

The Relationship Between Underage Alcohol Possession and Future Criminal Behavior: An Empirical Analysis Using Age–Period Cohort Characteristics Models

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Abstract

This study examines the relationship between underage alcohol possession and criminal behavior through a cohort, age, and period analysis. Utilizing the Age–Period Cohort Characteristic (APCC) models method and national arrest data, while controlling for age and period effects, this study examined single-year age cohorts and determines that strict enforcement of PULA (Possession Under Legal Age) laws decreases the likelihood of strongly correlated vandalism and assaults as young adults. The analysis indicates an increase in assaults and vandalism as cohort size increases, but little effect from single parent, resource deprivation.

Keywords

criminology and criminal justice, crime, crime prevention, juvenile delinquency, punishment

Introduction

In recent years, alcohol use by young people has received considerable attention. Vivid news accounts and high-profile scholarly articles have fueled interest in this topic. In addition to motor vehicle crashes, the consequences resulting from underage drinking include alcohol-related arrests, injuries from fights and assaults, increases in vandalism and disorderly conduct, dangerous sexual practices, and unintended injuries due to accidents and falls (Hingson & Kenkel, 2004). And still yet another aspect of youthful consumption is noteworthy. Many researchers assert that underage drinking has enduring implications for behavior (Bonnie & O’Connell, 2004; Flewelling, Paschall, & Ringwalt, 2004). They argue that teenagers who begin drinking early in life are more likely than those who start later to face drinking problems as adults (Hawkins et al., 1997; Hingson, Heeren, Jamanka, & Howland, 2000; Hingson, Heeren, Levenson, Jamanka, & Voas, 2002; Hingson, Heeren, & Zakocs, 2001; Schulenberg, O’Malley, Bachman, Wadsworth, & Johnston, 1996). Consequently, young drinkers suffer the costs associated with alcohol well into adulthood. We use criminal arrest records to investigate this claim. Our interest centers on the following question: Do strict law enforcement efforts targeting underage possession of alcohol reduce the likelihood of alcohol-related crime in the future?¹

At both the local and national levels, the predominant strategy for dealing with underage drinking is to delay the

age of its onset as long as possible (Bonnie & O’Connell, 2004; U.S. Department of Health and Human Services, 2007). This approach is predicated on curbing drinking by reducing the availability of alcohol to minors. In part, policy makers have relied on zero-tolerance possession laws (sometimes called PULA [Possession Under Legal Age] laws) and strict enforcement efforts to control the access of alcohol to juveniles.² Studies show reduced availability of alcohol delays the onset of drinking, and also reduce its prevalence and intensity (Chaloupka, 2004; Chesson, Harrison, & Kassler, 2000; Coate & Grossman, 1988). Proponents believe that the benefits accrued by the delayed onset of drinking are enduring. Accordingly, they argue strict enforcement measures reduce arrests and social problems associated with drinking into adulthood (Bonnie & O’Connell, 2004). But are these arguments correct? Do tough underage possession laws combined with strict enforcement measures temper the damaging consequences associated with heavy alcohol consumption later in life? We investigate this issue by comparing birth-cohorts longitudinally using Age–Period Cohort Characteristic

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(APCC) models. We use these models to explore whether cohort members who were subjected to strict enforcement measures as teens are arrested less frequently as adults for alcohol-related crimes than cohort members who experienced more lenient enforcement as adolescents.

Our analysis departs from earlier investigations in three important ways. First, we use arrest records rather than self-reports to investigate alcohol-related problems. We believe our behavioral measures circumvent some of the problems surrounding self-report procedures. Arrest records are also high-quality indicators of the legal consequences of intoxication. Second, as noted, we use cohort theory and APCC models to investigate this issue. These models control for differences in the data arising from two factors associated with longitudinal research: (a) the time periods in which the investigation was conducted and (b) the ages of the participants investigated in the study. Third, our models are grounded in established sociological explanations of deviance. These concepts are built on ideas originating in classic works investigating social integration, social control, and deterrence. In the following sections, we first briefly describe the scope of underage drinking and its relationship with crime, then we review relevant theory, and finally describe our models and analysis.

The Correlates of Alcohol Consumption

Considerable research describes the relationship between drinking and crime (Carpenter, 2005; Harwood, Fountain, & Livermore, 1998). For example, The Bureau of Justice Statistics (1995) reports that well over a third of convicted offenders were intoxicated when arrested in the mid-1990s (Carpenter, 2005), and Harwood and colleagues (1998) estimate that 50% of violent crime is alcohol related. The relationship between alcohol and crime is especially salient for younger drinkers. Alcohol is a factor in at least 36% of homicides involving young people (Bonnie & O'Connell, 2004) and nearly 90% of assaults and violent crime on college campuses (National Center on Addiction and Substance Abuse, 1994). Likewise, large numbers of college students self-report vandalizing property while intoxicated (Saffer, 2001; Wechsler et al., 2002). An important point to make is that a PULA arrest does not necessarily mean that the individual was intoxicated at the time of arrest. Simply being in possession of alcohol while underage is enough for an arrest regardless of the level of intoxication. However, research has consistently shown that teenagers tend to binge drink and drink to intoxication more often than adults (Wechsler et al., 2002). Furthermore, those individuals who are intoxicated may be more likely to draw the attention of the police which could result arrest for PULA violation.

