



HHS Public Access

Author manuscript

Prev Sci. Author manuscript; available in PMC 2017 January 01.

Published in final edited form as:

Prev Sci. 2016 January ; 17(1): 32–39. doi:10.1007/s11121-015-0579-2.

Alcohol sales to youth: Data from rural communities within the Cherokee Nation

Sarah D. Lynne-Landsman, Ph.D.¹, Terrence K. Kominsky, Ph.D.², Melvin D. Livingston, Ph.D.³, Alexander C. Wagenaar, Ph.D.¹, and Kelli A. Komro, Ph.D.¹

¹Department of Health Outcomes and Policy, College of Medicine and Institute for Child Health Policy, Gainesville, FL, USA

²Cherokee Nation Behavioral Health, Tahlequah, OK, USA

³Department of Biostatistics and Epidemiology, School of Public Health, University of North Texas Health Science Center, Fort Worth, TX, USA

Abstract

Background—Access to alcohol among individuals under 21 years of age continues to be a public health concern with approximately 5,000 youth deaths attributable to alcohol each year (United States Department of Health and Human Services, 2007). To date, there is no research on youth access to alcohol from commercial sources within rural communities with large populations of Native American families.

Methods—We evaluated commercial access to alcohol by underage-appearing female confederates in 4 rural towns within the Cherokee Nation, a non-reservation tribal jurisdiction that includes a high proportion of Native Americans embedded within a predominately White population. Alcohol purchase attempts were conducted approximately every four weeks on 10 occasions for a total of 997 alcohol purchase attempts. In addition to purchase attempt outcome, we collected data on characteristics of the outlets and clerks.

Results—Alcohol was sold to confederates without use of age identification on 23% of all purchase attempts. Across repeated attempts, 76% of outlets sold alcohol to a confederate at least once. Males and younger clerks were more likely to sell alcohol to the confederates. Grocery stores and gas stations were more likely to sell alcohol to the confederate than liquor stores but this effect was no longer significant once seller age was accounted for in a multivariable model.

Conclusion—Three out of 4 outlets sold alcohol to young-appearing buyers at least once across repeated attempts. Results reinforce the continuing need for regular enforcement of laws against selling alcohol to minors.

Keywords

Alcohol; purchase attempts; compliance checks; underage drinking; adolescents; Native Americans

Corresponding Author: Sarah D. Lynne-Landsman, sarah.landsman@ufl.edu.

The authors declare that they have no conflict of interest.

Teen alcohol use has slowly declined since the early 1980s, leveling off temporarily in the 1990s, then continuing on the slow downward trend through 2013 (Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2014). This can be attributed to some effective policy changes (e.g., increasing the minimum legal drinking age to 21 years) and prevention efforts (Horgan, Skwara, & Strickler, 2001). Yet, current results from the 2013 Youth Risk Behavior survey, a nationally representative survey of high school students, indicated that approximately 31% of 10th graders and 47% of 12th graders reported drinking alcohol in the past month (Kann et al., 2014). Similarly results from the Youth Risk Behavior Survey conducted within the jurisdictional service area of the Cherokee Nation (CN-YRBS) found that approximately 32% of 10th graders and 42% of 12th graders reported drinking alcohol in the past month (Cherokee Nation, 2013). Previous studies that included Native American populations indicated that adolescent alcohol use is either comparable or higher among Native American youth compared to White youth (Beauvais, Jumper-Thurman, Helm, Plested, & Burnside, 2004; National Survey on Drug Use and Health, 2007; Substance Abuse and Mental Health Services Administration, 2011). Importantly, Native Americans are more likely to suffer the negative effects of alcohol (e.g., mortality, morbidity) compared to other Americans (Indian Health Service, 2013; Szlemko et al., 2006). These results, both across the U.S. and in the Cherokee Nation, emphasize the need to understand factors related to easy youth access to alcohol. Regardless of race/ethnicity, teen drinking causes numerous problems, most notably unintentional injuries, the leading cause of death among adolescents in the United States. Approximately 5,000 youth deaths are attributable to alcohol-related injuries each year (United States Department of Health and Human Services, 2007).

In early adolescence, youth typically obtain alcohol from social sources (e.g., parents, friends). Access to alcohol directly from commercial retailers occurs in later adolescence, with a typical trickle-down effect where older adolescents then provide alcohol to younger teens (Lynne-Landsman & Wagenaar, 2015). Under both circumstances, adults are responsible for access to alcohol by youth either by providing alcohol to youth directly, failing to secure the alcohol in their home, or selling directly to teens.

