HHS Public Access

Author manuscript

J Transp Health. Author manuscript; available in PMC 2023 March 01.

Published in final edited form as:

J Transp Health. 2022 March ; 24: . doi:10.1016/j.jth.2021.101303.

Trajectories and Outcomes of Adolescents that Ride With an Impaired Driver/Drive While Impaired

Federico E Vaca[1], **Kaigang Li**[1,2,3], **Denise L Haynie**[4], **Xiang Gao**[2], **Deepa R Camenga**[1], **James Dziura**[1], **Barbara C Banz**[1], **Leslie A. Curry**[5], **Linda Mayes**[6], **Niyousha Hosseinichimeh**[7], **Rod MacDonald**[8], **Ronald J. Iannotti**[9], **Bruce Simons-Morton**[4]

[1]Department of Emergency Medicine, Developmental Neurocognitive Driving Simulation Research Center (DrivSim Lab), Yale University School of Medicine

[2]Department of Health & Exercise Science, Colorado State University

[3]Colorado School of Public Health, *Eunice Kennedy Shriver* National Institute of Child Health & Human Development

[4]Division of Intramural Population Health Research, *Eunice Kennedy Shriver* National Institute of Child Health & Human Development

[5]Yale School of Public Health

[6]Yale Child Study Center

[7]Department of Industrial and Systems Engineering, Virginia Tech

[8]School of Integrated Sciences, James Madison University

[9]The CDM Group, Inc.

Abstract

Introduction: For young drivers, independent transportation has been noted to offer them opportunities that can be beneficial as they enter early adulthood. However, those that choose to engage in riding with an impaired driver (RWI) and drive while impaired (DWI) over time can face negative consequences reducing such opportunities. This study examined the prospective association of identified longitudinal trajectory classes among adolescents that RWI and DWI with their later health, education, and employment in emerging adulthood.

Address Correspondence: Kaigang Li, PhD, MEd, Department of Health & Exercise Science, Colorado State University, 215E Moby B Complex, Fort Collins, CO 80523, kaigang.li@colostate.edu, Tel: (970) 491-7253.

Federico E. Vaca: Conceptualization, Methodology, Writing - Original Draft, Writing - Review & Editing, Visualization, Funding acquisition; **Kaigang Li**: Investigation, Methodology, Formal analysis, Writing - Original Draft, Writing - Review & Editing, Visualization; **Denise L. Haynie**: Investigation, Resources, Writing - Review & Editing, Funding acquisition; **Xiang Gao**: Writing - Review & Editing; **Deepa R Camenga**: Writing - Review & Editing; **James Dziura**: Writing - Review & Editing; **Barbara Banz**: Writing - Review & Editing; **Leslie Curry**: Writing - Review & Editing; **Linda Mayes**: Writing - Review & Editing; **Niyousha Hosseinichimeh**: Writing - Review & Editing; **Xiang Gao**: Writing - Review & Editing; **Rod MacDonald**: Writing - Review & Editing; **Ronald J. Iannotti**: Investigation, Resources, Writing - Review & Editing, Funding acquisition; **Bruce Simons-Morton**: Investigation, Resources, Writing - Review & Editing, Funding acquisition.

Methods: We analyzed all seven annual assessments (Waves, W1-W7) of the NEXT Generation Health Study, a nationally representative longitudinal study starting with 10th grade (2009-2010 school year). Using all seven waves, trajectory classes were identified by latent class analysis with RWI (last 12 months) and DWI (last 30 days) dichotomized as ≥once = 1 vs. none = 0.

Results: Four RWI trajectories and four DWI trajectories were identified: abstainer, escalator, decliner, and persister. For RWI and DWI trajectories respectively, 45.0% (N=647) and 76.2% (N=1,657) were abstainers, 15.6% (N=226) and 14.2% (N=337) were escalators, 25.0% (N=352) and 5.4% (N=99) were decliners, and 14.4% (N=197) and 3.8% (N=83) persisters. RWI trajectories were associated with W7 health status (χ^2=13,20, p<.01) and education attainment (χ^2=18.37, p<.01). Adolescent RWI abstainers reported better later health status than RWI escalators, decliners, and persisters; and decliners reported less favorable later education attainment than abstainers, escalators, and persisters. DWI trajectories showed no association with health status, education attainment, or employment.

Conclusions: Our findings suggest the importance of later health outcomes of adolescent RWI. The mixed findings point to the need for more detailed understanding of contextual and time-dependent trajectory outcomes among adolescents engaging in RWI and DWI.