Researchers have found that strict policy intervention programs reduce underage drinking.³ For example, Carpenter (2004, 2005) describes how tough zero-tolerance laws for

underage possession and drinking combined with stringent enforcement efforts reduce heavy episodic drinking by teenagers. Likewise, Joksch and Jones (1993) conclude that an increase in the minimum legal drinking age in the 1980s was associated with reductions in the incidence of vandalism, disorderly conduct, and other nuisance crimes. For our purposes, however, these studies are limited. They tend to focus exclusively on the immediate impact of interventions without taking into account the potential for enduring behavioral changes that might be brought by these laws. We will have more to say about this in the following sections.

Cohorts

Cohort analysis provides a practical method for exploring the relationship between early-age onset of drinking and subsequent behavior. A cohort consists of a group of individuals who are all nearly the same age. Although the age span defining the cohort can vary in size, most researchers using APCC models operationalize this time period as from 1 to 5 years (e.g., all people born in 1960 or all born between 1960 and 1965). As noted by O'Brien and Stockard (2006), cohort theory rests on two guiding principles:

- (1) The "life stage principle" (Elder 1974, p. 87): suggesting that the experiences of one cohort differ from those of another because they experience different historical events at different ages or developmental periods
- (2) The "lasting effects principle" (O'Brien, Stockard, and Isaacson 1999): positing that certain events or conditions, such as the size of One's birth cohort, can produce lasting changes in the attitudes and behaviors of cohort members.

Operationally, researchers follow cohorts through time noting whether they differ in terms of attributes of interest. The observed disparity between cohorts can result from at least three sources of variation including *age effects*—differences due to the ages of the individuals being observed; *period effects*—differences resulting from the influence of the time periods observed; and *cohort effects*—differences attributable to factors or characteristics associated with the cohort. The impact of a cohort effect is long lasting, often influencing members throughout their life span. Analysts observe these differences at specified points in time. Consequently, any assessment of these effects must include an examination of the age/period conditions that are specific to the cohort. The APCC model provides one of the most rigorous methods for investigating cohort-related effects (O'Brien, 2000). The model consists of age and period dummy variables in conjunction with one or more continuous cohort independent variables.

The age and period dummy variables provide very strong statistical control. The age-specific dummy variables control

for any age-related factor that is not included in the model, so long as its effects are invariant across time (O'Brien, 2000). For example, these variables control for the empirical observation that young people tend to drink to intoxication more than adults. Likewise, the period-specific dummy variables control for any period-related effects that are invariant across age. In our model, these dummy variables control for the age-invariant differences in drinking patterns that are seen across time periods. Examples include changes from period to period associated with the availability of specific types of alcohol, differences in weather patterns, or variations in unemployment rates and economic conditions.⁴

The control variables in combination with the continuous cohort independent variable(s) are used to predict an age/period-specific dependent variable. In the analysis to follow, we estimate models predicting values on two dependent variables: the age/period-specific arrest rates for (a) vandalism and (b) assault.

Relevant Theory

There is a broad range of theories that attempt to explain the factors that contribute to problem drinking behavior. Although a comprehensive review of these theories is beyond the scope of this article,⁵ we provide elements of relevant work.

Cohort theory has been used in previous research to explain deviant behavior including suicide, homicide, and other criminal behaviors (O'Brien & Stockard, 2002, 2003, 2006; Savolainen, 2000). Many of these works build on seminal ideas found in Durkheim. These articles specify how deviance⁶ (O'Brien & Stockard, 2006) is mediated by two social processes: *egoism*—a feeling of purposelessness due to a lack of social integration—and *anomie*—negative emotion and cognition generated by weak normative regulation of behavior.⁷ Although there is slippage related to the meanings of these terms, (see Bearman, 1991), several theorists argue that egoism and anomie are two sides of the same coin (Gibbs & Martin, 1964; Johnson, 1965). For them, social integration is a precondition for regulation; the latter cannot exist without the former.

