Impaired-Driving Prevalence Among US High School Students: Associations With Substance Use and Risky Driving Behaviors

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Objectives. We examined the prevalence of impaired driving among US high school students and associations with substance use and risky driving behavior.

Methods. We assessed driving while alcohol or drug impaired (DWI) and riding with alcohol- or drug-impaired drivers (RWI) in a nationally representative sample of 11th-grade US high school students (n = 2431). We examined associations with drinking and binge drinking, illicit drug use, risky driving, and demographic factors using multivariate sequential logistic regression analysis.

Results. Thirteen percent of 11th-grade students reported DWI at least 1 of the past 30 days, and 24% reported RWI at least once in the past year. Risky driving was positively associated with DWI (odds ratio [OR] = 1.25; $P < .001$) and RWI (OR = 1.09; $P < .05$), controlling for binge drinking (DWI: OR = 3.17; $P < .01$; RWI: OR = 6.12; $P < .001$) and illicit drug use (DWI: OR = 5.91; $P < .001$; RWI: OR = 2.29; $P = .05$). DWI was higher for adolescents who drove after midnight (OR = 15.7), drove while sleepy or drowsy (OR = 8.6), read text messages (OR = 11.8), sent text messages (OR = 5.0), and made cell phone calls (OR = 3.2) while driving.

Conclusions. Our findings suggest the need for comprehensive approaches to the prevention of DWI, RWI, and other risky driving behavior. (*Am J Public Health.* 2013;103:e71–e77. doi:10.2105/AJPH.2013.301296)

Motor vehicle crashes are the leading cause of mortality for US adolescents.[1] In general, alcohol and drug use impairs driving performance in proportion to the amount consumed and contributes significantly to motor vehicle crashes,[2,3] particularly among younger drivers.[4] In 2008, 31% of young drivers who were killed in motor vehicle crashes had been drinking[5]; in 2009, half of the child passengers who died in crashes involving alcohol were riding with an alcohol-impaired driver.[6] Illicit drug use also contributes to a large portion of fatal motor vehicle crashes involving adolescents and adults.[7–10] Despite downward trends among adolescents in rates of drinking and driving (from 17% in 1991 to 10% in 2009) and riding with drinking drivers (from 40% in 1991 to 28% in 2009), rates remain alarmingly high.[11] Therefore, better understanding of the current prevalence, variability, and determinants of adolescent driving while intoxicated (DWI) and riding with alcohol- or drug-impaired drivers (RWI) is needed to guide the development of prevention strategies.

Adolescence, the transition period from childhood to emerging adulthood, is a time of increased sensation seeking and risk behavior.[12,13] During this transition, learning to drive and obtaining a license are major rites of passage for entering adulthood. However, adolescent drivers have high crash rates and tend to drive in a deliberately risky manner, typified by speeding, close following, sharp cornering, and hard stops.[14–18] At the same time, drinking and drug use increase during adolescence, and vehicles become a primary means of transportation and provide a somewhat private place for adolescents to drink and use illicit drugs.[19,20]

Previous research indicates that the prevalence of DWI and RWI among adolescents is higher for male than female adolescents and for Latinos than Whites.[21–24] Concurrent and longitudinal research has shown that drinking, binge drinking, cigarette use, and marijuana use are associated with adolescent DWI and RWI.[20,25–28] Similarly, drinking, drug use, and traffic violations are associated with adolescent risky driving.[17,26] It has been shown in a few regional studies that risky driving covaries with other problem behaviors,[17,26,29] but no national studies have reported associations between risky driving and DWI and RWI among adolescents.

Using a national probability sample, we examined the following: (1) the variability in the prevalence of DWI and RWI among adolescents by demographic factors; (2) the association between risky driving and DWI and RWI; and (3) the independent contribution of binge drinking, illicit drug use, and risky driving to DWI and RWI.