Keywords

driving while impaired; riding with an impaired driver; trajectory classes; health status; education attainment; employment

1. Introduction

Impaired driving is a major risk factor for motor vehicle crashes (MVCs), injuries, and fatalities among all age groups. In the context of young drivers, they are at higher risk of being involved in a MVCs at any blood alcohol concentration (BAC) compared to older drivers (Voas et al., 2012). In the U.S., in 2019, among young drivers alone, alcohol impaired driving accounted for 24% of the 1,603 young driver deaths (National Highway Traffic Safety Administration, 2021). Further, 82% these young drivers had a BAC ≥ 0.08 g/dL (National Highway Traffic Safety Administration, 2016a).

Despite the more recent reductions of high school teens who reported driving after drinking (2013 (10%) – 2015 (7.8%)) (Kann et al., 2016), still 16.7 % of high school students reported riding with a driver who had been drinking alcohol and 5.4% (8.9% for those ≥ 18 y/o) report driving after drinking at least once in the last 30 days (Yellman et al., 2020). In this same context, when driving after reported use of marijuana and other illicit drugs, 38% U.S. high school students report riding with an alcohol- or drug-impaired driver (RWI) in the last 12 months (Li et al., 2014a) and 13% reported driving while alcohol or drug impaired (DWI) in the last 30 days (Li et al., 2013). Previous research shows that earlier RWI is a robust predictor of future DWI in emerging adults after licensure (Harris et al., 2017; Li et al., 2014b).

Motor vehicle crashes remain the leading cause of mortality for U.S. adolescents. In 2019, nearly 2,400 U.S. teens were killed and 258,000 were in emergency rooms for injuries in motor vehicle crashes (Centers for Disease Control and Prevention (CDC) and National

Center for Injury Prevention and Control (NCIPC), 2020). A substantial body of research has reported that binge drinking, drug use, or the combination of binge drinking and drug use are central risk factors for the increased trend in crashes among youth (Centers for Disease Control and Prevention (CDC) and National Center for Injury Prevention and Control (NCIPC), 2020; Elvik, 2013). This is reflected by the fact that every day, about 1 alcohol-related crash death occurs every 51 minutes and 1 in every 5 alcohol-related crash deaths occur in passengers (National Highway Traffic Safety Administration, 2016b). Illicit drug use also contributes to a considerable portion of fatal motor vehicle crashes involving adolescents (Bates et al., 2014; Drummer et al., 2004; Holmgren et al., 2005). Complicating the landscape of impaired driving crashes is the number of U.S. states passing legislation to legalize recreational marijuana use. This will plausibly continue to impact the number of impaired driving crashes among young driver age groups. Several studies have reported increased numbers of marijuana-related fatal crashes in states that legalize its use (Salomonsen-Sautel et al., 2014; Tefft and Arnold, 2020).

Extensive adolescent alcohol and drug use trajectory-related research has explored outcomes in emerging adults (e.g., health; (Parthasarathy and Weisner, 2005) employment (McMorris and Uggen, 2000) and education (Arria et al., 2011)). Despite the well-known relationship between regular and reliable access to transportation and youth having greater opportunity to thrive in health (Arcury et al., 2005), education (Kenyon, 2011), and employment (Thakuriah and Metaxatos, 2000), relatively little is known about the association of teen engagement in RWI and DWI during high school and these same domains in later emerging adulthood.

The purpose of this study was to examine identified trajectory classes of longitudinal RWI and DWI engagement among adolescents and to assess their prospective associations with emerging adulthood health, education attainment, and employment.

2. Methods

2.1. Sampling

The data were from all seven annual waves (W1-W7; 2010-2016) of the NEXT Generation Health Study, a longitudinal nationally representative cohort study starting in 10th grade. The sampling strategy for NEXT has been previously reported (Li et al., 2014a). From W1-W7, 91% (16.27 years, se=0.03) (260 recruited students were unable to complete the study at W1 due to delayed approval from the school district), 88% (17.19 years, se=0.03), 86% (18.17 years, se=0.03), 78% (19.16 years, se=0.02), 79% (20.28 years, se=0.02), 84% (21.28 years, se=0.02), and 83% (22.64 years, se=0.03) of the full sample (N=2785) completed the survey during spring each year. African American participants were oversampled to allow for more accurate population estimates and representativeness. Parent consent and participant assent were obtained for those under age 18. After turning age 18, participants were consented as adults. The study protocol was approved by the Institutional Review Board of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development and the Yale Institutional Review Board.

2.2. Outcome Variables

2.2.1. Overall physical health in emerging adulthood (W7)—Perceived overall physical health, was measured with a single question "Would you say your health is…?" with possible responses being, Excellent; Good; Fair; and Poor at W7 (Eaton et al., 2010). The four categories were dichotomized as excellent or good health vs. poor or fair health.