Relative Cohort Size (RCS)

When these ideas are integrated with Easterlin's (1978, 1980, 1987) hypothesis (that members of relatively large cohorts are less socially integrated and regulated than members of smaller cohorts), cohort theory provides an elegant medium for explaining deviant behavior. Stockard and O'Brien (2002) stress that a large cohort size generates deprivation in terms of institutions of support and control. Members of large cohorts often face increased competition for scarce socioemotional resources such as nurturing, attention, and discipline. In comparison with smaller cohorts, members of large cohorts grow up in bigger families, attend more crowded schools, and have less contact with adults.

Consequently, these children receive less attention from parents, teachers, clergy, counselors, and other important adult stakeholders. Members of large cohorts also tend to associate with each other more than they associate with members of other cohorts. This leads to the development of "youth cultures," defined as relatively insulated cliques that are cut off from the influence of older generations (Holinger, Offer, Barter, & Bell, 1994, p. 70). Participation in a youth culture functions to progressively reduce parents' involvement in their children's lives and exacerbates the negative and isolating effects of large cohorts.

Family Structure

The structure of the family unit also affects a person's life chances. Early childhood experiences, generated by the composition of the family, may be responsible for thoughts and feelings that increase tendencies toward nonconformity. Single-parent families have fewer collective financial and social resources. Consequently, compared with other children, children from these backgrounds are less likely to live in safe neighborhoods, have access to suitable day care, do well in school, or have a parent who occupies positions in beneficial adult social networks (Stockard & O'Brien, 2002).

In terms of networking, two-parent families generally have twice the access to these opportunities. These network structures link families with important community resources, including other parents, teachers, mentors, and counselors. This arrangement leaves single-parent households with comparatively fewer prospects for extrafamilial support and supervision of their children.

All members of the cohort are affected by RCS and family structure, regardless of the size and structure of their own family (Stockard & O'Brien, 2002). On average, all members of large cohorts experience a reduction in adult resources and social capital. Likewise, when the number of single-parent families is large, each young member has, on average, fewer adults to supervise them.

Each of these factors generates reductions in overall social integration and regulation. In terms of drinking behavior, we would expect (a) teenage members of relatively large cohorts to possess alcohol as minors more than teenagers from smaller cohorts and (b) members of cohorts consisting of a relatively large percentage of single-parent households to possess alcohol underage and drink more as teenagers than members of other cohorts.

Deterrence

RCS and family structure are intrinsic demographic features of the cohort that affect members' attitudes and behavior. Cohort theory posits that other external types of attributes can produce similar long-lasting changes. These include notable events, such as living through an economic depression or a war. The nature of these changes depends on the

cohort members' ages when the events occur. For instance, the Great Depression affected the life course of infants differently than those who experienced it in middle age. The changes caused by these types of external events are stable and analytically distinct from changes associated with age and period. With this in mind, we use deterrence theory to explicate how changes in PULA enforcement might produce lasting changes in the attitudes and behaviors of cohort members.

Deterrence theory stems from the Classical School of Criminology. The metatheoretical foundations of this approach are anchored in hedonism and humanism. People attempt to maximize pleasure while minimizing pain, and as free-willed, rational actors they weigh the costs and benefits of their actions. Consequently, according to this perspective, the chief purpose of the law is to deter criminal behavior by increasing the costs of committing crimes. There are two forms of deterrence. *Specific* deterrence is a punishment directed at an individual who has broken the law. Its purpose is to stop the apprehended offender from future criminal activity by countering the pleasure received from committing the offence with sufficient amounts of pain. *General* deterrence is aimed at potential offenders. It uses punishment directed at an individual to set an example for others. General deterrence is founded on the idea that once people gain knowledge of the punishment of another, they will become aware that they too may be caught. The perception of this linkage discourages would-be offenders.⁸ Recalling that, the life stage principle in cohort analysis submits that members of cohorts are affected by notable events in their lives leads to the supposition that the high-profile implementation of strict enforcement of PULA laws may have an enduring impact on teenagers' attitudes and behaviors in regards to alcohol. Research shows that reduced availability of alcohol delays the onset of drinking and also reduces its prevalence and intensity later in life (Chaloupka, 2004; Chesson et al., 2000; Coate & Grossman, 1988; Hawkins et al., 1997; Hingson et al., 2000; Hingson et al., 2001; Hingson et al., 2002; Schulenberg et al., 1996).

Hypotheses

We use arrest statistics to investigate the relationship between teenage drinking and alcohol-related problems. A large body of research demonstrates that excessive drinking behavior is associated with "second hand effects" (Saffer, 2001; Wechsler et al., 2002), especially vandalism and assaults (The Bureau of Justice Statistics, 1995; Carpenter, 2005; National Center on Addiction and Substance Abuse, 1994). As noted, theory argues that teenagers from relatively large cohorts are less socially integrated and regulated than adolescents from smaller cohorts. According to Durkheim, such individuals likely experience the destructive aspects of anomie and egoism. Drinking may offer a temporary relief. Consequently, heavy episodic drinking is a form of retreatism (Merton, 1938), and as such is one of many

potential indicators of decreased social integration and regulation. Recalling that research also suggests that compared with others, young people who drink heavily as teens are more likely to face alcohol-related problems leads to the first hypothesis:

Hypothesis 1 (H1): Net of other factors, there will be a positive relationship between RCS and the number of age/period-specific arrests for alcohol-related crimes, including vandalism and assault.