METHODS

Participants (n = 2431) were 11th-grade US adolescents during the 2010–2011 school year. The data used were from wave 2 (participation rate = 87.3%) of the NEXT Generation study,[30] a 7-year longitudinal, nationally representative study with a probability cohort starting with 10th-grade students in the 2009–2010 school year. Black participants were oversampled to provide better population estimates and an adequate sample to examine racial/ethnic differences. Parental consent was obtained.

Dependent Variables

We measured DWI and RWI on the basis of replies to 2 questions derived from the Youth Risk Behavior Survey (YRBS) questionnaire.[11] The question on DWI asked participants on how many days in the last 30 days they drove after drinking alcohol or using illegal drugs. We coded the DWI scores as a dichotomous variable (1 = 1 day or more vs 0 = no days). The question on RWI asked 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, with 5 options (1 = 0 times through 5 = 6 or more times). We coded the RWI scores to a dichotomous variable (1 = 1 or more times vs 0 = never).

Independent Variables

We measured alcohol drinking on the basis of replies to 1 question, derived from the Health Behavior in School-Aged Children questionnaire[31]: "On how many occasions (if any) have you drunk alcohol in last 30 days?" Response options ranged from 1 (never) to 7 (40 times or more). We then dichotomized the scores (1 = at least once vs 0 = none).

We measured binge drinking using 1 question from the Monitoring the Future national survey[19]: "Over the last 30 days, how many times (if any) have you had four (for females)/five (for males) or more drinks in a row on an occasion?" Response options ranged from 1 (none) to 6 (10 or more times). We dichotomized the scores (1 = at least once vs 0 = none).

We measured substance use by asking participants 10 questions derived from the Monitoring the Future survey[19] on how often they had ever used drugs (e.g., marijuana, ecstasy, medication to get high) in the last 12 months, with 7 options (from 1 = never to 7 = 40 times or more). We then generated a dichotomous variable (1 = used any of those drugs as least once vs 0 = none).

We used the 21 questions from the Checkpoints Self-Reported Risky Driving Scale (C-RDS) to measure risky driving (e.g., on how many days in the last 30 days have you "exceeded the speed limit in residential or school zones?" "purposely tailgated or followed another vehicle very closely?").[32] The internal consistency of the C-RDS was good (Cronbach $\alpha = 0.90$). We then dichotomized responses on each of the 21 questions (1 = at least 1 day vs 0 = none) and summed the 21 dichotomies, with possible scores ranging from 0 to 21.

We measured secondary task engagement while driving on the basis of participants' responses to 9 questions (e.g., on how many days in the last 30 days had they "received a call on your cell phone" or "sent text messages" while driving?).[15,32] The internal consistency of the scale used to measure secondary task engagement while driving was good (Cronbach $\alpha = 0.87$). We then dichotomized the scores of the 9 questions (1 = at least 1 day vs 0 = none) and summed the 9 dichotomies, with possible scores ranging from 0 to 9.

Demographic and Other Potential Control Variables

Participants reported age (mean = 17.31 years; SE = 0.07), gender, racial/ethnic background, and family socioeconomic status; 1 parent provided the higher education levels of both parents when completing the informed consent forms. We estimated family socioeconomic status using the Family Affluence Scale[31]; measures included number of cars owned, computers owned, whether the student had his or her own bedroom, and the number of family vacations in the last 12 months. We then categorized students as low, moderate, and high affluence.[33] We categorized the higher education level of both parents as less than high school diploma; high school diploma or general equivalency diploma (GED); some college, technical school, or associate degree; and bachelor's or graduate degree. Access to a vehicle during the last 30 days (1 = none to 4 = all of the time) and number of days having driven a vehicle in the last 30 days were potential control variables.