2.2.2. Education attainment (W7)—Education attainment was measured with one question, "What is the highest grade of regular school you have completed (or anticipate completing by the end of the current academic term)?" with seven possible responses: 1) <high school diploma; 2) high school diploma; 3) GED; 4) some college or technical school; 5) associate's degree; 6) bachelor's degree; and 7) graduate degree. The seven categories were collapsed into three categories: 1) ≤high school diploma or GED; 2) some college, technical school or an associate degree (Tech/Community College); 3) and ≥bachelor's degree (4-Year College+).

2.2.3. Employment in emerging adulthood (W7)—Employment at W7 was measured with one question, "On average, what are the total hours per week you spend working in paid and/or unpaid jobs?" with possible responses: 1) None; 2) ≤5; 3) 6-10; 4) 11-15; 5) 16-20; 6) 21-25; 7) 26-30; 8) >30 hours/week. The eight categories were collapsed to four categories: 1) None; 2) ≤20; 3) 21-30; and 4) >30 hours/week.

2.3. Trajectory Variables

2.3.1. Riding with an alcohol or drug-impaired driver in the past 12 months (RWI, W1-W7)—At W1-W4, RWI was measured using one question derived from the Youth Risk Behavior Survey (YRBS) (Centers for Disease Control and Prevention, 2011) asking participants "How many times, during the last 12 months, they rode in a vehicle driven by someone else who had been drinking alcohol or using illegal drugs?" At W5-W7, RWI was measured by three questions. Participants were first asked: "During the last 12 months, how many times did you ride in a vehicle driven by someone who had been drinking alcohol?" The same question was repeated for "smoking marijuana" and "using illicit drugs other than alcohol or marijuana." The questions at W1-W4 and W5-W7 were collapsed and dichotomized as: 1=RWI ≥once vs. 2=no RWI (last 12 months).

2.3.2. Driving while alcohol- or drug-impaired in the past 30 days (DWI, W1-W7)—At W1-W3, DWI was measured using one question derived from the YRBS questionnaire (Centers for Disease Control and Prevention, 2011) asking participants on how many days in the last 30 days they drove after drinking alcohol or using illegal drugs. At W4-W7, DWI was assessed with three items asking participants how many days they drove after drinking alcohol, smoking marijuana or using illicit drugs. The questions at W1-W3 and W4-W7 were collapsed and dichotomized as: 1=DWI ≥1 day vs. 2=no DWI (past 30 days).

2.4. Statistical Analysis

The latent classes of RWI and DWI among U.S. high school adolescents have been recently identified and related detailed analyses have been published elsewhere (Vaca et al., 2021a).

Separately for RWI and DWI, we conducted Rao-Scott Chi-square test to examine the associations between trajectory classes and outcome variables: later general health, education attainment, and employment. The computations were performed in SAS software version 9.4 (SAS Institute, Cary, NC) and PROC LCA procedure (Lanza et al., 2015; PROC LCA & PROC LTA (Version 1.3.2) [Software], 2015) taking into consideration complex sampling features.

3. Results

3.1. Riding with an impaired driver (RWI)

For RWI, 3-, 4- and 5-class models were estimated from the LCA and the 4-class model (Figure 1) was selected for the analysis (Vaca et al., 2021b). The four classes included abstainer (consistently low probability over 7 waves), escalator (low to high probability over 7 waves), decliner (high to low probability over 7 waves), and persister (consistently high probability over 7 waves). Among participants, 647 (45.0%, weighted and hereafter) were categorized as abstainer, 226 (15.6%) escalator, 352 (25.0%) decliner, and 197 (14.4%) persister (Table 1).

Significant associations of RWI with general health (χ^2=13.20, p=.004) and education attainment (χ^2=18.37, p=.005) at W7, but not employment (χ^2=10.18, p=.335), were found (Table 1). All four RWI trajectory classes were associated with higher proportions of participants who reported excellent/good health at W7. Although a greater proportion of abstainers (30.2% vs. 25.4%), escalators (38.0% vs. 14.1%), and persisters (33.3% vs. 18.2%) were more likely to attain 4-Year College+ education than high school or less; decliners were less likely to attain 4- Year College+ education (21.3%) than high school or less (36.9%).

3.2. Driving while alcohol- or drug-impaired (DWI)

For DWI, 3-, 4- and 5-class models were estimated from the LCA and the 4-class model (Figure 2) was selected for the analysis (Vaca et al., 2021b). Among participants, 1657 (76.2%) were categorized as abstainer, 337 (14%) escalator, 99 (5%) decliner, and 83 (4%) persister (Table 2).

General health, education attainment, and employment at W7 were not significantly associated with DWI trajectory classes (Table 2).

