

Household Environment and Monitoring on Adolescent Drinking Behaviors

Abstract:

Alcohol consumption among teenagers has been an alarming issue in the United States, with Iowa ranking highly in long-term abuse. To better understand how familial factor affects their drinking awareness and habits, we obtain data from Iowa Youth Survey and perform multivariate logistic regression. Our hypothesis is that better family organization correlates with lower probability of alcohol drinking, and we find statistical significant results in the amount of time spending with adults in their family and their living condition. Teenagers who have clear home rules, less time without adult supervision or living with parents tend to have lower odds of drinking. We assess the robustness of our model by Drop-in-deviance test, Coefficient of Discrimination, and Concordance. Since the data collection is from self-reported answers and conducted in Iowa specifically, the statistical findings provides useful information for Iowa policymakers to implement alcohol-related policies.

i. Background and significance

Underage drinking has become a detrimental social issue, with approximately 12.7 million people between the ages of 12 and 20 had admitted to drinking alcohol at least once in 2024¹. According to National Center for Drug Abuse Statistics (NCDAS), Alcohol Use Disorder affected 9.7% of Americans aged 12 and over in 2024. Iowa ranked highly across the United States for alcohol-related mortality from long-term abuse. On average, one death results from heavy alcohol consumption for every 1,420 individuals living in Iowa. These concerning numbers highlight the necessity of evaluating the risk factors associated with consumption of alcohol in adolescence.

Teenage drinking is driven by a variety of causes, including family and friend influence², and personality traits³. Adolescent health behavior and social norms are significantly fostered and solidified by the family unit's organization⁴. Both male and female children who have poor relationships with their parents and siblings are more likely to consume alcohol⁵. These literature findings prompted us towards assessing the family relationship factor more robustly, expanding to time spent with parents as well as family rules and organization. Our main objective is to examine how the quality of familial bonds serves as both predictive and preventive factors for alcohol abuse in Iowa adolescence.

Our research question is: Are Iowa teens with stronger family communication and monitoring less likely to report alcohol use, even after controlling for grade level, gender, and grades? We hypothesize that students with stronger family monitoring and communication will have lower odds of reporting alcohol use.

ii. Methods

We obtain data from 2005 Iowa Youth Survey, with information on student alcohol and substance consumption, and the social contexts of their schools, peers, and families. Randomly selected 3839 observations from this survey were used in this analysis. Since answers recorded in this survey relied on the students' self-assessment, we chose to acquire explanatory variables from the most objective questions, attempting to minimize self-reported bias.

We are interested in the effects of household environment and parent or caretaker interaction on alcohol use among Iowa teens. To measure alcohol use, we transform the categorical variable "30Drink" into a binary variable equal to 0 if a student reports 0 drinking days in the past 30 days and 1 otherwise (if they report drinking on one or more days). This generated binary variable is the outcome of interest in our analysis. The explanatory variables of interest measure different aspects of household environment and supervision. The variable `home_rules_clear` measures whether students report that the rules in their home are clear and consistently enforced. The variable `time_no_adult` measures the amount of time students spend outside of school without parent or caretaker supervision, which may capture differences in parental monitoring. The variable `living_parent` indicates whether students currently live with parent(s), while `independent_living` is a dummy variable that identifies students living independently, without any guardian. With this group of explanatory variables we aim to capture differences in family structure, supervision, and household organization that may influence adolescent drinking behaviors. Additionally, we control for variables that also likely affect alcohol consumption to reduce omitted variable bias. These are mostly school-related or demographic factors, and include school grades, grade level (age dependent), and gender.

To test the effects of household environment and student-guardian interaction on alcohol use, multivariate logistic regression model is used to estimate the log-odds that student i reported drinking in the past 30 days. The model specification is as follows:

$$\begin{aligned} \log \left(\frac{\pi_i}{1 - \pi_i} \right) = & \beta_0 + \beta_1(\text{home rules})_i + \beta_2(\text{unsupervised time})_i \\ & + \beta_3(\text{living with parent})_i + \beta_4(\text{living independently})_i \\ & + \beta_5(\text{school safety})_i + \beta_6(\text{school grades})_i \\ & + \beta_7(\text{grade level})_i + \beta_8(\text{gender})_i + \varepsilon_i \end{aligned}$$

where π_i is the probability that student i reported drinking at least once in the past 30 days.

iii. Data explanatory:

Table 1 in Appendix shows that 80.6% of surveyed students report not drinking (0 days response) in the past 30 days, while 19.4% report drinking at least one day in the past 30 days. The descriptive bar plots in Appendix 1 reveal patterns consistent with our hypothesis that stronger household monitoring and structure are associated with lower alcohol use. In particular, the drinking proportion decreases from around 43% among students with unclear home rules to only 17% among those with clear rules. Similarly, students reporting 6+ without adult supervision show the highest proportion of drinking (around 38%), compared to only about 7% of students reporting 0-2 hours. The plots also suggest that students not living with parents or caretakers report higher rates of drinking relative to those living with parents, and around 72% of independently living students report alcohol use. Overall, these visualizations suggests that weaker household supervision is associated with higher alcohol use among surveyed teens.

iv. Results

Model Assessment

Since all of explanatory variables in our model are categorical, we do not assess the linearity of the log-odds for those variables. This survey was conducted in all public school districts and alternative programs in Iowa, so the data recorded was randomized and not being affected by underlying county-level biased. Our main research focus on the effect of household supervision on teenager's alcohol consumption, so if two students were siblings or relatives, they were likely to generate the same outcome. Since we do not know this information from the survey, the independent condition of the model is not fully satisfied. The VIF values for all explanatory variables are around 1 (Appendix 2), so multicollinearity was not arised in the logistic regression model.

Model Interpretation

Table 1: Logistic Regression Results for Drinking Behavior

Variable	Odds Ratio	p-value	Lower 95% CI	Upper 95% CI
(Intercept)	0.174	0.000	0.085	0.351
home_rules_clearClear home rules	0.543	0.000	0.407	0.725
time_no_adult3-5 hours	1.957	0.000	1.480	2.597
time_no_adult6+ hours	3.681	0.000	2.831	4.812
living_parentWith parent(s)	0.692	0.136	0.429	1.133
independent_living	9.091	0.030	1.428	86.035
grades_catAverage	0.654	0.053	0.426	1.010
grades_catExcellent/above average	0.333	0.000	0.218	0.514
grade8th	2.740	0.000	1.923	3.982
grade11th	8.298	0.000	5.906	11.925
genderMale	0.864	0.150	0.709	1.054

Regression results in Table 2 show that several household environment variables are associated with alcohol use among Iowa teens, after controlling for school and demographic factors. First, students reporting clear home rules have lower odds of reporting drinking; the OR of 0.54 (statistically significant) implies that, holding other variables constant, students with clear home rules have 46% lower odds of alcohol use relative to those with unclear rules. Time without adult supervision is positively associated with drinking behavior. Relative to students reporting 0-2 hours without adult supervision, those reporting 3-5 hours have almost twice the odds of alcohol use ($OR = 1.96$), and those reporting 6+ hours have more than 3.5 times the odds of drinking ($OR = 3.68$). This suggests that lower adult supervision is associated with more alcohol

use. The coefficient for living with parent(s)/caretakers is negative, but not statistically significant. Yet, students living independently/alone have significantly higher estimated odds of reporting alcohol use ($OR = 9.09$, statistically significant at the 1% level), though the confidence interval is wide, which likely reflects the small number of independently living students in the sample (only 7). Among the control variables, students reporting excellent or above-average grades have significantly lower odds of reporting alcohol use, and higher grade levels are associated with higher reported drinking. The odds of drinking in 30 days did not have enough statistical difference between male and female ($p = 0.168$), so we could not conclude that gender was an indicator for whether the teenage drank alcohol or not.

Drop-in-deviance test, Coefficient of Discrimination, and Concordance

To test whether household environment and family supervision variables improve model fit beyond school/demographic controls, we compare our full logistic regression model to a reduced model only with control variables; the reduced model includes school grade level, grades, and gender. The full model adds the household-related variables of interest: clear home rules, time without adult supervision, living with a parent/caretaker, and independent living. The drop-in-deviance test gives a deviance statistic of 135.47 (5 df) with a p-value less than $2.2e-16$ (technically zero) (Appendix 2). This suggests that household environment and supervision are associated with whether students report drinking in the past 30 days (even after controlling for grade level, grades, and gender), and should thus be included in the model. After we validated the essential inclusion of the household-related variables in the logistic regression model, we evaluated the effectiveness of the model by Coefficient of Discrimination and Concordance. The difference between mean of probabilities of not drinking alcohol and drinking alcohol was around 0.19, so its effectiveness was moderately met. This was consistent with the concordance value ($c = 0.81$). The effectiveness of the model could be disrupted by the omitted variables that is not included in the model such as the relationship with their friends and the quality of the school in relative to other schools in Iowa.

