schemes.

Delinquency and violent victimization

In the model including all variables, recent delinquent behavior was the most effective variable in distinguishing AA/AD diagnosis. Only one fifth of the sample committed more than seven types of delinquency in the past year, but this subgroup accounted for more than half the diagnoses. This is not surprising, given that several forms of delinquency assessed—lying to guardians or stealing, for example—are potentially symptomatic of underage alcohol use. On the other hand, association with delinquent peers provides opportunity for engaging in alcohol use. The commonly reported association of alcohol problems with delinquency most likely involves a reciprocal relationship over time and represents a comorbid manifestation of common risk factors (Loeber et al., 1999; Wade and Pevalin, 2005; White et al., 1999). This association holds for youths with histories of maltreatment and foster care, among whom conduct problems are found to be more prevalent with higher substance use (Wall and Kohl, 2007) or to be predictive of substance use (Aarons et al., 2008; Vaughn et al., 2007).

However, the findings of this study illustrate that additional factors alter the likelihood of serious alcohol problems even among youths engaged in high levels of delinquent behavior. The combination of delinquency with higher levels of violent victimization resulted in a classification profile in which more than half the youths (53%) had an alcohol-related diagnosis, the highest rate of any subgroup identified in either analysis. The interaction between delinquency and exposure to violence, based on the distinction between zero or one versus more than one type of victimization, accounted for a striking 32% difference in diagnosis rate among youths reporting high levels of delinquency. Once again, the link between alcohol-use problems and exposure to violence is likely to be bi-directional. Studies have found that trauma and other types of victimization are strongly associated with adolescent alcohol-use disorder (Clark et al., 1997), and both experiencing and witnessing violence are independently associated with earlier and increased adolescent substance-use disorder (Kilpatrick et al., 2000).

Finding the association of delinquency and violent victimization with AA/AD may be confirmatory for mental health and juvenile justice professionals who regularly address these co-occurring problems. For example, one study reported diagnosable substance-use disorder among 41% of adolescents in the public mental health system and 62% in juvenile justice, which compares with only 19.2% of youths in the child welfare system (Aarons et al., 2001). Given the lower prevalence among youths in foster care, child welfare professionals may not routinely assess and address substance-use disorders. However, the current findings indicate that a certain subset of youths in foster care with higher levels of delinquent behavior and exposure to violence do

require greater attention to AA/AD screening and treatment services.

Independent living

Current placement type is another variable that effectively distinguishes alcohol-use disorder diagnosis in the analysis with all variables, further subdividing the majority of sampled youths who fall into the lower delinquency subgroup. The important practical and conceptual distinction is residence in independent-living situations versus in traditional foster homes (with or without relatives), group homes, or residential treatment centers. In independent-living situations, youths still have child welfare caseworkers but not designated caregivers in their living spaces. Housing may be a group facility or a home or apartment in the community. The reduced level of adult supervision and monitoring implies that these youths have already begun an early transition to adulthood and are essentially living on their own. The findings of the current study are consistent with other research on older foster youths showing that independent living (as well as group home care) is associated with increased rates of substance-use disorder (Vaughn et al., 2007).

The freedom and lack of supervision characteristic of independent-living situations may provide greater opportunity for excessive alcohol use and the associated consequences. In another child welfare-involved sample, higher levels of caregiver monitoring decreased the odds of substance use, although placement type was not directly associated with use (Wall and Kohl, 2007). On the other hand, problematic alcohol use may cause difficulties with caregivers in foster homes and other supervised settings, resulting in placement in an independent-living situation. In the general adolescent population, for example, early-onset substance use has also been associated with premature transitions to independent-living situations as well as increased substance use after transition (Krohn et al., 1997; Kypros et al., 2004).

Living in a foster or group home at age 17 may be a protective factor limiting problematic alcohol use. Even youths who might seem prepared for independent living are likely to benefit from higher levels of structure and supervision as they transition to adulthood. In other cases, independent-living arrangements might be avoided if treatment for underlying alcohol- or substance-use problems alleviates friction with foster parents. One caveat, however, is that even indirect supervision of youths in independent-living placements is likely preferable to disconnection from the child welfare system altogether; staying in care beyond age 18 is associated with lower prevalence of substance-use disorders (Courtney and Dworsky, 2006; Narendorf and McMillen, 2010; White et al., 2007). In fact, a few states consider substance-use treatment needs a reason to keep youths engaged in foster care services, including independent-living arrangements,

beyond the age of majority (Dworsky and Havlicek, 2009; Narendorf and McMillen, 2010).

Race

Although race did not play a role in the classification solution with all independent variables in the analysis, it was the first factor to distinguish the likelihood of alcohol-use disorders in the restricted model. After the first split, African American adolescents as a group represented a terminal node of the classification tree. No other factors had predictive utility among African American youths, likely because of the particularly low rate of diagnosis for African Americans (8%). This result aligns with previous research showing lower rates of alcohol and substance use among African American youths relative to their peers, whether in the child welfare system (Vaughn et al., 2007; Wall and Kohl, 2007) or in the general population (Johnston et al., 2005; Kilpatrick et al., 2000).