RWI and DWI trajectory classes were significantly correlated (chi-square =444.8, p<.001). Among DWI abstainers, escalators, decliners, and persisters, 56.7%, 37.6, 59.6%, and 73.1% were RWI abstainers, escalators, decliners, and persisters, respectively.

4. Discussion

From a prevention perspective, there is considerable need to understand the trajectories and later life implications of teens who engage in RWI and DWI This is particularly true if we are to understand how to help teens recognize and implement protective behaviors that could position them better to flourish in early adulthood. This is one of the first studies to

examine the associations of emerging adulthood outcomes with established RWI and DWI behavioral trajectories (Vaca et al., 2021a). Our study results show that adolescents' RWI trajectories were associated with later general health and education attainment. Interestingly, DWI trajectory classes were not significantly associated with adolescents' later (i.e., 4 years after high school) general health, education attainment, or work status. These findings shed light on the complexity of these behavior and provide new information on how RWI and DWI may influence important outcomes in early adulthood that typically have considerable bearing on later life success.

We found that adolescent engagement in RWI was prospectively associated with general health status and education attainment as they emerged into early adulthood. Further, we found that RWI decliners reported more fair/poor health. It is conceivable that perhaps their reported fair/poor health was correlated with less opportunities to socialize with peers and RWI. In addition, decliners had the highest proportion of high school or less plus tech/community college, and the lowest proportion of 4-year college education. College education is related to older age at the time of marriage (Payne, 2012) and having children (Heck et al., 1997; Moore and Waite, 1977; Neels et al., 2017; Payne, 2012). It has been reported that being married may reduce RWI in young adults (Beirness, 2014; Cartwright and Asbridge, 2011; Shults et al., 2009). Therefore, it is possible that young adults with non-college levels of educational attainment have jobs (Neels et al., 2017), are married (Heck et al., 1997; Moore and Waite, 1977; Neels et al., 2017), or have children of their own at earlier stages of young adulthood (Heck et al., 1997; Moore and Waite, 1977; Neels et al., 2017), all of which could attenuate engagement in RWI as protective factors. The majority of RWI escalators were found to be employed full time. This could be related to their high rates of college completion.

Despite the association between RWI trajectory and general health status as well as education attainment, it was surprising not to find similar associations between DWI trajectory classes and the outcomes of interest. Admittedly, while there is an abundance of DWI literature and it is well understood that DWI at every age is highly associated with likelihood of crash, there is comparatively few published studies evaluating specific longitudinal trajectories of teens that DWI and their early adulthood outcomes. Further, while speculative, we believe that the absence of significant findings in the DWI group could be attributed to the relatively short period of evaluation (i.e., only 4 years after high school for this study) as well as the low prevalence of escalators (14%) and persisters (4%). Given that emerging adulthood is characterized as a distinct period in terms of development, demographics, norms, and identity explorations (Arnett, 2007), the outcomes under evaluation for a DWI trajectory class, while likely malleable, are dynamic. As such, it is plausible that significant findings (e. g., DWI involving law enforcement) in this area may take longer to manifest. A recent prospective study found that early persistent high or increasingly frequent use of marijuana from adolescent to young adulthood was associated with risks for underachievement in the domains of education, occupational success, and health in young adulthood at age 22 to 29 (Thompson et al., 2019). The timing of when the effects occurred in that study (22 - 29 y/o) compared to ours (~ 23 y/o) provides some evidence of delayed effects of DWI.

Further, although RWI and DWI share some important behavioral characteristics (e.g., alcohol/drug-associated, health-risking, involve personal transportation), they are distinct in at least one important way that could differentially influence early adulthood outcomes. That is, youth that RWI can be completely sober when engaged in this behavior, while youth alcohol/drug impairment is a prerequisite for a DWI event. We believe that supplemental assessments (retrospectively and prospectively) of our study participants, allowing for a mixed-methods approach to inquiry, could provide novel contextual insight into RWI and DWI behaviors and their respective trajectory class outcomes.

Our study has important implications for development and education as well as health-related policy (Fell et al., 2016). Youth who engage in RWI and/or DWI are a key public health concern given their vulnerability, both physically in terms of the risk for crash-injury (National Highway Traffic Safety Administration, 2017) and behaviorally, for DWI, as a result neurotoxic effects on the developing brain due to alcohol/drug use (Jones et al., 2018). Further education targeting early prevention of alcohol- and substance use disorders with intentional focus on RWI and DWI behavior in adolescents could improve outcomes of adolescents as they transition to emerging adulthood. Therefore, one goal of primary intervention in this context should be more attentive and prevention-action orientation toward better control of underage drinking as well as impaired driving during high school (i.e., reinvigorating prevention efforts) and within communities that have large adolescents populations (Fell et al., 2009). Similarly, the use of approaches to enhance prevention-focused social norms of youth, families, and communities as it applies to RWI and DWI, could yield tangible and broader reaching benefits. Moreover, policy makers should further be encouraged to revisit well-known effective state-level underage drinking laws (e.g., minimum legal drinking age, zero-tolerance) and reassess the extent of state-level implementation that could save hundreds of lives every year (Fell et al., 2016).

