Association Between Riding With an Impaired Driver and Driving While Impaired

WHAT'S KNOWN ON THIS SUBJECT: Motor vehicle crashes, heavy drinking, and drug use are serious, interactive health concerns for the teenage population. Teenage alcohol-impaired driving behaviors are associated with heavy drinking, parenting practices, and exposure to drinking and driving.

WHAT THIS STUDY ADDS: Earliness of exposure to alcohol/drug impaired driving (DWI) and early licensure were independent risk factors for teenage DWI. A strong, positive dose-response existed between DWI and amount of prior exposure to DWI in the form of riding with an impaired driver.

abstract

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OBJECTIVE: To examine the association between driving while alcohol/drug impaired (DWI) and the timing and amount of exposure to others' alcohol/drug-impaired driving (riding while impaired [RWI]) and driving licensure timing among teenage drivers.

METHODS: The data were from waves 1, 2, and 3 (W1, W2, and W3, respectively) of the NEXT Generation Study, with longitudinal assessment of a nationally representative sample of 10th graders starting in 2009–2010. Multivariate logistic regression was used for the analyses.

RESULTS: Teenagers exposed to RWI at W1 (adjusted odds ratio [AOR] = 21.12, $P < .001$), W2 (AOR = 19.97, $P < .001$), and W3 (AOR = 30.52, $P < .001$) were substantially more likely to DWI compared with those reporting never RWI. Those who reported RWI at 1 wave (AOR = 10.89, $P < .001$), 2 waves (AOR = 34.34, $P < .001$), and all 3 waves (AOR = 127.43, $P < .001$) were more likely to DWI compared with those who never RWI. Teenagers who reported driving licensure at W1 were more likely to DWI compared with those who were licensed at W3 (AOR = 1.83, $P < .05$).

CONCLUSIONS: The experience of riding in a vehicle with an impaired driver increased the likelihood of future DWI among teenagers after licensure. There was a strong, positive dose-response association between RWI and DWI. Early licensure was an independent risk factor for DWI. The findings suggest that RWI and early licensure could be important prevention targets. *Pediatrics* 2014;133:620–626

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KEY WORDS

impaired driving, riding with impaired drivers, adolescents, heavy episodic drinking, driving licensure timing

ABBREVIATIONS

AOR—adjusted odds ratio
CI—confidence interval
DWI—driving while impaired by alcohol and/or drugs
HED—heavy episodic drinking
RWI—riding with an impaired driver
W1—W2, and W3, waves 1, 2, and 3

Dr Li led the analysis, interpretation of data, and drafting of the manuscript; Dr Simons-Morton conceptualized and designed the study and contributed to the writing of the article; Drs Hingson and Vaca contributed to the writing and provided advice on content and policy implications; and all authors approved the final manuscript as submitted.

www.pediatrics.org/cgi/doi/10.1542/peds.2013-2786

doi:10.1542/peds.2013-2786

Accepted for publication Jan 16, 2014

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: Supported by the Intramural Research Program of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (contract HHSN267200800009C) and the National Heart, Lung, and Blood Institute, the National Institute on Alcohol Abuse and Alcoholism, and the Maternal and Child Health Bureau of the Health Resources and Services Administration, with supplemental support from the National Institute on Drug Abuse. Funded by the National Institutes of Health (NIH).

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

Motor vehicle crashes, heavy drinking, and drug use are serious health concerns for the teenage population.[1,2] A substantial body of research[3,4] has established that an elevated crash risk results among drivers of all ages from impaired driving caused by alcohol,[5] drugs,[3,4] or alcohol and drugs used in combination.[6] More than 30% (20% for persons aged 16–20 years and 32% for those aged 21–24 years) of total motor vehicle traffic fatalities in the United States in 2011 were due to alcohol-impaired driving.[7–9] Current national prevalence estimates of teenage drinking and driving in the past month range from 9.1%[2] to 12.5%.[10] Therefore, identifying factors contributing to teenage driving while impaired from alcohol and/or drugs (DWI) is critical to preventing teenage crash injuries and fatalities.