In the early 1990s, researchers began to move beyond youth-self report and conduct the first direct evaluations of the ability of youth to purchase alcohol from commercial retailers. In these studies, underage youth or confederates (e.g., individuals aged 21 years and older who appear to be underage) attempted to purchase alcohol without age identification from retail outlets. The earliest of these studies found that confederates were able to successfully purchase alcohol without identification on between 44 – 97% of attempts (Forster et al., 1994; Forster, Murray, Wolfson, & Wagenaar, 1995; Preusser & Williams, 1992; Wolfson et al., 1996). This wide variability in the buy rate for early studies of alcohol purchase attempts could be due to both community characteristics and alcohol sale law enforcement activities. The lowest rate of 44% was in a community which the researchers discovered did have some active enforcement of underage alcohol sale laws. The highest rate of 97% was in an urban community for which the researchers were not aware of any active efforts to enforce underage alcohol sale laws. Of the studies that conducted repeated attempts on the same outlets, one found that just over 70% of outlets sold alcohol to the underage confederate across two repeated attempts (Forster et al., 1995) while another reported that 79% of alcohol outlets sold at least one time over the course of three repeated attempts (Forster et

al., 1994). Most of this research came from areas in Minnesota, Wisconsin, New York and Washington D.C., ranging from smaller rural towns to more-urban cities.

Research from the late 1990s and early 2000s found buy rates between 26 – 39% (Britt, Toomey, Dunsmuir, & Wagenaar, 2006; Freisthler, Gruenewald, Treno, & Lee, 2003; Paschall et al., 2007; Toomey, Komro, Oakes, & Lenk, 2008). Despite this drop in the average buy rate, Britt et al. (2006) found that 74% of retail establishments sold alcohol to the underage confederate at least once across 2 – 5 repeated alcohol purchase attempts. These studies were conducted primarily in suburban and metropolitan cities with one examining rural communities in Oregon.

Characteristics of alcohol purchase attempts that contribute to a successful purchase in off-premise outlets have also been evaluated, with mixed findings. More recent research observed that neither buyer nor seller characteristics predicted alcohol sales, including gender and age of seller using both male and female buyers (Britt et al., 2006; Paschall et al., 2007) or female buyers only (Freisthler et al., 2003; Toomey et al., 2008). However, earlier studies using only female buyers found some evidence that younger sales clerks (under age 30) and male clerks were more likely to sell alcohol to underage youth or confederates without identification (Forster et al., 1994; Forster et al., 1995). Sales clerks at grocery and convenience stores were more likely to sell compared to sales clerks at liquor stores (Paschall et al., 2007; Wolfson et al., 1996). Also, off-premise outlets in communities with greater disadvantage (e.g., low income, high unemployment) and higher outlet density were more likely to sell to underage confederates (Freisthler et al., 2003; Preusser & Williams, 1992; Toomey et al., 2008). The presence of warning signs in an outlet was associated with fewer sales in some studies (Britt et al., 2006; Paschall et al., 2007), but others found no effect for off-premise outlets (Forster et al., 1995; Toomey et al., 2008). Stores that were busier were also more likely to sell to underage confederates (Britt et al., 2006; Forster et al., 1995).

The most recent published data on commercial access to alcohol by underage youth is a decade old (data from 2005; Paschall et al., 2007) and none of the prior studies have evaluated communities with a high proportion of Native American residents. Furthermore, most of the previous research has not evaluated buy rates across repeated attempts. Of the three studies that did evaluate repeated attempts, there is some evidence that additional attempts at the same outlet results in greater likelihood of a sale with just over 70% selling across 2 attempts, 79% selling across 3 attempts, and an average of 74% selling across 2 – 5 attempts (Britt et al., 2006; Forster et al., 1994; Forster et al., 1995). The current study provides updated data on the ability of underage youth to purchase alcohol directly from off-premise commercial retail outlets across 6-10 attempts. In addition, we extend this research into a region of the United States that has never been evaluated, rural Oklahoma within the boundaries of the Cherokee Nation. Cherokee Nation is a non-reservation, 14-county jurisdictional service area located in northeastern Oklahoma where approximately 50% of the 300,000 Cherokee citizens reside. Given that the Cherokee Nation is *not* a reservation, there are not specific Cherokee outlets or towns in the Cherokee Nation. These communities are fully integrated, multi-ethnic rural communities comprised of primarily Native American and White populations (see Komro et al., 2015). This context is noteworthy in that both

Native American and rural communities have been underrepresented in previous research on commercial access to alcohol among youth. Further, rural youth, particularly ethnic minorities in rural communities, are at increased risk for alcohol use (Swaim & Stanley, 2010). As such, this study extends previous research into a new context and high risk population providing information on potential avenues for intervention to improve alcohol-related health outcomes among Native American and rural youth. This study provides new information on environmental risk factors for adolescent alcohol use (both Native and non-Native) within a culturally integrated, rural area with a high proportion of Native American students. We also evaluate characteristics of outlets that sell to youth, which will inform environmental strategies to reduce youth access to alcohol from commercial sources.