Likewise, cohort theory also suggests that family structure affects life chances. Children from cohorts with a relatively large percentage of single-parent families are less regulated than others because these children have fewer available resources and opportunities for extrafamilial support and supervision. As underage drinking is more likely to occur when supervision is lacking, we predict that teenagers from cohorts with a relatively large percentage of single-parent families will experience more alcohol-related problems than other young people.

Hypothesis 2 (H2): Net of other factors, there will be a positive relationship between the relative number of single-parent families in a cohort and the number of age/period-specific arrests for alcohol-related crimes, including vandalism and assault.

Finally, deterrence theory argues that young people who experience strict enforcement of PULA laws will be less likely to possess and therefore consume alcohol than other juveniles. These laws are geared toward reducing the availability of alcohol to underage drinkers. Studies show that reduced availability of alcohol delays the onset of drinking, and also reduce its prevalence and intensity (Chaloupka, 2004; Chesson et al., 2000; Coate & Grossman, 1988). Research also suggests that compared with peers, teenagers who drink less are also less likely to face alcohol-related problems as adults (Hawkins et al., 1997; Hingson et al., 2000; Hingson et al., 2001; Hingson et al., 2002; Schulenberg et al., 1996). PULA law enforcement is built on the principles of specific and general deterrence. Young people who are caught and punished for underage possession are less likely to drink in the future than others, and the example of their punishment also serves as a disincentive for their peers. The distinctiveness of general deterrence may also serve as an exogenous cohort-event that produces lasting changes in attitudes and behavior of members. This leads to the third hypothesis:

Hypothesis 3 (H3): Net of other factors, there will be an inverse relationship between the relative percentage of teenagers arrested for underage possession offenses in a cohort and the number of age/period-specific arrests for alcohol-related crimes, including vandalism and assault.

Test results from the third hypothesis have important implications for policy intervention programs. Confirmatory evidence suggests that strict PULA law enforcement measures may be effective in reducing subsequent drinking problems. Rejection of the hypothesis implies the opposite; these tactics have limited long-term implications and are ineffective in changing behavior.

Data and Analysis

The data for arrest rates comes from the Federal Bureau of Investigation's (FBI) Uniform Crime Reports (UCR; FBI, 1975-2006). We use relatively recent data because UCR arrest data for nonindex crimes before 1975 are not reliable. Prior to this date, the data are incomplete and not consistently submitted by a representative group of law enforcement agencies. As noted, our interest is centered on whether PULA enforcement reduces alcohol possession and consequently drinking and alcohol-related problems. The analysis focuses on assault and vandalism because research shows the majority of these crimes are committed by intoxicated persons. These offenses then serve as a reasonable proxy for such problems.

The UCR data for assault and vandalism are reported in 1-year increments for the ages between 15 and 24, and then in 5-year increments for ages 25 and older. This is problematic because APCC analysis requires equally spaced groupings and an age range that is equal to the time between periods. As noted, reliable UCR data for older cohorts is not available, so grouping the 1-year incremental data for 15- to 24-year-olds into 5-year cohorts is not an option because that would leave too few observations to effectively analyze. To sidestep this problem, our analysis is based on single-year groupings for ages ranging from 15 to 24 years old. Although, this methodology parts with the models used in a number of previous studies, it increases the number of observations available for analysis and so enables a close examination of the effect of teenage PULA enforcement on early adulthood drinking behavior.⁹ The data are arrayed in the form of a parallelogram (O'Brien, 2000). Each cohort is represented by the same number of cases for ages, while the number of cases for periods varies. There are 23 cohorts for the period 1975 to 2006. The first cohort was 15 years old in 1975; the final cohort was 24 years old in 2006. As the dependent variable is measured for the ages 15 to 24, this results in a total of 23 cohorts. Table 1 depicts a visual representation of the parallelogram coding matrix.

The number of law enforcement agencies reporting arrest data to the FBI changes from year to year. Moreover, the agencies reporting do not cover the entire population of the United States, so the data are corrected to reflect this.¹⁰ The regression calculations to follow are made for the natural log of arrest rates to reduce the skew in the distributions and to give equal weighting across age periods (O'Brien et al., 1999).