Analysis

We performed statistical analyses with SAS version 9.2 (SAS Institute, Cary, NC). We took into account features of complex survey design (i.e., stratification, clustering, and sampling weights) in all SAS procedures. We computed standard errors on the basis of the multistage stratified design of the survey. We examined bivariate associations between independent and potential covariates and dependent variables using bivariate logistic regression. We then ran sequential logistic regression models. The first models (model 1) included binge drinking and were adjusted for selected covariates. We then added other variables of interest to the models to examine the influence of each newly added variable on DWI and RWI after controlling for previous variables. After model 1, model 2 added illegal drug use and model 3 added risky driving and secondary task engagement. Covariates selected into the adjusted logistic regression were based on bivariate logistic regression at the significance level of .10 as suggested by Hosmer and Lemeshow.[34] We conducted the analyses for RWI for all participants, but the analyses for DWI only for the subsample of students (n = 880) who reported being licensed for independent, unsupervised driving. Therefore, we applied domain analysis (referring to the computation of statistics for subpopulations in addition to the computation of statistics for the entire study population) in analyses using the subsample.

RESULTS

Of the 2431 participants, 55.0% were female, 19.6% were Hispanic (vs 17.6% Blacks, 58.6% Whites, and 4% other minorities), 21.9% were from low-affluence families (vs 50.3% and 27.8% from moderate- and high-affluence families, respectively), and 8.2% of students had 1 parent with less than a high school diploma as the highest education level (vs 24.2% with high school diploma or GED, 40.5% with some college, technical school, or associate degree, and 27.2% with bachelor's or higher degree).

As shown in Table 1, 12.5% (weighted) of study participants reported DWI at least 1 day in the past 30 days and 23.9% reported RWI at least once in the past year (of whom 38% reported only once, 33% reported 2–3 times, and 29% reported ≥ 4 times). DWI was more prevalent among male than female adolescents, and DWI and RWI were much more prevalent among those who reported drinking and binge drinking in the past month and using illegal substances in the past year. RWI was more prevalent among Hispanics. As shown in Table 2, DWI and RWI were more prevalent among those reporting more frequent risky driving and secondary task engagement while driving. In bivariate analyses (data not shown), we also found significant associations between DWI and RWI and each of the individual measures of risky driving and secondary task engagement while driving. Significant odds ratios for increased risk of DWI due to risky driving included 15.7 for driving after midnight, 8.3 for not wearing a seat belt, 8.8 for showing off while driving, 8.6 for driving when sleepy or drowsy, 7.1 for racing another vehicle, 5.5 for purposely tailgating, and 4.4 for speeding. Odds ratios for secondary task engagement included 11.8 for reading text

TABLE 1—Percentage of DWI in the Past Month and RWI in the Past Year Among 11th-Grade Students: NEXT Generation Study, United States, 2010–2011

Covariate	DWI at Least 1 Day (n = 880)			RWI at Least 1 Time (n = 2431)		
	No.	Weighted % (SE)	OR (95% CI)	No.	Weighted % (SE)	OR (95% CI)
Total	844	12.53 (1.44)	. . .	2408	23.85 (2.45)	. . .
Gender						
Female (Ref)	447	7.95 (2.23)	1.00	1349	23.07 (2.24)	1.00
Male	397	17.67 (2.12)	2.49** (1.26, 4.90)	1059	24.81 (3.11)	1.10 (0.88, 1.38)
Race/ethnicity						
White (Ref)	608	12.56 (1.75)	1.00	969	21.05 (3.06)	1.00
Hispanic	88	6.27 (2.64)	0.47 (0.25, 0.86)	704	32.09 (4.40)	1.77* (1.14, 2.76)
Black	107	12.74 (6.37)	1.02 (0.29, 3.52)	602	25.38 (4.11)	1.28 (0.75, 2.18)
Other	38	22.21 (8.37)	1.99 (0.71, 5.58)	118	18.10 (4.60)	0.83 (0.44, 1.56)
Family affluence						
High (Ref)	273	12.09 (2.18)	1.00	472	24.65 (3.33)	1.00
Low	99	17.28 (5.18)	1.52 (0.66, 3.51)	652	24.29 (3.91)	0.98 (0.63, 1.52)
Moderate	415	11.60 (2.30)	0.95 (0.56, 1.62)	1027	22.24 (2.69)	0.87 (0.61, 1.25)
Education level (higher of both parents)						
< high school diploma (Ref)	23	8.20 (8.01)	1.00	285	34.16 (6.23)	1.00
High school diploma or GED	133	13.50 (4.43)	1.75 (0.24, 12.55)	503	26.98 (3.26)	0.71 (0.46, 1.12)
Some college, technical school, or associate degree	336	10.96 (2.16)	1.38 (0.15, 12.95)	765	20.16 (3.64)	0.49* (0.27, 0.87)
Bachelor's or graduate degree	273	13.31 (3.20)	1.72 (0.25, 12.07)	493	21.77 (3.92)	0.54 (0.26, 1.12)
Drinking alcohol in last 30 d						
No (Ref)	523	3.24 (1.26)	1.00	1649	14.33 (2.16)	1.00
Yes	313	28.16 (3.05)	11.70*** (4.66, 29.39)	742	41.39 (3.65)	4.22*** (3.00, 5.93)
Binge drinking in last 30 d						
No (Ref)	631	5.02 (1.01)	1.00	1914	14.89 (2.05)	1.00
Yes	206	34.39 (3.92)	9.91*** (5.94, 16.55)	465	47.05 (3.43)	6.43*** (4.56, 9.28)
Illegal drug use in the last y						
No (Ref)	638	4.56 (1.35)	1.00	1818	16.49 (2.79)	1.00
Yes	206	36.24 (4.15)	11.89*** (6.27, 22.55)	590	44.21 (3.17)	4.01*** (2.84, 5.68)