Method

Community Areas and Establishments

This paper reports alcohol purchase attempt rates and predictors of buy success using baseline data from a large ongoing randomized controlled interrupted time series intervention trial being implemented within the boundaries of the Cherokee Nation. Four communities were assessed across all 10 monthly baseline assessments with an additional two communities assessed starting in the eighth month. This study only used baseline assessments to avoid confounding with potential intervention effects. The populations of the six communities where the alcohol purchase attempts occurred ranged from 1,417 to 9,507 in 2012. The percent of the population that was Native American ranged from 10 to 48% across the six communities, with a larger percentage reporting mixed heritage that included Native American. The median household income ranged from \$26,431 to \$38,744 in 2012.

Alcohol purchase attempts were conducted at every off-premise alcohol retail outlet within a 20 minute drive-time from the city center in each of the six communities in 2012 with one exception. A random sample of off-premise alcohol outlets was selected for one of the communities due to the large number of outlets within the 20 minute drive-time radius. This radius was selected taking into account possible off-premise outlets youth might use, the likely geo-spatial range of intervention effects being evaluated in the research trial, and maintaining distinct geographic separation between the communities in the study. The geo-spatial range of intervention effects was determined based on previous trials of similar interventions in other communities (Komro et al., 2008, 2004; 2001; Wagenaar et al., 2000). The number of off-premise outlets tested each month ranged from 88 – 125 across the 3 to 10 baseline repeated assessments, resulting in a total of 997 alcohol purchase attempts from a total of 133 outlets. Twelve percent of the outlets were large grocery stores, 67% were convenience stores/gas stations, and 20% were liquor stores.

Purchase Attempts

Past research has shown that the rate of alcohol sales does not vary by the buyer's gender (Britt et al., 2006; Freisthler et al., 2003). Thus, female confederates conducted all purchase attempts as it allowed for protocols to be standardized across buy staff. The recruitment of buyers took place at a state university a minimum of 25 miles from any of the study communities. Buyers were required to be at least 21 years of age and pass an age panel that

consisted of between 10 and 20 community members selected at random from a local grocery store. To pass the age panel, the mean of the perceived visual age estimates had to have been less than 20 years. All confederates participated in a three-hour training session upon hiring. They were debriefed after each round of attempting to purchase alcohol and were provided feedback based on the debriefing.

All alcohol purchase attempts were conducted on Friday nights between the hours of 5pm and 10pm. Confederates always worked in teams of two, a buyer and a driver, and followed a pre-determined route to ensure that all off-premise alcohol retail establishments could be assessed during the time allotted. When driving, confederates were trained to park away from the front entrance of the off-premise alcohol outlets and observe aspects of its exterior to be able to complete a brief questionnaire after departing from the outlet. When buying, the buyer left their identification in the car, entered the off-premise alcohol outlet, and attempted to purchase alcohol. Based on availability of alcohol, buyers were instructed to first select a four- or six-pack of fruity, sweetened alcoholic beverage (e.g., Mike's Hard Lemonade). If none were available, a six-pack of light beer was to be selected. The focus on fruity, sweetened alcoholic beverages was to promote external validity as interviews with our female confederates and field observations indicated that this more accurately reflected the type of alcoholic beverage a young female would most likely prefer. Buyers were to select the register with the shortest line and trained on how to respond to seller inquiries. For example, when asked for identification, buyers were to feign looking for it, explain that they must have left it in the car and then truthfully state their age in an attempt to complete the purchase. If the seller required that the buyer provide age identification, the buyer left the establishment and went to the next off-premise outlet. After each alcohol purchase attempt, buyers returned to the car, drove to a different, non-outlet location (e.g., a carwash) and completed data collection instruments regarding the characteristics of the seller and the outcome of the attempt. Any alcohol that was successfully purchased was stored in the trunk until it could be turned in to and disposed of by research staff at the end of the night (i.e., poured down the drain, bottles recycled). Each off-premise alcohol retail establishment was assessed a minimum of 3 times and a maximum of 10 times. Confederates were rotated as drivers and buyers and between communities to avoid being recognized by clerks employed at the off-premise alcohol outlets. A given buyer was sent back to an outlet to attempt to purchase alcohol only after a minimum of six months had passed. Quality control checks of buyer/driver pairs were conducted unobtrusively in the field to ensure fidelity of data collection and adherence to protocols. One of two supervisors verified through direct observation and immediate intervention (if necessary) that buyers were strictly complying with the method (e.g., parking in an appropriate location, not filling out paperwork while in the parking lot of the outlet) outlined in the alcohol purchase attempt protocol. This information was then used to inform end-of-shift feedback and future training of the buyers. During training all confederates were informed that these observations would take place to assure that they were heeding all policies and procedures.

Measures

The driver and the buyer completed separate data collection instruments. The driver collected data on exterior maintenance of the off-premise outlet (good, fair, poor), and the number of people loitering outside (none, 1 – 5, 6 or more).