The UCR arrest data category *Liquor Law Violations*¹¹ subsumes underage drinking and possession of alcohol or PULA laws. Our analysis uses the natural log of a *Juvenile Enforcement Factor* (JEF) to capture the cohort effect of teenage PULA enforcement on subsequent behavior. For each cohort, JEF is equal to the average adjusted *Liquor Law Violations* arrest rate for 15- to 20-year-olds. This a proxy measure for level of enforcement. Higher values of JEF suggest increased enforcement. As noted, we predict that strict teenage PULA enforcement is associated with reductions in subsequent drinking problems.

Following previous APCC research, the variables *relative cohort size* (RCS) and *percentage of nonmarital births* (%NB) are used to characterize cohorts. Data for RCS is instantiated as the percentage of the total population age 15, when the cohort is 15 years old (multiplied by a factor of 1,000). Data were obtained from the U.S. Bureau of Census (various dates, 1975-1997). The percentage of births to unwed mothers was obtained from *The Vital Statistics of the United States* (U.S. Bureau of Census, 1975-1997) and is operationalized as the number of nonmarital births in a given year, per 1,000 live births.

A Word About UCR Data

A common criticism of the UCR is that it is not valid because it underestimates the incidence of criminal activity. Ample research indicates that this critique is well founded. However, our analysis is not dependent on identifying actual numbers of criminal offenses but rather is predicated on recognizing *trends* in offending. Fortunately, the UCR is helpful in this regard. For example, the UCR can be used to identify the degree to which law enforcement agencies step up their enforcement of PULA violations, even though it probably cannot accurately reflect the actual number of teenagers who are in violation of PULA laws. Another problem associated with official reports of crime is that they may reflect police monitoring behavior and differential PULA enforcement. For example, law enforcement officers may be more likely to police certain neighborhoods than others. Consequently, police officers may disproportionately enforce PULAs across different groups of people. Minority members in disadvantaged neighborhoods, for instance, may feel the effects of PULA enforcement more keenly than middle-class Whites in a suburban neighborhood. However, these patterns of differential enforcement are unlikely to affect the overall trends reflected in the UCR data especially in models like ours which do not differentiate offending rates by race or gender.

The Model

Equation (1) represents the APCC model used in the analysis.

Table 1. Matrix for Age–Period Cohorts

Year										
1975	I (15)									
1976	2	I (16)								
1977	3	2	I (17)							
1978	4	3	2	I (18)						
1979	5	4	3	2	I (19)					
1980	6	5	4	3	2	I (20)				
1981	7	6	5	4	3	2	I (21)			
1982	8	7	6	5	4	3	2	I (22)		
1983	9	8	7	6	5	4	3	2	I (23)	
1984	10	9	8	7	6	5	4	3	2	I (24)
1985	11	10	9	8	7	6	5	4	3	2
1986	12	11	10	9	8	7	6	5	4	3
1987	13	12	11	10	9	8	7	6	5	4
1988	14	13	12	11	10	9	8	7	6	5
1989	15	14	13	12	11	10	9	8	7	6
1990	16	15	14	13	12	11	10	9	8	7
1991	17	16	15	14	13	12	11	10	9	8
1992	18	17	16	15	14	13	12	11	10	9
1993	19	18	17	16	15	14	13	12	11	10
1994	20	19	18	17	16	15	14	13	12	11
1995	21	20	19	18	17	16	15	14	13	12
1996	22	21	20	19	18	17	16	15	14	13
1997	23 (15)	22	21	20	19	18	17	16	15	14
1998		23 (16)	22	21	20	19	18	17	16	15
1999			23 (17)	22	21	20	19	18	17	16
2000				23 (18)	22	21	20	19	18	17
2001					23 (19)	22	21	20	19	18
2002						23 (20)	22	21	20	19
2003							23 (21)	22	21	20
2004								23 (22)	22	21
2005									23 (23)	22
2006										23 (24)

Note: Each cohort (in bold) was born between 1960 and 1992. The age of selected cohorts for a year is given in parenthesis (for example, Cohort I was age 15 in 1975 and 24 in 1984).

$$\ln(CR)_{ijk} = \mu + \alpha_i + \pi_j + \rho(R_k) + \beta(B_k) + \ln \zeta(J_k) + e_{ij}. \quad (1)$$

The symbol CR represents the age/period-specific arrest rate for vandalism or assault, μ is the intercept parameter, α_i is the age effect for the i th age group, π_j is the period effect for the j th period, ρ is a regression coefficient for RCS, R_k represents the k th cohort, β is a regression coefficient for %NB, B_k represents the k th cohort and ζ is a regression parameter for the JEF, and J_k is the k th cohort. The subscripts run from $i = 1, \dots, 10$, for 10 age groups (starting at age 15 and ending at 24); and $j = 1, \dots, 32$, for 32 periods (beginning in 1975 and ending in 2006); and $k = 1, \dots, 23$, for our 23 cohorts.