Foster care factors

Two other variables that did not figure in the analysis with all factors but did distinguish the probability of a diagnosis in the second model pertain to the care the youths have received. Reflecting another interaction effect, the self-reported closeness of youths to their caregivers was an important distinction among the non-African American portion of the sample. Within the White/other group, adolescents who felt not at all close to their caregivers were more than twice as likely as others to have alcohol problems; they also had the highest rate of diagnoses (40%) for any profile in the second analysis. Even as adolescents seek greater autonomy from caregivers, strong relationships with dependable parental figures remain a foundation of healthy development during this transition period (Allen and Land, 1999). For most youths, maintaining connections to parental figures rather than detaching from them contributes to adjustment through adolescence and the transition to adulthood (Steinberg, 1990). In a sample of maltreated youths 11-15 years old, lower levels of attachment to caregiver were correlated with higher levels of substance use (Wall and Kohl, 2007). Early alcohol use in the context of foster care may also be related to poor youth relationships with biological mothers; 78% of adolescents who describe this relationship as "negative" also report early alcohol use (Kaufman et al., 2007). In turn, alcohol problems can cause difficulties in relationships with caregivers. One implication of this identified association, regardless of causal direction, is that alcohol-treatment providers working with this particular subpopulation will likely need to operate without the participation and support of parental figures because these youths lack close relationships with their caregivers.

Creating the most complex combination of distinguishing factors, the classification tree further subdivides White/

other adolescents who report greater closeness to caregivers. In this case, the distinction is between youths who have experienced more than one type of psychological abuse (e.g., abandonment, locked in closet) versus those who have experienced one type or none. Psychological abuse serves as an indicator of severe maltreatment because it typically occurs in conjunction with other forms of abuse or neglect and contributes to more detrimental developmental outcomes (Bifulco et al., 2002; Claussen and Crittenden, 1991; Claussen et al., 1994; Clemmons et al., 2007). In this study, the final subgroups distinguished by psychological abuse also differed substantially on rates of physical abuse (88% vs. 31%) and neglect (71% vs. 31%). The elevated risk of alcohol-related diagnoses for the subgroup with greater maltreatment is not surprising in the context of the literature. Type and severity of childhood maltreatment has been associated with earlier alcohol use (Kaufman et al., 2007) and the development of substance-use problems (Harrison et al., 1997; Moran et al., 2004; Simpson and Miller, 2002). Adolescents presenting for substance-related treatment often have a history of maltreatment (Grella and Joshi, 2003), and the current findings indicate that a portion of youths exiting state care with alcohol problems likewise will need trauma-focused treatment services.

Limitations

The reported findings must be interpreted in light of several study limitations. First, it is important to clarify that the identified profiles are based on the classification variables that were most effective for distinguishing the criterion variable at each stage of the CART analysis. The absence of some variables within a classification tree or within a subgroup does not necessarily indicate a lack of correlation but indicates only that a variable was not the most effective distinguishing factor at that point in the classification analysis. The CART procedure is data dependent, and different results could be obtained with alternate sets of variables. Because the results were derived through an inductive process, replication of the findings with other samples will enhance their credibility. Second, the inclusion of a classification variable for co-occurrence of other psychiatric diagnoses is limited by the lack of assessments for disruptive behavior diagnostic categories associated with alcohol-use disorder. Third, the retrospective assessment of lifetime diagnosis is subject to errors of memory and is not necessarily indicative of a problem with alcohol at the time of the interview. Some conditions that yielded a lifetime diagnosis may no longer be problematic for the youths, although early-onset diagnosis would still suggest risk for later disorder. Fourth, because of the cross-sectional nature of the study and ambiguity regarding the order of occurrence of some variables, the direction of effects cannot be ascertained, and claims of causality cannot be made. Instead, the analysis segments the popula-

tion based on probabilities for an alcohol-related diagnosis, and this information may have relevance in the assessment of cases or in targeting interventions. Last, the study reports findings from a large, tristate sample derived with an epidemiologically oriented, population-based sampling approach. However, the sample is not entirely representative of youths in the child welfare system because of the exclusion criteria, including the omission of youths in inpatient psychiatric wards, runaway youths, and youths with developmental disabilities.

Conclusion

The identification of subpopulations of adolescents on the verge of exiting the child welfare system with differential rates of alcohol-use disorder has implications for policy and practice. Particular profiles may guide child welfare and treatment professionals in identifying the adolescents most likely to exhibit serious alcohol problems and suggesting how to tailor programs and services to the needs of different types of youths in the system. For example, the subpopulation defined by involvement in delinquency, violence victimization, and high rates of alcohol-use disorders indicates a group of adolescents with multiple issues that likely will require intensive services before and after emancipation from the child welfare system. The research also calls for greater attention to the potential for alcohol problems among youths in independent-living situations. Likewise, the findings point to the relationships of these adolescents with their caregivers. White adolescents are more likely to exhibit alcohol problems when they lack a close connection with their substitute parents or when they have experienced more psychological maltreatment by caregivers before foster care. Overall, the study highlights that careful assessment incorporating multiple factors is necessary to identify intervention opportunities and service needs for the heterogeneous population of youths aging out of foster care.

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