The buyer answered questions about the outcome of the purchase, the alcohol type and price, demographics of the sales clerk, type of outlet, and the presence of signage relating to underage drinking. Response options for the purchase attempt outcome included: purchased with no questions, purchased after stating age, purchased after stating identification not on me, purchased after explaining that identification was in the car, no purchase. Purchase attempt outcome was dichotomized to purchase vs. no purchase for all analyses. The gender and estimated age of the sales clerk were categorized as male or female and less than 20, 20 – 29, 30 – 39, 40 or older, respectively. Perceived age of the seller was included because research has shown that based on facial features, a person's age can be accurately estimated within 2-4 years of their actual age (Rhodes, 2009). In another study, participants were able to classify individuals into age categories (18 – 25 years, 35 – 45 years, and 55 – 75 years) with 83% accuracy (Anastasi and Rhodes, 2006). Categories for the type of off-premise alcohol retail establishment were gas station/convenience store/drug store, large grocery store (operationally defined as a full aisle of produce), liquor store, and an open-ended write-in option. There were only four write-ins across all purchase attempts; these were examined and it was determined that they should have been coded differently when originally recorded. Thus, they were recoded into the appropriate categories. Finally, the presence of signage related to underage drinking was recorded as Yes or No.

Analyses

All baseline purchase attempts were used in the evaluation of the overall buy rate as well as the analysis of outlet/seller characteristics related to purchase attempt outcome. To estimate an outlet-specific buy rate (e.g., the percent of stores that sold at least once across repeated attempts), we restricted the sample to outlets that had at least 6 repeated assessments. Stores with fewer repeated assessments were missing by design, primarily due to the delayed addition of 2 communities to the monthly assessments, and did not have the same opportunity in our data to sell to our confederate buyers.

Frequencies were conducted to evaluate the overall buy rate across all attempts. Pooled cross-sectional analyses using mixed-effects logistic regression were conducted to examine associations between a successful alcohol purchase attempt and characteristics of the off-premise outlets and sellers. Initial estimates used a three-level model accounting for the nesting of outlets within community and repeated attempts within outlet. However, the random effect for community was dropped from the final models when it was estimated to be zero. Autocorrelation due to repeated assessments of the same outlet was modeled using an AR(1) covariance structure. Bivariate (crude) models were analyzed to assess whether there were any differences in the probability of a successful alcohol purchase by outlet and seller characteristics. A multivariable (adjusted) model including all predictors was analyzed to assess the independent association of each outlet and seller characteristic with successful

alcohol purchases. All regression models were conducted using PROC GLIMMIX in SAS v9.3.

We conducted an analysis to determine the level of missingness in the study taking into account differences in the number of attempts due to design. Outlets from the original four communities had 10 possible assessments ($n = 96$), while outlets from the additional two communities only had a total of three possible assessments ($n = 37$). Seventy-one percent of the outlets ($n=95$) missed none of their possible assessments, 15% missed a single possible assessment ($n=20$), 7.5% missed two possible assessments ($n=10$), 4.5% missed four possible assessments ($n=6$), and 1.5% missed five possible assessments ($n=2$). Missing purchase attempts were overwhelmingly due to confederates being unable to finish their assigned routes. Outlets with missing possible attempts were more likely to be liquor stores ($p<0.01$) and have male sellers during assessment ($p=0.01$) as they close at 9:00pm. As a sensitivity analysis, we estimated the multivariable model using full information maximum likelihood in MPlus v6. There were no substantial differences between the full information maximum likelihood and complete case results.

Results

Alcohol was sold to the confederates on 23% of *all* purchase attempts (see Table 1). Over the course of 6 to 10 repeated assessments, 76% of off-premise outlets sold alcohol to a confederate at least once (see Figure 1). Of the 76% of off-premise outlets that ever sold to a confederate, more than half sold on 1 out of every 4 attempts (stores with a 25% buy rate) with a small number of outlets selling to the confederate at 50% or more of attempts.

Bivariate analyses were conducted on purchase attempt outcome. Only three of the independent variables were statistically associated with purchase attempt outcome (see Table 2).

Clerks at grocery stores had 120% higher odds and clerks at gas stations had 93% higher odds of selling alcohol to the confederate compared to clerks at liquor stores. Male clerks had 59% higher odds of selling alcohol to the female confederates compared to female clerks. Younger sales associates were also more likely to sell alcohol compared to older sales associates. In other words, clerks that appeared less than 20 years and clerks that appeared between 20 and 29 years of age had 204% higher odds and 104% higher odds of selling alcohol, respectively, compared to clerks who appeared 40 years of age or older. In the multivariable model only seller characteristics (age and gender) remained statistically associated with the buy rate.

A follow-up examination revealed that seller age was systematically associated with business type. Older sales clerks were more likely to work at liquor stores with 83% appearing age 30 or older. In contrast, 60% of grocery store clerks and 41% of gas station clerks appeared to be 29 years old or younger.