Descriptive Statistics

Table 2 lists the descriptive statistics for the two dependent variables and the three independent variables used in the analyses.¹²

The mean assault, vandalism, and JEF rates are based on 230 age-specific rates. The means for each of these offenses are relatively high because they represent arrest rates for teenagers and young adults. The RCS changes moderately during the study period and the trends in the data for the %NB are increasing during the time period of the analysis.

PULA Enforcement and Alcohol-Related Behavior

We are interested in the relationship between strict enforcement of underage possession of alcohol laws and illegal behavior associated with intoxication, including assault and vandalism. A high percentage of these crimes are committed by intoxicated people. In fact, some research shows that as many as 90% of all assaults committed on college campuses involve intoxicated subjects (National Center on Addiction and Substance Abuse, 1994). Figure 1 depicts the 5-year

Table 2. Descriptive Statistics

	Dependent	Variables	Independent	Variables	%NB
	Assault	Vandalism	JEF	RCS	
M	1,348.95	374.58	1,540.28	20.30	117.43
SD	366.23	160.62	336.67	3.09	44.23
Minimum	520.39	166.53	710.70	16.78	53
Maximum	1,833.47	756.03	1,941.12	26.41	194

Note: JEF = juvenile enforcement factor; RCS = relative cohort size; NB = nonmarital births.

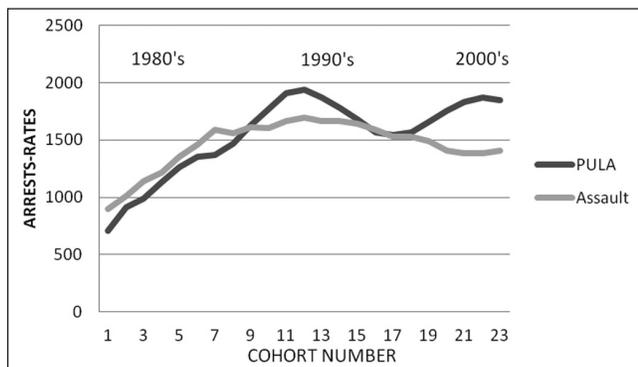


Figure 1. Arrest rates for assault (24-year-olds) and PULA (juveniles)

Note: PULA = Possession Under Legal Age.

average arrest rates (JEF) for PULA and single-year arrest rates for assaults involving 24-year-olds during the period from 1975 to 2006.¹³

Although the descriptive data in Figure 1 are not lagged, they imply an inverse relationship between these variables, especially in the 1990s and beyond. During this time frame, PULA arrest rates and the number of assault arrests for 24-year-olds trend in opposite directions. Yet, this apparent relationship could be misleading and does not necessarily imply causation. Any number of alternative explanations could account for the findings. For instance, shifts in the economy, the availability of alcohol to minors, changes in drinking age laws,¹⁴ changes in enforcement practices, or any combination of these factors and many others could explain one or both of these trend-lines. As noted, APCC analysis is useful in identifying spurious relationships given that it incorporates strong controls for these types of age and period effects.

Table 3 depicts the results from ordinary least squares (OLS) regression of two separate APCC model analyses that enable a test of our three hypotheses.

Only the three independent variables used to test the hypotheses are reported in Table 2. The dummy control variables are not reported, this is done to save space.¹⁵ For each model, the regression coefficient for JEF is in the predicted direction and significant ($p < .01$). For a one-unit increase in

the 5-year average PULA arrest rate within a cohort, the arrest rates for assault and vandalism of cohort members decrease by 0.125 and 0.134, respectively (net of other variables). This corroborates H3. The effects RCS are also significant ($p < .01$) and in the predicted direction. For a unit increase in the RCS, the arrest rate for assault increases by 0.014 and the arrest rate for vandalism increases by 0.026 (net of other variables). This evidence supports H1. However, the effects for nonmarital births are not significant ($p > .01$) in either model.¹⁶ This evidence contradicts H2. We analyzed each model for the presence of autocorrelation using O'Brien's (2000) method for the inspection of residuals and sign test. This technique detected no significant autocorrelation due to cohorts ($p = .447$ for assault; and $p = .105$ for vandalism).

Discussion

The results from the analysis support two of our three hypotheses. First, the findings suggest that RCS is related to problems associated with adult drinking behavior (H1). Exclusive of other factors, people born to larger cohorts are arrested more for vandalism and assault than those from smaller cohorts. Because these crimes are often committed by intoxicated persons, this implies that the percentage of intoxicated persons is greater among members of larger cohorts than smaller ones. Members of large cohorts often face increased competition for scarce socioemotional resources such as nurturing, attention, and discipline. This leads to the development of isolated youth cultures, less social integration and regulation, and the destructive experience of anomie and egoism. Drinking behavior may be a form of retreatism that stems from this decreased social integration and regulation often found in larger cohorts.