Note. CI = confidence interval; DWI = driving while intoxicated; GED = general equivalency diploma; OR = odds ratio; RWI = riding with alcohol- or drug-impaired drivers.
*P < .05; **P < .01; ***P < .001.

messages, 8.3 for reading or grooming, 5.0 for sending text messages, and 3.2 for making cell phone calls. For multivariate analyses, we combined individual items into composite measures of risky driving and secondary task engagement to avoid multicollinearity.

As shown in Tables 1 and 2, six variables (race/ethnicity, alcohol in last 30 days, binge drinking in last 30 days, illegal drug use in last year, risky driving, and secondary behavior while driving) met the criteria for inclusion ($P \leq .1$) in subsequent models for both DWI and RWI. We included parents' education in the RWI models and gender in the DWI models. Drinking alcohol and binge drinking were highly correlated, and only the models including binge drinking are reported. We included the variable "driving days in the past 30 days" as an exposure variable in the adjusted models, although it was not associated with either DWI or RWI at the significance level of .1.

Table 3 shows the results of sequential logistic regression of DWI, controlling for race/ethnicity, gender, and driving exposure in the past 30 days. In model 1, binge drinking was significantly associated with DWI in the past month. In model 2, the addition of illegal drug use in the past year to the model substantially improved the model fit ($\Delta\chi^2 = 116705$; $\Delta df = 1$; $P < .001$), and both binge drinking and illegal drug use were significantly associated with DWI. Finally, in model 3, the addition of risky driving and secondary behavior further improved the model fit ($\Delta\chi^2 = 143841$; $\Delta df = 2$; $P < .001$), and binge drinking (odds ratio [OR] = 3.17; 95% confidence interval [CI] = 1.53, 6.54), illegal drug use (OR = 5.91; 95% CI = 2.64, 13.23), and risky driving (OR = 1.25; 95% CI = 1.12, 1.39) were significantly associated with DWI. The results indicate that risky driving maintains a significant relationship to DWI after control for binge drinking and illegal drug use; risky driving, binge drinking, and illegal drug use are concurrent risk factors of adolescent DWI.