Discussion

The overall rate of alcohol sales to underage-appearing, female confederates not presenting age-identification in this study is comparable to the estimates from the late 1990s and early 2000s (Britt et al., 2006; Freisthler et al., 2003; Paschall et al., 2007; Toomey et al., 2008) which were considerably lower than those found in the early 1990s (Forster et al., 1994; Forster et al., 1995; Preusser & Williams, 1992; Wolfson et al., 1996). The current study found that for outlets assessed at least 6 times, approximately 1 of every 4 attempts resulted in a sale of alcohol to a confederate. Further, 3 out of every 4 of these same off-premise outlets sold alcohol at least once. This is consistent with previous research which found rates of sales across 2 – 5 attempts between 70 – 79% (Britt et al., 2006; Forster et al., 1994; Forster et al., 1995). While most of the off-premise outlets that sold across repeated attempts did so less than 50% of the time, there were a number of outlets selling alcohol to the confederate at almost every attempt as illustrated in Figure 1. While any reduction in the ability of youth to purchase alcohol is an improvement, obviously it is critical that outlets consistently refuse to sell alcohol without identification to underage youth. The fact that most of the off-premise outlets sold alcohol to underage-appearing confederates across repeated attempts highlights the importance of prevention efforts to reduce the ease which with youth gain access to alcohol from commercial sources.

Similar to earlier studies of factors related to alcohol purchase attempt outcomes, we found that younger sales clerks (Forster et al., 1994) and male clerks (Forster et al., 1995) were more likely to sell alcohol to confederates. Other more recent studies have not found an association between seller characteristics and purchase attempt outcome (Britt et al., 2006; Freisthler et al., 2003; Paschall et al., 2007; Preusser & Williams, 1992; Toomey et al., 2008). In contrast to previous studies which found a protective effect of signage for off-premise outlets (Britt et al., 2006; Paschall et al., 2007), we found no evidence that the presence of warning signs in an off-premise outlet was associated with alcohol purchase attempt outcome. Further study of the effectiveness of such signage is warranted.

Store type was significantly related to purchase only in the bivariate analyses. This effect is consistent with Paschall et al. (2007) and Wolfson et al. (1996) who found that confederates are more likely to be sold alcohol without identification at grocery stores and gas stations relative to liquor stores. Given that liquor stores are more likely to have older sales clerks, the effect of business type is no longer significant after accounting for seller age in the adjusted model. Each of the communities evaluated in the current study had a large national superstore (e.g., retail department store with grocery section). While there were too few of these superstores to statistically evaluate them as a separate category, a sensitivity analysis was conducted to determine if their inclusion in the grocery store category inordinately influenced results. None of the previously reported effects changed when the superstores were removed from the analyses. However, we found that 39% of attempts at grocery stores resulted in a purchase when superstores were not included in the grocery store category whereas the buy rate was 26% when superstores were included. Future research should consider categorizing grocery stores and superstores separately. Moreover, many grocery stores have self-checkout aisles which may provide an easier way for underage youth to purchase alcohol. While this is not yet a tested hypothesis, self-checkout aisles may partially

account for higher rates of sales at grocery stores due in part to having only one clerk monitoring multiple self-checkout stations. Although an evaluation of self-checkout stations was beyond the current study, future research should specifically evaluate the possibility of youth accessing alcohol via self-checkout.

Strengths and Limitations

This research has updated what was known about the potential procurement of alcohol by underage youth via commercial access. In addition, this study expands the literature in a number of ways. First, it is the only study to include more than 5 repeated assessments on the same outlet given that some outlets were assessed 6 – 10 over the course of 9 months. The repeated assessments provided new information about off-premise outlet risk for alcohol sales to underage youth in that this isn't a problem attributable to a minority of non-compliant off-premise outlets. Rather, the majority of outlets failed an attempt within a relatively short time frame. This information has major implications for preventing commercial access to alcohol by youth, emphasizing a need for training and monitoring of all off-premise alcohol outlets. Moreover, this type of surveillance research has not been conducted in the past decade thus providing contemporary data on the problem of commercial access to alcohol among youth.

A strength of this study is the unique population, particularly given that previous research indicated that adolescent alcohol use is either comparable or higher among Native American youth compared to White youth (Beauvais et al., 2004; National Survey on Drug Use and Health, 2007; Substance Abuse and Mental Health Services Administration, 2011) and that Native Americans are more likely to suffer the negative effects of alcohol compared to other Americans (Indian Health Service, 2013; Szlemko et al., 2006). However, given that the Cherokee Nation is not a reservation and is, in fact, a tribal jurisdiction service area that includes a high proportion of Native American embedded within a predominately White population, it is not possible to draw inferences specific to Native American, or more specifically Cherokee youth or communities. This study does provide information about commercial availability of alcohol to all youth (Native and non-Native) who reside in this unique rural area. Preventing commercial access to alcohol by youth is an important avenue for interventions to prevent alcohol-related harms for this population.

Although the unique characteristics of this sample are a strength in expanding our knowledge of factors related to alcohol purchase attempts, these same characteristics may also hinder generalizability. In fact, the results of this study and all prior research in this field are community-specific. To date, there has not been an evaluation of commercial availability of alcohol to youth through alcohol purchase attempts using a systematic random sample of outlets representative of an entire state or the United States. Despite this limitation, the general confluence of estimates of rates of sales well above zero among the variety of location-specific studies conducted in the United States over the past 25 years provides some evidence in support of the widespread nature of the problem of commercial access to alcohol by youth.