Second, the findings indicate that increasing arrests for underage possession of alcohol is associated with reductions in arrests for vandalism and assault (H3). Net of other variables, including age and period effects, cohort members who experienced tough PULA enforcement were less likely to be arrested for alcohol-related crimes both as teenagers and young adults. This evidence supports the principles of deterrence and cohort theory which argue respectively that (a) teenagers who are arrested for underage possession are less likely

Table 3. APCC Analysis for Assault and Vandalism

	B	SE	t	Significance
Assault				
Constant	8.181	.565	14.471	.000
JEF	-0.125	.040	-3.112	.002
RCS	0.014	.004	3.205	.002
%NB	-0.001	.002	-0.678	.499
$R^2 = .967$				
Vandalism				
Constant	6.455	.501	12.890	.000
JEF	-0.134	.036	-3.760	.000
RCS	0.026	.004	6.680	.000
%NB	-0.003	.002	-1.988	.048
$R^2 = .986$				

Note: APCC = Age-Period Cohort Characteristic; JEF = juvenile enforcement factor; RCS = relative cohort size; NB = nonmarital births.

to consume in the future and their punishment serves as an example for others and (b) the distinctiveness of visible enforcement serves as an exogenous cohort factor that shapes members' attitudes and behavior. These findings have important potential implications for public policy. If tough enforcement of underage drinking by 15- to 20-year-olds has an enduring impact on behavior, then law enforcement's efforts in imposing underage possession laws may be instrumental in reducing both adolescent and subsequent adult drinking and intoxication.

Finally, contrary to predictions, the results show that the %NB in a cohort is not related to alcohol-related arrests (H2). Although this finding runs counter to results from previous research related to deviance from cohort theory and research, it may be partly a product of the truncated nature of our data set. It maybe possible, for instance, that significant findings for nonmarital births may have materialized for suspects who were older than 24 years.

There are several important limitations of the current study that warrant further discussion. First, the results showing no effect for the %NB may be due to an interaction effect rooted in racial and cultural issues. For example, research shows that nonmarital births are more common for certain racial groups than others. In 2006, 65% of African American children lived in single-parent households, compared with 23% of non-Hispanic White children. However, during this same time period, African American teenagers self-reported drinking about 33% less often than did Whites (NHSDA, 2006). Future studies should attempt to control for this possibility.

Second as noted, the results of this study may be a consequence of the limited range of data available for analysis. Our cohort data range spanned only 10 years. Other research examines cohorts for a period up to 60 years or more. It is well known that a restricted data range reduces the size of regression and correlation coefficients. Accordingly, a relationship between the %NB and legal problems associated

with drinking may be detectable if older cohort members were included in the analysis. This is also a topic for future research. Third, using assault and vandalism rates as proxies for alcohol consumption may not accurately reflect decreases or increases in alcohol use. Instead, changes in assault and vandalism arrest rates may simply reflect, for example, differential reporting and enforcement practices. We believe however, that this is unlikely because prior investigations report that vandalism and assaults are very frequently committed by people who have consumed alcohol and so these indicators should serve as excellent proxies for intoxication (Saffer, 2001; Wechsler et al., 2002). Fourth, it should be noted that crimes like vandalism and assault are widely underreported, so caution must be used in interpreting the results. In the future, it would be beneficial to replicate this study using self-report data for vandalism and assault. In a similar vein, it would be interesting to replicate this study by investigating state or regional differences in these data. This could be accomplished using APCC models in combination with pooled time-series analysis.

Finally, future research should strive to understand how demographic factors like age, race, class, and sexuality interact with cohort and period effects to shape and structure life experiences, including problem drinking behavior. These variables likely do not affect the overall trends reflected in the UCR data or the interpretation of results from our model because we did not differentiate offending rates by race, gender, or class. However, future investigations of these types of variables could be accomplished by including them as *contemporaneous* control variables in the model. These factors are not constant across time periods or age groups but can be added to the model as additional control variables.

Conclusions

Research consistently suggests that early underage drinking may have serious implications for adult drinking behavior.

Teenagers who begin drinking early in life are more likely than those who start later to face drinking problems as adults. At both the local and national levels, the predominant strategy for dealing with underage drinking is to delay the age of its onset as long as possible by curbing drinking through reduced availability and tough zero-tolerance possession laws. Strict enforcement of PULA laws reduces the availability of alcohol to teenagers and so delays the onset of drinking. Scholarly investigations posit that delayed onset of consumption reduces alcohol consumption and drunkenness in adults. We investigated this issue by comparing birth-cohorts longitudinally using APCC models. These models explore whether cohort members who were subjected to strict enforcement measures as teens are arrested less frequently as adults for alcohol-related crimes than cohort members who experienced more lenient enforcement as adolescents. Results suggest that adolescent deterrence efforts and cohort size may affect adult drinking behavior.