Table 4 shows the results of sequential logistic regression of RWI. In model 1, binge

TABLE 2—Mean of Continuous Covariates as Function of DWI in the Past Month and RWI in the Past Year Among 11th-Grade Students: NEXT Generation Study, United States, 2010–2011

Covariate	DWI at Least 1 Day (n = 880)			RWI at Least 1 Time (n = 2431)		
	Yes, Mean(SE)	No, Mean(SE)	OR (95% CI)	Yes, Mean(SE)	No, Mean (SE)	OR (95% CI)
Age, y	17.31 (0.08)	17.33 (0.03)	0.93 (0.49, 1.77)	17.32 (0.05)	17.30 (0.03)	1.10 (0.83, 1.46)
Driving days in past 30 d[a]	25.68 (1.28)	23.90 (0.48)	1.03 (0.98, 1.09)	19.70[b] (1.30)	18.83[b] (0.91)	1.01 (0.99, 1.02)[b]
Risky driving[c]	15.01 (0.74)	6.90 (0.20)	1.34*** (1.25, 1.44)	11.33[b] (0.63)	6.79[b] (0.21)	1.16*** (1.10, 1.22)[b]
Secondary tasks while driving[d]	6.86 (0.17)	5.12 (0.10)	1.55*** (1.33, 1.79)	6.32[b] (0.26)	5.03[b] (0.10)	1.30*** (1.12, 1.52)[b]

Note. CI = confidence interval; DWI = driving while intoxicated; OR = odds ratio; RWI = riding with alcohol- or drug-impaired drivers.
[a]Participants were excluded (n = 5) if they reported more than 30 days.
[b]Only including those who had an independent driver's license (not a learner's permit; n = 844).
[c]Number of incidents of risky driving in past 30 days.
[d]Number of incidents of secondary task engagement while driving in the last 30 days.
***$P < .001$.

drinking was significantly associated with RWI in the past year after race/ethnicity and parent education were controlled for. In model 2, the addition of illegal drug use to the model substantially improved the model fit ($\Delta\chi^2 = 71168$; $\Delta df = 1$; $P < .001$), and both binge drinking and illegal drug use were significantly associated with RWI. Finally, in model 3, binge drinking (OR = 6.12; 95% CI = 3.52, 10.64), illegal drug use (OR = 2.29; 95% CI = 1.00, 5.30), and risky driving (OR = 1.09; 95% CI = 1.02, 1.17) were significantly associated with RWI. The results indicate that risky driving maintains a significant relationship to RWI after covariates, binge drinking, and illegal drug use are controlled for, and that binge drinking, illicit drug use, risky driving, and RWI co-occur.

Similar results were seen when we substituted the variable "drinking alcohol in the past month" for binge drinking in the sequential logistic regression models of Tables 3 and 4 (analyses not shown).

DISCUSSION

Previous research indicates that drinking and driving[11] and alcohol use prevalence among US adolescents have declined in the past decade,[35] but remain unacceptably high. In our nationally representative sample of 11th-grade students, we found that 12.5% reported DWI in the past month and 23.9% reported RWI in the past year. DWI, but not RWI, was higher among male adolescents, whereas among Hispanics, DWI was lower and RWI was higher. Binge drinking, illegal drug use, and risky driving were independently associated with DWI and RWI (illegal drug use and risky driving were only marginally associated [$P = .05$]).

Prevalence was consistent with the YRBS rates for 11th graders in 2011 (drinking and driving, 9.1%; riding with a drinking driver, 23.8%).[36] Measures of DWI in the 2 studies are not completely compatible in that YRBS asked only about drinking and driving, whereas NEXT asked about drinking and drug use. Although alcohol remains the most common impairing substance for drivers young and old,[37,38] other drug use is recognized as a significant threat to traffic safety, and our study captured the prevalence of alcohol- and drug-impaired driving.[37] Our findings are consistent with other research indicating that DWI is more likely among male than female adolescents, and that DWI is less likely—and RWI more likely—among Hispanics compared with their White counterparts.[23,39] Notably, in bivariate analysis, Walker et al.[23] found that Latinos were less likely to drive after drinking (OR = 0.65; $P > .05$) and more likely to ride with drinking drivers (OR = 1.34; $P > .05$), consistent with the findings of O'Malley et al.[40] One likely explanation for this finding is the

TABLE 3—Sequential Logistic Regression of DWI in the Past Month Among 11th-Grade Students: NEXT Generation Study, United States, 2010–2011