Implications and Future Directions

There were some reductions in buy rates from the early 1990s to the late 1990s – early 2000s based on community-specific samples. However, buy rates from studies within the past decade are remarkably similar. There continues to be mixed evidence regarding contemporaneous predictors of alcohol sales to underage confederates and as such these factors may not be the most effective targets of prevention efforts. Specifically, the current study found that younger male clerks were more likely to sell to the confederates; however, most previous research has not found effects for seller characteristics (Britt et al., 2006; Freisthler et al., 2003; Paschall et al., 2007; Preusser & Williams, 1992; Toomey et al., 2008) with two exceptions (Forster et al., 1994; Forster et al., 1995). As such, it is still important to encourage proper training of alcohol outlet staff but alternative strategies must also be considered. For instance, there is strong evidence to support that regular compliance check enforcement is an effective strategy for reducing commercial sales of alcohol to underage youth (Lynne-Landsman & Wagenaar, 2015; Preusser, Williams, & Weinstein, 1994; Wagenaar, Toomey, & Erickson, 2005). Wagenaar et al. (2005) found that alcohol retail outlets that experienced an enforcement check were 17% less likely to sell alcohol to underage buyers. However, most of this effect dissipated after three months in the absence of further enforcement checks. There is evidence of modest reductions in alcohol sales to minors among establishments geographically close to those checked for compliance but this effect dissipated quickly as distance increased (Erickson, Smolenski, Toomey, Carlin, & Wagenaar, 2013). Checking the compliance of all alcohol retail outlets at least once every three months may be the most effective strategy for reducing commercial access to alcohol among underage buyers over time. There is also evidence that media coverage of citations issued in compliance checks for sales of alcohol to underage youth helps spread the influence of those checks to other outlets that were not part of the checks (Scribner & Cohen, 2001). As such, a media-based strategy may be effective in spreading the effects of checks to other outlets if paired with compliance check enforcement efforts but it is unclear if combining media-based strategies and compliance checks would increase the sustainability of the effects for longer than 3 months.

Commercial access to alcohol among underage youth is illegal and entirely preventable. The finding that 3 out of 4 off-premise outlets sold at least once to the young-appearing confederates highlights the fact that direct alcohol sales to youth is not just the result of a small number of “bad” outlets. Rather, this is a problem that communities need to address among all alcohol retailers. Future research should continue to monitor rates of commercial access to alcohol in various contexts and populations in addition to identifying effective strategies to prevent youth from accessing alcohol through both commercial and social sources.

Acknowledgments

Research reported in this publication was supported by the National Institute on Alcohol Abuse and Alcoholism, with co-funding from the National Institute on Drug Abuse, of the National Institutes of Health (NIH) under Award Number 5R01AA02069 (PI, Kelli A. Komro). We also acknowledge generous support from the Cherokee Nation and the University of Florida Institute for Child Health Policy. Finally, we thank Jessica Douthitt for her excellent management and dedication to excellence in the supervision of the monthly alcohol purchase attempts, and for each

of the confederate buyers who participated in this study. The content is solely the responsibility of the authors and does not necessarily represent the views of the NIH, the University of Florida, or the Cherokee Nation.