In cross-sectional studies of DWI risk, male gender,[11] previous driving offenses,[12] risky driving,[10] riding with an impaired driver (RWI),[11] poor family relationships,[13] and lack of parental monitoring[14] were found to be associated with teenage DWI. The most consistent predictor of DWI in studies in adolescent samples is problem drinking, including heavy alcohol use and drinking-related problems.[10,11,13,15–18] Some results were affirmed in longitudinal studies. For example, heavy episodic drinking (HED) was found to predict DWI, and parental monitoring knowledge, particularly for fathers, was protective against DWI, independent of the effect of substance use.[19]

Driving has been described as a socially regulated behavior.[20] Social learning theory posits that social behavior is learned primarily by observing and imitating the actions of others.[21] There is a body of evidence that shows that the social norms of novice teenage drivers are influenced by parents' and peers' driving, including speeding traffic violations and crashes.[22,23] Therefore, exposure during childhood and adolescence to DWI by others may make it seem acceptable (normative) and increase its future likelihood. The association between exposure to others' drinking and driving during adolescence, primarily through RWI, and engaging in DWI has been examined in cross-sectional and longitudinal studies. Consistent results indicate that exposure to parental and peer drinking and driving during adolescence is associated with high likelihood of DWI in the near future (1 year later)[24] and during young adulthood.[25,26] More recently, Evans-Whipp et al[27] confirmed these associations while addressing some limitations identified in previous studies. However, it remains unclear the extent to which the amount of exposure to others' drinking/drug-impaired driving (ie, RWI) is associated with DWI.

Other research indicates that younger teenage novice drivers had higher crash rates compared with older drivers, partially due to younger driver inexperience[28] and underestimation of risky driving situations such as driving after drinking.[29] A review suggested that teenage crash rates are associated with age at licensure and driving experience (length of licensure).[28] Another previous study indicated that early licensure promoted some teenagers' risky driving behaviors such as speeding and switching lanes to weave through slower traffic.[30] However, it is unclear whether early driving licensure is predictive of DWI in teenagers.

The purpose of the current study is to determine prospective associations of DWI assessed in the 12th grade with exposure to others' drinking/drug-impaired driving and driving licensure timing.

METHODS

Sampling

The data used were from waves 1, 2, and 3 (W1, W2, and W3, respectively) of the NEXT Generation Study, a longitudinal, nationally representative study with a probability cohort starting with 10th-grade students in the 2009–2010 school year. Sampling strategy was reported elsewhere.[19] Of 3796 students recruited in the 10th grade, assent or parental consent for 2619 students was obtained at W1. A total of 2525 students completed the survey at W1. From W2, 260 more students were recruited and a total of 2432 students completed the survey at W2, and 2408 students at W3. African-American participants were oversampled to provide better population estimates. Parental or students' consent was obtained in all waves. 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.

Outcome Measures

DWI at W3 was measured by using 1 question derived from the Youth Risk Behavior Survey questionnaire[31] by asking participants on how many days in the past 30 days they drove after drinking alcohol or using illegal drugs. Because of severe floor effect and nonnormal distribution of the data (the same reason for the dichotomous variables below), the DWI score was coded as a dichotomous variable: 1 = ≥1 day and 0 = no days.

Predictors

RWI was measured by asking participants how many times, during the past 12 months, they rode in a vehicle driven by someone else who had been drinking alcohol or using illegal drugs with 5 options of 1 = 0 times through 5 = ≥6 times. The RWI score was coded as a dichotomous variable: 1 = ≥1 times and 0 = never. Exposure timing (or earliness) of RWI was generated on the basis of the reported RWI at W1, W2, and W3. Participants were categorized into 4 groups: 0 = never reported RWI,