Covariate	Model 1, OR[a] (95% CI)	Model 2, OR[a] (95% CI)	Model 3, OR[a] (95% CI)
Binge drinking in last 30 d			
No (Ref)	1.00	1.00	1.00
Yes	11.96*** (7.71, 18.58)	5.75*** (3.28, 10.09)	3.17** (1.53, 6.54)
Illegal drug use in the past y			
No (Ref)		1.00	1.00
Yes		7.80*** (3.81, 16.00)	5.91*** (2.64, 13.23)
Risky driving			1.25*** (1.12, 1.39)
Secondary tasks while driving			1.09 (0.92, 1.29)

Note. CI = confidence interval; DWI = driving while intoxicated; OR = odds ratio. Model 1 includes binge drinking in last 30 days and covariates; model 2 includes model 1 variable plus illegal drug use in the past year and covariates; model 3 includes model 2 variables plus risky driving and secondary tasks while driving and covariates. Risky driving and secondary task engagement are continuous variables. The total sample size was n = 880 (those who had an independent driver's license, not a learner's permit). Goodness-of-fit statistics were as follows: for model 1, $\chi^2 = 283373.68$, $df = 6$; for model 2, $\chi^2 = 400079.35$, $df = 7$, $\Delta\chi^2 = 116705.67$ ($P < .001$), $\Delta df = 1$, compared with model 1; for model 3, $\chi^2 = 543920.79$, $df = 9$, $\Delta\chi^2 = 143841.44$ ($P < .001$), $\Delta df = 2$, compared to model 2.
[a]Controlling for race/ethnicity, gender, and driving days in the past 30 days.
**$P < .01$; ***$P < .001$.

TABLE 4—Sequential Logistic Regression of RWI in the Past Year Among 11th-Grade Students: NEXT Generation Study, United States, 2010–2011

Covariate	Model 1, OR[a] (95% CI)	Model 2, OR[a] (95% CI)	Model 3,[b] OR[a] (95% CI)
Binge drinking in last 30 d			
No (Ref)	1.00	1.00	1.00
Yes	7.86*** (4.97, 12.42)	5.71*** (3.52, 9.28)	6.12*** (3.52, 10.64)
Illegal drug in the past y			
No (Ref)		1.00	1.00
Yes		2.34*** (1.53, 3.58)	2.29* (1.00, 5.30)
Risky driving			1.09* (1.02, 1.17)
Secondary tasks while driving			1.02 (0.81, 1.30)

Note. CI = confidence interval; OR = odds ratio; RWI = riding with alcohol- or drug-impaired drivers. Model 1 includes binge drinking in last 30 days and covariates; model 2 includes model 1 variable plus illegal drug use in the past year and covariates; model 3 includes model 2 variables plus risky driving and secondary tasks while driving and covariates. Risky driving and secondary tasks while driving are continuous variables. The total sample size was n = 2431. Goodness-of-fit statistics were as follows: for model 1, $\chi^2 = 536969.66$, $df = 7$; for model 2, $\chi^2 = 608137.71$, $df = 8$, $\Delta\chi^2 = 71168.05$ ($P < .001$), $\Delta df = 1$, compared with model 1; for model 3, $\chi^2 = 456508.22$, $df = 11$ (model fit comparison was not examined because the sample size used in model 3 was not consistent with that in model 2).

[a]Controlling for race/ethnicity and parent education.

[b]Model 3 was tested only among those who had an independent driver's license (not a learner's permit; n = 844).

*$P \leq .05$; **$P < .01$; ***$P < .001$.

relatively low rate of having a driver's license among Hispanic youths in our sample (18.8% of Hispanics vs 62.5% of Whites), which would provide less opportunity for DWI and more opportunity for RWI. Another possible explanation is the higher average number of DWI events among Hispanic adults compared with other racial/ethnic groups and the higher likelihood of family-involved DWI in Hispanic communities,[41,42] which could increase the prevalence of RWI among Hispanic youths riding with adults, at least as measured by the annual rate of alcohol-impaired driving.[41] However, additional research is needed on this topic.[42]