We recognize that our study has limitations. First, the school-based recruitment does not allow the study finding to be generalized to all youth, particularly those teens that are not enrolled in high school. Second, the study sample related to our DWI variable changed over annual assessment waves because the eligibility of driver licensure increased over the time of the study as participants aged (eligible participants W1, N = 402 - W7, N = 1877). This could have influenced related analyses. Third, RWI and DWI were measured based on different time periods (i.e., RWI: in the last 12 months; DWI: within the last month). This may have contributed to some under-reporting of RWI and DWI behavior limiting identification of relationships between RWI and DWI trajectory classes and outcome variables. Fourth, with annual wave assessment data usually collected during the springtime each year, participants were asked to report the highest grade of schooling they had completed or anticipate completing by the end of the academic term.

5. Conclusion

Adolescent RWI abstainers reported better later health status than RWI escalators, decliners, and persisters; and decliners reported less favorable 4-year college education attainment than abstainers, escalators, and persisters. Our results suggest that adolescent RWI and DWI are complex dynamic behaviors warranting both in-depth contextual (i.e., qualitative/mixed

methods approach) and extended-time detailed investigation of trajectories and relationships to later health, education, and employment. These and future-related findings can inform prevention and intervention efforts aimed at preserving future beneficial opportunities, so adolescents thrive in emerging adulthood.

Acknowledgements

NIAAA Funding Support: Research reported in this publication was supported by the National Institute on Alcohol Abuse and Alcoholism of the National Institutes of Health under Award Numbers R21AA026346 and R01AA026313. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

NICHD – NEXT Generation Health Study: This project (contract HHSN275201200001I) was supported in part by the Intramural Research Program of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development; the National Heart, Lung, and Blood Institute; the National Institute on Alcohol Abuse and Alcoholism; the National Institute on Drug Abuse; and the Maternal and Child Health Bureau of the Health Resources and Services Administration.

References

Arcury TA, Preisser JS, Gesler WM, Powers JM, 2005. Access to transportation and health care utilization in a rural region. The Journal of Rural Health 21, 31–38. [PubMed: 15667007]

Arnett JJ, 2007. Emerging adulthood: What is it, and what is it good for? Child Development Perspectives 1, 68–73.

Arria AM, Caldeira KM, Vincent KB, Garnier-Dykstra LM, O'Grady KE, 2011. Substance-related traffic-risk behaviors among college students. Drug Alcohol Depend 118, 306–312. [PubMed: 21601379]

Bates LJ, Davey J, Watson B, King MJ, Armstrong K, 2014. Factors contributing to crashes among young drivers. Sultan Qaboos University Medical Journal 14, e297. [PubMed: 25097763]

Beirness DJ, 2014. The characteristics of youth passengers of impaired drivers. Canadian Centre on Substance Abuse. Ottawa, Ontario.

Cartwright J, Asbridge M, 2011. Passengers' decisions to ride with a driver under the influence of either alcohol or cannabis. Journal of Studies on Alcohol and drugs 72, 86–95. [PubMed: 21138715]

Centers for Disease Control and Prevention, 2011. Vital signs: Alcoholimpaired driving among adults—United States, 2010. Morbidity and Mortality Weekly Report 60, 1351–1356. [PubMed: 21976118]

Centers for Disease Control and Prevention (CDC), National Center for Injury Prevention and Control (NCIPC), 2020. WISQARS (Web-based Injury Statistics Query and Reporting System). U.S. Department of Health and Human Services.

Drummer OH, Gerostamoulos J, Batziris H, Chu M, Caplehorn J, Robertson MD, Swann P, 2004. The involvement of drugs in drivers of motor vehicles killed in Australian road traffic crashes. Accident Analysis & Prevention 36, 239–248. [PubMed: 14642878]

Eaton DK, Kann L, Kinchen S, Shanklin S, Ross J, Hawkins J, Harris WA, Lowry R, McManus T, Chyen D, 2010. Youth risk behavior surveillance-United States, 2009. MMWR Surveill Summ 59, 1–142.