1 = first RWI at W1, 2 = first RWI at W2, and 3 = first RWI at W3. Exposure amount of RWI was also generated on the basis of the reported RWI at W1, W2, and W3. Participants were categorized into 4 groups: 0 = never reported RWI, 1 = RWI at only 1 of 3 waves, 2 = RWI at only 2 of 3 waves, and 3 = RWI at all 3 waves. Driving licensure time was generated on the basis of students' reporting if they had a license allowing independent, unsupervised driving (with or without temporary restriction on late-night driving, teen passengers, etc) at W1, W2, and W3; they were then categorized into 4 group accordingly: 0 = not reported to have an independent driver's license at any of the 3 waves, 1 = reported to have an independent driver's license at W1; 2 = reported to have an independent driver's license at W2; and 3 = reported to have an independent driver's license at W3. HED was adapted from the Monitoring the Future national survey.[32] At W1 and W2 participants were asked, "Over the last 30 days, how many times (if any) have you had 4 (for females)/5 (for males) or more drinks in a row on an occasion?" with response options from 1 = none to 6 = ≥10 times. The scores were dichotomized: 0 = never HED at W1 and W2, 1 = HED at W1 or/and W2. Substance use was measured in W1 and W2 by asking participants 10 questions derived from the Monitoring the Future national survey[32] on how often they have ever used drugs (eg, marijuana, ecstasy, medication to get high) in the past 12 months with 7 options ranging from 1 = never to 7 = ≥40 times. A dichotomous variable was then generated as 1 = have used any of those drugs as least once at W1 and/or W2 and 0 = had never used drugs at W1 and W2. Parenting practices include mother's and father's monitoring knowledge and parental control. Parental monitoring knowledge was measured in W1 and W2 by using questions adapted from a validated 5-item scale.[33] Adolescents reported their perceptions of their mother's and (on separate items) their father's monitoring knowledge about their activities, eg, where they were after school and where they went at night, with 4 response options: 1 = don't have/see father or mother/guardian, 2 = he/she doesn't know anything, 3 = he/she knows a little, and 4 = he/she knows a lot. The Cronbach's α for adolescents' responses to mother- and father-related questions were 0.83 and 0.95 for W1 and 0.88 and 0.96 for W2, respectively. Mean scores of W1 and W2 were calculated for mother's and father's monitoring knowledge.

Demographic and Control Variables

Participants reported age (mean ± SE: 17.30 ± 0.02 years), gender, race/ethnicity, family socioeconomic status, parent education, and days driven in the past 30 days. Family socioeconomic status was estimated by using the Family Affluence Scale,[34] and students were then categorized as low, moderate, and high affluence.[35] Parents reported the educational level of both parents and were categorized on the basis of the highest level of education of either parent.

Statistical Analyses

Statistical analyses were performed by using SAS 9.3 (SAS Institute, Cary, NC). Features of complex survey design (ie, stratification, clustering, and longitudinal sampling weights) were taken into account. Binary logistic regression was first conducted to examine associations between predictors and potential covariates and the outcome variables (DWI and RWI). Then multivariate logistic regression models were run including selected covariates and confounding variables. Covariates selected into the adjusted logistic regression were based on bivariate logistic regression at the significance level of $P = .10$.

For questions related to DWI, the analysis was limited to those who had a license allowing independent, unsupervised driving at W3 ($n = 1217$). For questions related to RWI, the analysis was limited to those who completed a survey at W3 ($n = 2408$) but excluded those who started at W2. Domain analysis was applied for the analyses when using the subsample.

RESULTS

The frequency and percentage of the total sample in W1 ($n = 2525$) and subsample ($n = 1217$) including only those who had an independent driving license in W3 are shown in Table 1. White youth and those with more educated parents were more likely to be licensed.

Table 2 shows the prevalence of DWI in the past month, RWI in the past year, and combined DWI and RWI among 10th-, 11th-, and 12th-grade students. Over the 3 waves, the percentage reporting DWI at least 1 day was 12% to 14%, the percentage reporting RWI at least 1 day was 23% to 38%, and the percentage reporting either DWI or RWI was 26% to 33%.

Table 3 shows the unadjusted relationship of each potential predictor and covariate to DWI. Males, those from higher affluence families, and those licensed at W1 were significantly more likely to DWI. Similarly, those who reported HED and drug use were more likely to DWI. RWI exposure at any wave greatly increased the likelihood of DWI. All potential covariates except for race/ethnicity and driving exposure were marginally ($.05 < P \leq .10$) or fully (from $P < .001$ to .05) associated with DWI at W3 and included in subsequent models.