References

- Anastasi JS, Rhodes MG. Evidence for an own-age bias in face recognition. *North American Journal of Psychology*. 2006; 8:237–253.
- Beauvais F, Jumper-Thurman P, Helm H, Plested B, Burnside M. Surveillance of drug use among American Indian adolescents: Patterns over 25 years. *Journal of Adolescent Health*. 2004; 34:493–500. [PubMed: 15145406]
- Britt H, Toomey TL, Dunsmuir W, Wagenaar AC. Propensity for and Correlates of Alcohol Sales to Underage Youth. *Journal of Alcohol & Drug Education*. 2006; 50(2):18.
- Cherokee Nation. Cherokee Nation Youth Risk Behavior Surveillance System Survey Data. Tahlequah, OK: Cherokee Nation Behavioral Health Services; 2013.
- Erickson D, Smolenski DJ, Toomey T, Carlin BP, Wagenaar AC. Do Alcohol Compliance Checks Decrease Underage Sales at Neighboring Establishments? *Journal of Studies on Alcohol and Drugs*. 2013; 74(6):852–858. [PubMed: 24172111]
- Forster JL, McGovern PG, Wagenaar AC, Wolfson M, Perry CL, Anstine PS. The Ability of Young-People to Purchase Alcohol without Age Identification in Northeastern Minnesota, USA. *Addiction*. 1994; 89(6):699–705. [PubMed: 8069171]
- Forster JL, Murray DM, Wolfson M, Wagenaar AC. Commercial Availability of Alcohol to Young-People - Results of Alcohol Purchase Attempts. *Preventive Medicine*. 1995; 24(4):342–347. [PubMed: 7479623]
- Freisthler B, Gruenewald PJ, Treno AJ, Lee J. Evaluating Alcohol Access and the Alcohol Environment in Neighborhood Areas. *Alcoholism: Clinical and Experimental Research*. 2003; 27(3):477–484.
- Horgan, C.; Skwara, KC.; Strickler, G. Substance abuse: The nation's number one health problem. Princeton, NJ: Schneider Institute for Health Policy, Brandeis University; 2001.
- Indian Health Service. Indian Health Disparities. 2013 Jan. Retrieved from http://www.ihs.gov/factsheets/index.cfm?module=dsp_fact_disparities
- Kann L, Kinchen S, Shanklin SL, Flint KH, Hawkins J, Harris WA, et al. Zaza S. Youth risk behavior surveillance – United States, 2013. *Morbidity and Mortality Weekly Report*. 2014; 63(no. SS-4): 1–168. [PubMed: 24402465]
- Komro KA, Perry CL, Veblen-Mortenson S, Farbaksh K, Toomey TL, Stigler MH, Williams CL. Outcomes for a randomized controlled trial of a multi-component alcohol use preventive intervention for urban youth: Project Northland Chicago. *Addiction*. 2008; 103:606–618. [PubMed: 18261193]
- Komro KA, Perry CL, Veblen-Mortenson S, Stigler MH, Bosma LA, Munson KA, Farbaksh K. Violence-related outcomes of the D.A.R.E. Plus project. *Health Education & Behavior*. 2004; 31:335–354. [PubMed: 15155044]
- Komro KA, Perry CL, Williams CL, Stigler MH, Farbaksh K, Veblen-Mortenson S. How did Project Northland reduce alcohol use among young adolescents? Analysis of mediating variables. *Health Education Research*. 2001; 16:59–70. [PubMed: 11252284]
- Komro KA, Wagenaar AC, Boyd M, Boyd BJ, Kominsky T, Pettigrew D, et al. Maldonado Molina MM. Prevention trial in the Cherokee Nation: Design of a randomized community trial. *Prevention Science*. 2015; 16:291–300. [PubMed: 24615546]
- Lynne-Landsman, SD.; Wagenaar, AC. Alcohol policy: Interventions to prevent youth alcohol use. In: Scheier, LM., editor. *Handbook of Adolescent Drug Use Prevention*. Washington, DC: American Psychological Association; 2015. p. 329-341.
- National Survey on Drug Use and Health. Substance use and substance use disorders among American Indians and Alaska Natives. Rockville: Substance Abuse and Mental Health Services Administration; 2007.

- Paschall MJ, Grube JW, Black C, Flewelling RL, Ringwalt CL, Biglan A. Alcohol outlet characteristics and alcohol sales to youth: Results from alcohol purchase surveys in 45 Oregon communities. *Prevention Science*. 2007; 8:153–159. [PubMed: 17243019]
- Preusser DF, Williams AF. Sales of alcohol to underage purchasers in three New York counties and Washington, D.C. *Journal of Public Health Policy*. 1992; 13(3):306–317. [PubMed: 1401049]
- Preusser DF, Williams AF, Weinstein HB. Policing underage alcohol sales. *Journal of Safety Research*. 1994; 25:127–133.
- Rhodes MG. Age estimation of faces: A review. *Applied Cognitive Psychology*. 2009; 23:1–12.
- Scribner R, Cohen D. The effect of enforcement on merchant compliance with the minimum legal drinking age law. *Journal of Drug Issues*. 2001; 31(4):857–866.
- Substance Abuse and Mental Health Services Administration. Executive summary: Report to congress on the prevention and reduction of underage drinking. 2011.
- Swaim RC, Stanley LR. Rurality, region, ethnic community make-up and alcohol use among rural youth. *The Journal of Rural Health*. 2010:1–12.10.1111/j.1748-0361.2010.00324.x
- Szlemko WJ, Wood JW, Thurman PJ. Native Americans and alcohol: Past, present, and future. *Journal of General Psychology*. 2006; 133:435–451. [PubMed: 17128961]
- Toomey TI, Komro KA, Oakes JM, Lenk KM. Propensity for Illegal Alcohol Sales to Underage Youth in Chicago. *Journal of Community Health*. 2008; 33:134–138.10.1007/s10900-007-9080-6 [PubMed: 18196448]
- United States Department of Health and Human Services. The Surgeon General's call to action to prevent and reduce underage drinking. U.S. Department of Health and Human Services, Office of the Surgeon General; 2007.
- Wagenaar, ACMurray; Murray, DM.; Gehan, JP.; Wolfson, M.; Forster, JL.; Toomey, TL.; Jones-Webb, R. Communities mobilizing for change on alcohol: Outcomes from a randomized community trial. *Journal of Studies on Alcohol*. 2000; 61:85–94. [PubMed: 10627101]
- Wagenaar AC, Toomey TL, Erickson DJ. Preventing youth access to alcohol: Outcomes from a multi-community time-series trial. *Addiction*. 2005; 100:335–345. [PubMed: 15733247]
- Wolfson M, Toomey TL, Murray DM, Forster JL, Short BJ, Wagenaar AC. Alcohol outlet policies and practices concerning sales to underage people. *Addiction*. 1996; 91(4):589–602. [PubMed: 8857384]