Elvik R, 2013. Risk of road accident associated with the use of drugs: a systematic review and meta-analysis of evidence from epidemiological studies. Accid Anal Prev 60, 254–267. [PubMed: 22785089]

Fell JC, Fisher DA, Voas RB, Blackman K, Tippetts AS, 2009. The impact of underage drinking laws on alcohol-related fatal crashes of young drivers. Alcohol Clin Exp Res 33, 1208–1219. [PubMed: 19389192]

Fell JC, Scherer M, Thomas S, Voas RB, 2016. Assessing the impact of twenty underage drinking laws. J Stud Alcohol Drugs 77, 249–260. [PubMed: 26997183]

Harris SK, Johnson JK, Sherritt L, Copelas S, Rappo MA, Wilson CR, 2017. Putting adolescents at risk: Riding with drinking drivers who are adults in the home. J Stud Alcohol Drugs 78, 146–151. [PubMed: 27936375]

Heck KE, Schoendorf KC, Ventura SJ, Kiely JL, 1997. Delayed childbearing by education level in the United States, 1969–1994. Maternal and child health journal 1, 81–88. [PubMed: 10728230]

Holmgren P, Holmgren A, Ahlner J, 2005. Alcohol and drugs in drivers fatally injured in traffic accidents in Sweden during the years 2000–2002. Forensic science international 151, 11–17. [PubMed: 15935937]

Jones SA, Lueras JM, Nagel BJ, 2018. Effects of binge drinking on the developing brain: studies in humans. Alcohol Rresearch: Current Reviews 39, 87.

Kann L, McManus T, Harris WA, Shanklin SL, Flint KH, Hawkins J, Queen B, Lowry R, Olsen EOM, Chyen D, 2016. Youth risk behavior surveillance—United States, 2015. Morbidity and Mortality Weekly Report: Surveillance Summaries 65, 1–174.

Kenyon S, 2011. Transport and social exclusion: access to higher education in the UK policy context. Journal of Transport Geography 19, 763–771.

Lanza ST, Dziak JJ, Huang L, Xu S, Collins LM, 2015. Proc LCA & Proc LTA users' guide (Version 1.3. 2). University Park: The Methodology Center, Penn State.

Li K, Simons-Morton BG, Brooks-Russell A, Ehsani J, Hingson R, 2014a. Drinking and parenting practices as predictors of impaired driving behaviors among US adolescents. J Stud Alcohol Drugs 75, 5–15. [PubMed: 24411792]

Li K, Simons-Morton BG, Hingson R, 2013. Impaired-driving prevalence among US high school students: Associations with substance use and risky driving behaviors. Am J Publ Health 103, e71–e77.

Li K, Simons-Morton BG, Vaca FE, Hingson R, 2014b. Association between riding with an impaired driver and driving while impaired. Pediatrics 133, 620–626. [PubMed: 24639277]

McMorris BJ, Uggen C, 2000. Alcohol and employment in the transition to adulthood. J Health Soc Behav, 276–294. [PubMed: 11011505]

Moore KA, Waite LJ, 1977. Early childbearing and educational attainment. Family Planning Perspectives, 220–225. [PubMed: 902716]

National Highway Traffic Safety Administration, 2016a. Alcohol impaired driving: 2015 data. Traffic Safety Facts, pp. 1–7.

National Highway Traffic Safety Administration, 2016b. Traffic Safety Facts: 2015 Data, Alcohol-Impaired Driving, Washington, DC.

National Highway Traffic Safety Administration, 2017. Traffic Safety Facts, 2017 Data. Young Drivers. U.S. Department of Transportation, DOT HS 812 753, Washington, DC. .

National Highway Traffic Safety Administration, 2021. Young drivers: 2019 data (Traffic Safety Facts. Report No. DOT HS 813 130). National Highway Traffic Safety Administration.

Neels K, Murphy M, Bhrolcháin MN, Beaujouan É, 2017. Rising educational participation and the trend to later childbearing. Population and Development Review 43, 667. [PubMed: 29398739]

Parthasarathy S, Weisner CM, 2005. Five-year trajectories of health care utilization and cost in a drug and alcohol treatment sample. Drug Alcohol Depend 80, 231–240. [PubMed: 15916868]

Payne KK, 2012. Median age at first marriage, 2010. National Center for Family & Marriage Research. Retrieved from http://scholarworks.bgsu.edu/cgi/viewcontent.cgi.

PROC LCA & PROC LTA (Version 1.3.2) [Software], 2015. University Park: The Methodology Center, Penn State.

Salomonsen-Sautel S, Min S-J, Sakai JT, Thurstone C, Hopfer C, 2014. Trends in fatal motor vehicle crashes before and after marijuana commercialization in Colorado. Drug Alcohol Depend 140, 137–144. [PubMed: 24831752]

Shults RA, Kresnow M.-j., Lee KC, 2009. Driver-and passenger-based estimates of alcohol-impaired driving in the US, 2001–2003. American journal of preventive medicine 36, 515–522. [PubMed: 19362801]

Tefft B, Arnold L, 2020. Cannabis Use Among Drivers in Fatal Crashes in Washington State Before and After Legalization. AAA Foundation for Traffic Safety.