Our findings suggest that net of other factors, people who are born into larger cohorts are more likely to be arrested for vandalism and assault than those born to smaller cohorts. This is significant because these crimes are often associated with intoxication. Likewise, members of cohorts exposed to relatively strict underage drinking laws and enforcement were less likely to be arrested for these crimes than others. This second finding may have important implications for public policy. If subsequent research confirms that tough enforcement of underage drinking by 15- to 20-year-olds has an enduring impact on behavior, then law enforcement's efforts in imposing underage possession laws may be instrumental in reducing both adolescent and subsequent adult drinking and intoxication.

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Notes

1. The research evidence is unambiguous that increases in the minimum drinking age and strict enforcement efforts have lowered the number of drunk drivers (both adults and minors) on the roads and reduced alcohol-related deaths (National Highway Traffic Safety Administration [NHTSA], 2002). However, we focus on nuisance crimes and assault because drunk driving enforcement efforts are aimed at both juveniles and adults, whereas, the effort to curb underage drinking is aimed solely at juveniles.
2. Tough laws and strict enforcement measures are usually only one element of most comprehensive plans. Other components include increasing the cost of alcohol; collaboration with

parents, schools, and community stakeholders to change the culture surrounding alcohol consumption; the elimination of alcohol advertising; and sponsorship.

3. See Bonnie and O'Connell (2004) for a complete review of these studies.
4. Finally, other variables called *contemporaneous* control variables—factors that are not constant across time periods or age groups—can be added to the model if additional control variables are needed.
5. See Wagenaar and Perry (1994) for an appropriate review.
6. Most notably homicides and suicides (O'Brien & Stockard, 2006).
7. In addition to the anomie and egoism, Durkheim delineated two other sources or factors that lead to suicide. These concepts also revolve around the concepts of social integration and regulation. Altruistic suicide is caused by too much social integration; fatalistic suicide is caused by too much social regulation.
8. Although it is beyond the scope of this article, several other criminological theories share common features with deterrence theory. These include operant conditioning, social learning theory, and social control theories.
9. Many previous researchers have constructed cohorts of 5-year age groupings usually because such cohorts serve as a surrogate for a generation. These studies often investigate theoretically relevant characteristics across the life span of the cohort and have access to valid and reliable data from a considerable number of years. Although these models have significant theoretical advantages, they come with a high methodological cost because they drastically reduce the number of observations available for analysis. The theoretical cost of structuring single-year cohorts is less in this study than other cases. We examine behavior that “ages out.” The prevalence and incidence of vandalism and assault rapidly declines as people grow older. This is much different from analyses that inspect the effect of cohorts on relatively enduring facets of human behavior such as political attitudes, prejudice, generational differences in income, and suicide.
10. The data are corrected to reflect for coverage by dividing the number of residents in the areas reporting to the Federal Bureau of Investigation (FBI) by the total U.S. population. This number is then multiplied by the number of arrests for each age group. The crime rates per 100,000 were calculated by dividing the corrected number of arrests by the U.S. population for a given age group, and then multiplied by 100,000.
11. Defined as the violation of laws or ordinances prohibiting the manufacture, sale, transporting, furnishing, possessing of intoxicating liquor; maintaining unlawful drinking places; bootlegging; operating a still; furnishing liquor to a minor or intemperate person; using a vehicle for illegal transportation of liquor; drinking on a train or public conveyance; and all attempts to commit any of the aforementioned. (Drunkenness and driving under the influence are not included in this definition; FBI, 1993.)
12. The data for 1979 are an average of 1978 and 1980.

13. An analysis between JEF and vandalism yielded similar curves. However, the curve for vandalism is based on a different scale than that for assaults and so could not be included in Figure 1. To save space, the vandalism versus PULA arrests figure is not included in this article (but is available from the lead author on request).
14. It is interesting to note that during the early to mid-1980s, 22 states briefly reduced the minimum drinking age from 21 by 1 to 3 years. All states reinstated the 21-year-old minimum drinking age by 1988. Period changes such as these are controlled for by the dummy variables included in the model.
15. The omitted dummy variables for age and period are the values "24" and "2006," respectively. In both analyses, nearly all the dummy control coefficients are significant, $p < .05$. For most of the coefficients, the values of the independent variables to each dependent variable are negative for period and positive for age. These data are available from the lead author on request.
16. However, this variable is significant (at $p < .05$) for vandalism.

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