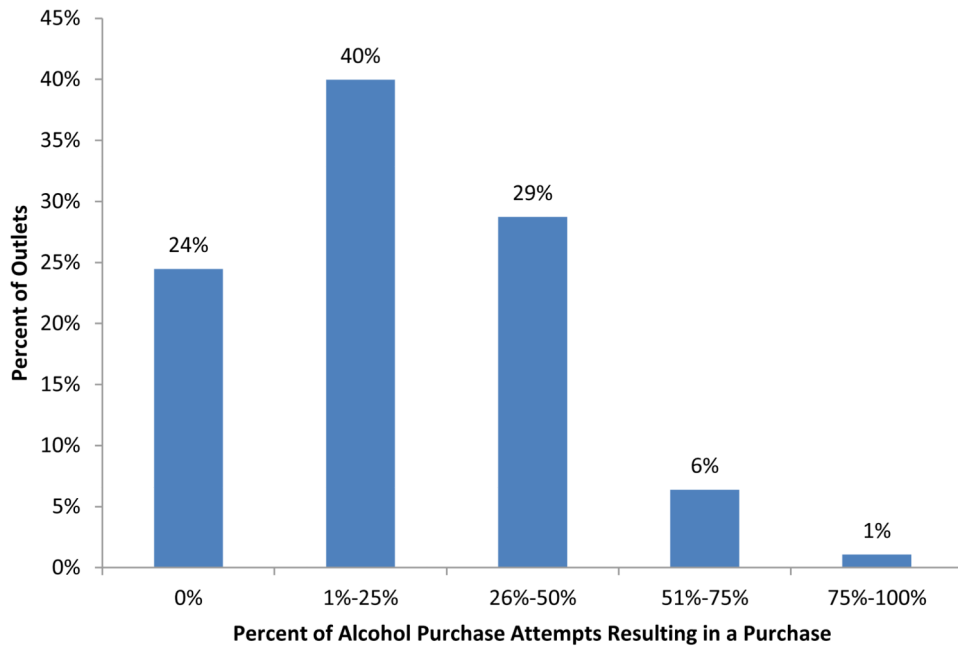


Figure 1. Distribution of outlets by proportion of alcohol sales across repeated attempts

Table 1

Cross-tabulation of purchase attempt outcome and predictor variables.

	Purchase Attempt Outcome	
	<i>n</i>	Percent Sold
Overall	997	22.6
Exterior Maintenance	988	
Good	687	22.3
Fair	272	23.5
Poor	29	20.7
Number Loitering	988	
None	780	21.9
1 to 5	189	25.4
6 or more	19	21.1
Type of Business	997	
Gas station/convenience	687	24.6
Large grocery	106	25.5
Liquor store	204	14.2
Seller's Gender	927	
Male	259	30.5
Female	668	21.3
Seller's Age	926	
less than 20	65	43.1
20 - 29	290	31.7
30 - 39	224	16.1
over 40	347	18.4
Underage signage	934	
Yes	589	21.7
No	345	27

Table 2
Odds ratios and 95% confidence intervals for predictors of purchase attempt outcome

	Purchase Attempt Outcome			
	Crude		Adjusted	
	OR	95% CI	OR	95% CI
Exterior Maintenance				
Fair vs. Good	1.03	0.73 - 1.45	1.05	0.73 - 1.51
Poor vs. Good	1.03	0.42 - 2.52	1.48	0.52 - 4.20
Loitering				
1 - 5 vs. None	1.19	0.83 - 1.72	1.1	0.74 - 1.62
6 or more vs. None	1.23	0.43 - 3.5	1.11	0.33 - 3.79
Business Type				
Grocery vs. Liquor	2.20*	1.11 - 4.35	1.27	0.61 - 2.65
Gas Station vs. Liquor	1.93**	1.18 - 3.18	1.38	0.82 - 2.34
Seller Gender				
Male vs. Female	1.59**	1.13 - 2.23	1.54*	1.08 - 2.20
Seller Age				
< 20 vs. > 40	3.04***	1.72 - 5.38	2.77***	1.51 - 5.08
20 - 29 vs. > 40	2.04***	1.40 - 2.99	2.07***	1.39 - 3.09
30 - 39 vs. > 40	0.86	0.55 - 1.34	0.85	0.54 - 1.36
Underage Signage				
Sign vs. No sign	0.74	0.55 - 1.01	0.83	0.59 - 1.16

Note.

*
p < .05,

**
p < .01,

p < .001.