Thakuriah P, Metaxatos P, 2000. Effect of residential location and access to transportation on employment opportunities. Transportation Research Record 1726, 24–32.

Thompson K, Leadbeater B, Ames M, Merrin GJ, 2019. Associations between marijuana use trajectories and educational and occupational success in young adulthood. Prevention science 20, 257–269. [PubMed: 29704147]

Vaca FE, Li K, Haynie D, Gao X, Camenga DR, Dziura J, Banz B, Curry L, Mayes L, Hosseinichimeh N, 2021a. Riding with an impaired driver and driving while impaired among adolescents: Longitudinal trajectories and their characteristics. Traffic injury prevention 22, 337–342. [PubMed: 33960855]

Vaca FE, Li K, Haynie D, Gao X, Camenga DR, Dziura J, Banz B, Curry L, Mayes L, Hosseinichimeh N, 2021b. Riding with an impaired driver and driving while impaired among adolescents: Longitudinal trajectories and their characteristics. Traffic injury prevention, 1–10.

Voas RB, Torres P, Romano E, Lacey JH, 2012. Alcohol-related risk of driver fatalities: an update using 2007 data. Journal of studies on alcohol and drugs 73, 341–350. [PubMed: 22456239]

Yellman MA, Bryan L, Sauber-Schatz EK, Brener N, 2020. Transportation Risk Behaviors Among High School Students—Youth Risk Behavior Survey, United States, 2019. MMWR supplements 69, 77. [PubMed: 32817609]

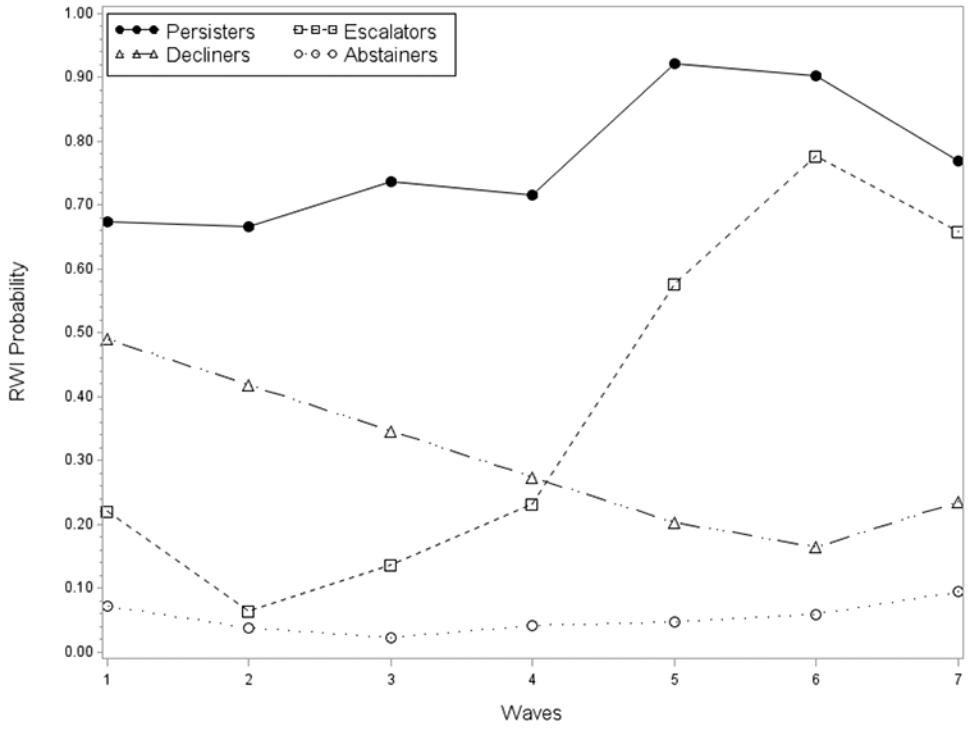

Figure 1.

Trajectories of riding with an alcohol or drug-impaired driver (RWI) in the past 12 months using latent class analysis