v. Discussion

In summary, we find evidence to support our hypothesis that clear household structure and adult supervision matter when it comes to alcohol consumption behaviors among Iowa adolescents. Especially, students reporting clearer home rules have lower odds of reporting alcohol use, and students spending more time without adult supervision have greater odds of drinking. The conditions for the logistic regression model are moderately satisfied, and the effectiveness of the model, particularly our variables of interest, are holistically inspected using the drop-in-deviance test, the coefficient of discrimination, concordance, and VIF values.

However, there are several limitations in data collection worth considering. The response variable only captured drinking behavior for the past 30 days, which did not imply that students reporting 0 drinking days never consumed alcohol before. Students reporting at least one drinking day in the past 30 days were likely more engaged in drinking behaviors relative to those reporting none, though that is only an assumption and not necessarily true. Because the survey relied on self-reported responses, our results are subject to self-reporting bias and measurement error. The survey was conducted in educational institutions, so it excluded homeschooled or dropout teens as participants, who may have different household environments than students attending school.

The purpose of this survey was to implement policy to alleviate substance abuse issues at the state level, so the results of our findings may not fully generalize beyond Iowa. Policymakers, when taking these findings into account, must also consider that there are omitted confounding variables, especially given the observational nature of the data, and therefore causation cannot be claimed. Iowa's Substance Use Prevention Strategic Plan from 2018 to 2022⁶ included outreach programs that conducted follow-up calls to families. Based on our findings, these outreach efforts may be more effective if they are adapted to different household conditions and levels of supervision. Teenagers coming from households with less structure or lower adult supervision may benefit from more targeted community or school support. Future research could also look at additional household and peer-related factors, and use longitudinal data to be able to see how changes in family environment influence adolescent drinking behaviors over time.