Our finding that binge drinking was associated with DWI and RWI after we controlled for other risk-taking behaviors such as illicit drug use is consistent with previous findings.[25,38] Logically, alcohol use increases the likelihood of DWI and RWI, particularly in the absence of alternative transportation and strong cultural norms that discourage driving after use. Moreover, we found that licensed adolescents who engaged in risky driving were also more likely to engage in DWI and RWI, consistent with the notion that risky driving, impaired driving, and substance use are adolescent risk-taking behaviors that may have common antecedents.[20,26–29]

The findings emphasize the potential of substance use prevention programs in reducing DWI and RWI. For example, improved substance use prevention programs[43] and the general decline in adolescent drinking[35] may have contributed to reductions in DWI prevalence since the 1980s in the United States and worldwide. Particularly in the United States, the dramatic decline in adolescent alcohol-related crashes since the 1980s has been attributed mainly to federally mandated zero tolerance, the strengthening of age-21 drinking laws, and purchase and possession laws.[44,45] Of course, improved laws, enhanced enforcement, improvements in public transportation, greater public awareness, and changes in social norms[44,46,47] also contribute to the reductions in DWI prevalence. Despite the progress in reducing DWI and RWI in the last several decades, more comprehensive efforts may be needed.[38,48] In this sense, risky driving should be incorporated into future substance use and DWI–RWI prevention programs as potential risk factors. Programs such as the Checkpoints Program and DriveCam for Families have been shown to reduce risky driving by monitoring and setting limits on adolescent driving.[49–52]

It is notable that secondary task engagement while driving was not significant in both final regression models for DWI and RWI, although it was significantly associated with DWI and RWI in the bivariate models (Table 2). We conducted additional analyses (not shown) to examine whether participants' risky driving mediated the association between their secondary task engagement and DWI and RWI, using Preacher and Hayes's INDIRECT macro.[53] The results showed that the relationships between secondary task engagement and DWI and RWI were completely mediated by risky driving, which indicates that performing secondary tasks while driving is risky driving behavior and that those engaged in such tasks while driving may be more likely to perform other risky driving behaviors as well.

Further progress in reducing DWI and RWI may require enhancement or expansion of population-based approaches such as those just described, plus complementary approaches that target high-risk youths. For example, the National Institute on Alcohol Abuse and Alcoholism and the American Academy of Pediatrics have recently recommended screening for DWI among adolescents.[54,55] In addition, family-based education and intervention to prevent DWI and RWI may be particularly important for Hispanic adolescents given that they have the highest percentage of RWI, Hispanic adults are more likely to engage in DWI, and Hispanic family members are more likely to experience RWI.[41,42]

Limitations

The study has limitations. First, the cross-sectional design prohibits causal interpretations of the findings. Second, the school-based recruitment might limit the generalization of the findings to adolescents not in school. Third, the analyses for DWI were limited to the 11th-grade high school students who had been licensed for independent, unsupervised driving. Fourth, our measures did not distinguish between driving after drinking and driving after other drug intoxication, limiting direct comparisons to other studies. Future research should include separate measures of these co-occurring behaviors. Fifth, for RWI, we did not determine whether the driver was another adolescent or an adult. Future research could investigate factors that are associate with adolescents riding with impaired adolescent drivers vs impaired adult drivers. Sixth, although the self-report measures employed are standard and widely used, social desirability

bias could lead to under- or overreporting of sensitive behaviors like DWI and RWI.

Conclusions

Our findings confirm that the prevalence of adolescent DWI and RWI varies by gender and race/ethnicity and is strongly associated with substance use, suggesting the utility of both population and targeted interventions. We also found strong associations between risky driving, substance use, and DWI and RWI, suggesting a constellation of risk-taking behaviors and the possible utility of including the topic of risky driving in substance use and DWI prevention programs. ■

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Contributors

K. Li led the analysis, interpretation of data, and drafting of the article. B. G. Simons-Morton conceptualized and designed the study and contributed to the writing of the article. R. Hingson reviewed the article, contributed to the writing, and provided advice on content and policy implications.

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Human Participant Protection

The study protocol was reviewed and approved by the institutional review board of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development.

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