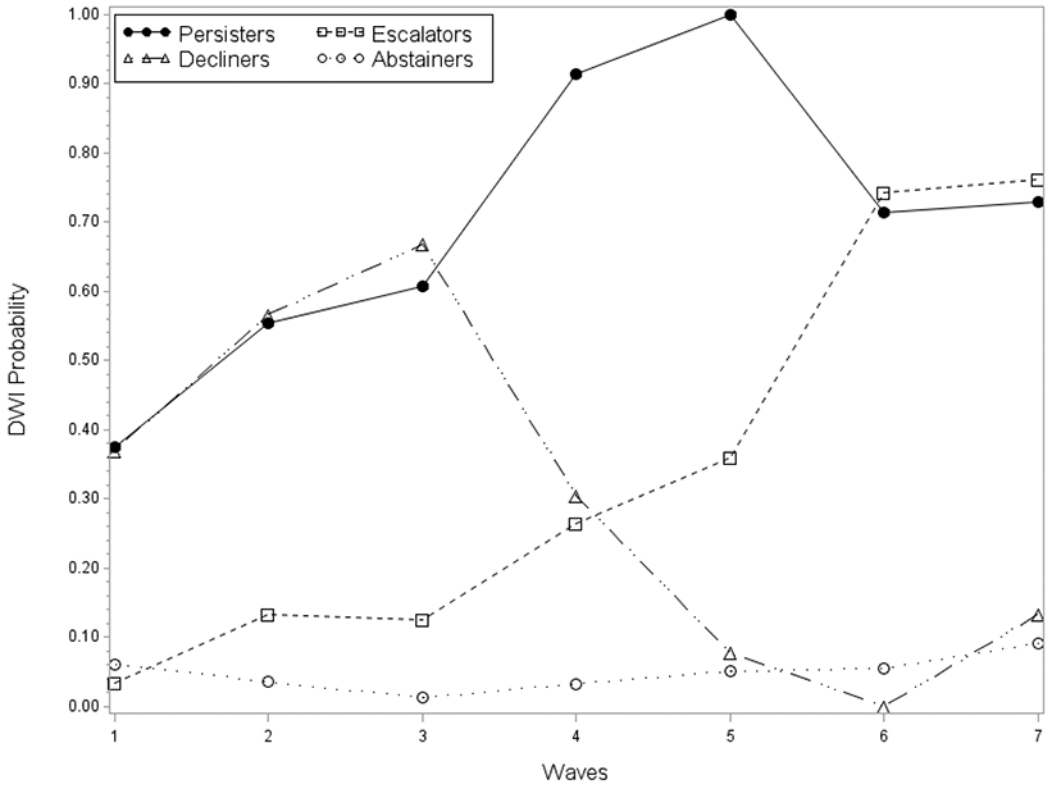

Figure 2.

Trajectories driving while alcohol- or drug-impaired (DWI) in the past 30 days using latent class analysis

Table 1.

Frequency of outcome variables by 4-group RWI trajectories

	Abstainers		Escalators		Decliners		Persisters			
	N	%#	N	%#	N	%#	N	%#	Rao-Scott χ^2	P
	647	100	226	100	352	100	197	100		
General Health										
Fare/poor	178	28.1	76	30.2	135	46.2	63	29.1	13.20	.004
Excellent/good	469	71.9	150	69.8	217	53.8	134	70.9		
Education Attainment										
High school or less	167	25.4	48	14.1	115	36.9	39	18.2	18.37	.005
Tech/Community College	283	44.5	97	47.9	159	41.8	95	48.5		
4-Year College+	197	30.2	81	38.0	78	21.3	63	33.3		
Employment Status										
None	164	23.8	43	12.0	91	24.1	48	25.0	10.18	.34
≤20 hr.	95	14.3	37	15.2	47	13.2	27	10.2		
21-30 hr.	96	13.3	35	15.3	56	13.2	34	18.5		
>30 hr.	292	48.7	111	57.4	158	49.5	88	46.3		

Note:

weighted %. Tech/Community College = GED, some college or technical school, or associate's degree; 4-Year College+ = bachelor's degree or above.

Table 2.

Frequency of outcome variables by 4-group DWI trajectories

	Abstainers		Escalators		Decliners		Persisters			
	N	%#	N	%#	N	%#	N	%#	Rao-Scott χ^2	P
	1657	76.2	337	14.2	99	5.4	83	3.8		
General Health										
Fare/poor	425	31.2	102	32.6	28	31.0	26	31.6	0.12	.99
Excellent/good	1033	68.8	216	67.4	55	69.0	48	68.4		
Education Attainment										
High school or lessTech/Community	426	31.3	82	21.4	20	25.7	18	17.78	8.81	.19
College	641	44.8	155	52.2	41	46.7	36	52.1		
4-Year College+	383	23.9	79	26.3	22	27.6	20	30.2		
Employment Status										
None	333	20.8	62	17.9	15	20.0	17	20.0	6.11	.73
≤20 hr.	187	11.3	43	12.9	13	8.5	8	13.9		
21-30 hr.	209	13.8	44	10.5	16	20.5	16	21.8		
>30 hr.	734	54.1	170	58.8	39	51.0	33	44.3		

Note:

weighted %. Tech/Community College = GED, some college or technical school, or associate's degree; 4-Year College+ = bachelor's degree or above.