vi. References

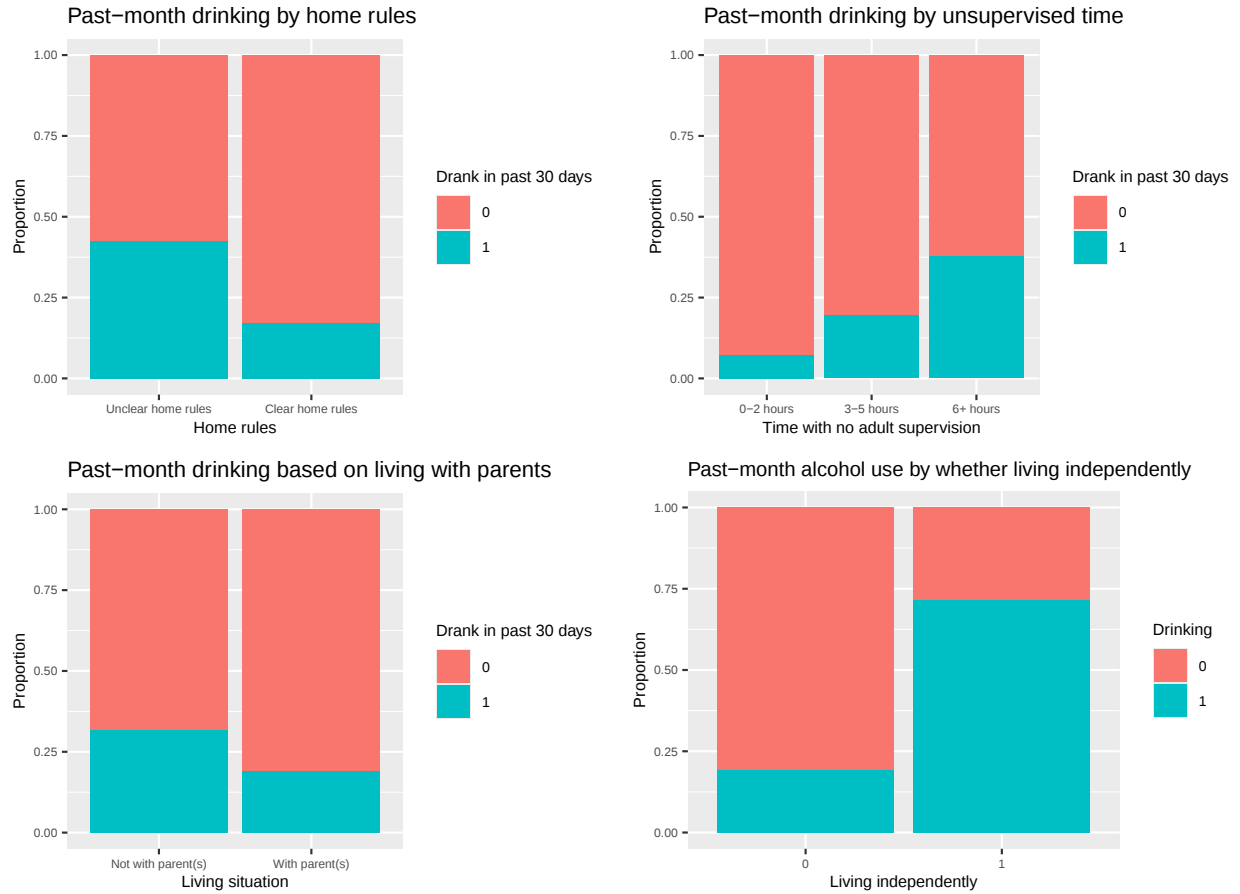
1. Substance Abuse and Mental Health Services Agency (SAMHSA), Center for Behavioral Health Statistics and Quality (CBHSQ). 2024 National Survey on Drug Use and Health. [cited 2025 Aug 12]. Available from: <https://www.samhsa.gov/data/report/2024-nsduh-detailed-tables>
2. Eitle, D. (2005). The moderating effects of peer substance use on the family structure-adolescent substance use association: Quantity versus quality of parenting. *Addictive Behaviors*, 30, 963–980. doi:10.1016/j.addbeh.2004.09.015.
3. Nawi AM, Ismail R, Ibrahim F, Hassan MR, Manaf MRA, Amit N, Ibrahim N, Shafurdin NS. Risk and protective factors of drug abuse among adolescents: a systematic review. *BMC Public Health*. 2021 Nov 13;21(1):2088. doi: 10.1186/s12889-021-11906-2. PMID: 34774013; PMCID: PMC8590764.
4. Šumskas, L., & Zaborskis, A. (2017). Family Social Environment and Parenting Predictors of Alcohol Use among Adolescents in Lithuania. *International Journal of Environmental Research and Public Health*, 14 (9), 1037. doi:10.3390/ijerph14091037.
5. Moñino-García, M., Adoamnei, E., Gadea-Nicolás, A., Arense-Gonzalo, J. J., López-Espín, J. J., & Torres-Cantero, A. M. (2019). Family environmental factors associated with underage drinking. *Journal of Substance Use*, 24(1), 110–116. <https://doi.org/10.1080/14659891.2018.1523965>.
6. Substance Use Prevention Related Programs. (2025b, July 29). Health & Human Services. <https://hhs.iowa.gov/health-prevention/addiction-substance-use-disorders/substance-use-prevention-programs>.

vi. Appendix

Table 2: Drinking Behavior Distribution in the Past 30 Days

Drinking	Count	Proportion
No drinking in past 30 days	2612	0.806
Drank at least once in past 30 days	627	0.194

Appendix 1: Descriptive Plots of Drinking Behavior by Household Environment Variables



Appendix 2: Additional Model Diagnostics

Table 3: Drop-in-Deviance Test Comparing Reduced and Full Logistic Regression Models

Model	Residual df	Residual deviance	df	Drop in deviance	p-value
Reduced model: controls only	3232	2636.52	NA	NA	NA

Model	Residual df	Residual deviance	df	Drop in deviance	p-value
Full model: adding household variables	3228	2512.35	4	124.17	<0.001

Table 4: Coefficient of Discrimination

Outcome	Mean of probability
0	0.152245
1	0.365767

Table 5: Variance Inflation Factors (VIFs)

	GVIF	Df	$GVIF^{1/(2 \cdot Df)}$
home_rules_clear	1.036	1	1.018
time_no_adult	1.119	2	1.029
living_parent	1.071	1	1.035
independent_living	1.076	1	1.037
grades_cat	1.054	2	1.013
grade	1.108	2	1.026
gender	1.010	1	1.005

Acknowledgement:

In the process of data analysis and report preparation, we do not use generative AI.