Table 4 shows the results of adjusted logistic regression models of DWI for the association between each of predictors and DWI controlling for selected covariates. Students who first reported having an independent driving license at W1 (adjusted odds ratio [AOR] = 1.83; 95% confidence interval [CI]: 1.08–3.08) were more likely to DWI compared with those not licensed until W3. Students who reported RWI at any of W1 (AOR = 21.12; 95% CI: 6.07–73.42), W2 (AOR =

TABLE 1 Total Sample in W1 and Subsample Including Only Those Who Had an Independent Driving License in W3: NEXT Generation Study, 2009–2012

	Total Sample in W1 (n = 2525)			Students With Independent Driving License in W3 (n = 1217)		
	n	Weighted % (SE)	95% CI	n	Weighted % (SE)	95% CI
Gender						
Female	1388	54.44 (1.69)	50.92–57.96	642	54.15 (1.98)	50.03–58.27
Male	1132	45.56 (1.69)	42.04–49.08	575	45.85 (1.98)	41.73–49.97
Race/ethnicity						
White	1092	57.92 (5.45)	46.55–69.29	772	71.22 (4.35)	62.15–80.29
Hispanic	802	19.64 (3.93)	11.44–27.83	162	11.96 (2.99)	5.72–18.19
Black	485	17.53 (3.65)	9.91–25.15	223	13.19 (3.13)	6.65–19.72
Other	132	4.91 (1.05)	2.71–7.10	55	3.64 (0.94)	1.68–5.59
Family affluence						
Low	804	23.85 (2.79)	18.04–29.67	185	15.09 (1.91)	11.10–19.07
Moderate	1173	48.95 (1.45)	45.92–51.98	566	50.63 (1.78)	46.92–54.33
High	541	27.19 (2.50)	21.98–32.40	356	34.29 (2.45)	29.17–39.41
Educational level (higher of both parents)						
Less than high school diploma	335	8.43 (2.03)	4.19–12.67	50	3.95 (1.27)	1.30–6.59
High school diploma or GED	602	25.05 (2.11)	20.64–29.47	199	18.34 (2.23)	13.69–23.00
Some degree	865	39.75 (1.68)	36.25–43.25	456	41.89 (2.49)	36.69–47.09
Bachelor's or graduate degree	560	26.77 (2.96)	20.60–32.94	367	35.82 (3.84)	27.80–43.83

Data are presented as frequencies and percentages unless otherwise indicated. Some degree: some college, technical school, or associate degree. GED, general equivalency diploma.

19.97; 95% CI: 7.43–53.68), and W3 (AOR = 30.52; 95% CI: 30.52–104.56) were more likely to DWI compared with those who never reported RWI by W3. The dose-response relationship between W3 DWI and amount of RWI shows that compared with students never exposed to RWI, those who reported RWI at only 1 wave (AOR = 10.89; 95% CI: 3.49–34.01), at 2 waves (AOR = 34.34; 95% CI: 10.10–116.77), and at all 3 waves (AOR = 127.43; 95% CI: 28.84–562.94) were more likely to DWI with increased AORs.

DISCUSSION

We reported the prevalence of DWI and RWI for 10th, 11th, and 12th graders and examined the prospective associations with RWI of exposure timing and amount, driving licensure timing, and DWI among 12th graders. We found that reported exposure timing to impaired drivers (RWI) was associated with a high likelihood of W3 DWI, there was dose-response association between exposure timing to RWI and likelihood of W3 DWI, and early driving licensure was a risk factor for W3 DWI.

Previous research indicates that drinking and driving[31] and alcohol-use prevalence among US adolescents have declined in the past decade[36] but remain unacceptably high. In our nationally representative sample, the prevalence of reported DWI in the past month did not change significantly from 10th- to 11th-grade students, with prevalences of 12.9%, 12.5%, and 14.3% in the 10th, 11th and 12th grades, respectively. In contrast, the prevalence of reported RWI in the past year significantly decreased from 10th grade, with a significant difference between 10th-grade (32.3%) and 11th-grade (23.9%) and 10th- and 12th-grade (26.8%) students (results of SAS MIXED model with repeated statement not shown) but remained extremely high throughout. The marginal increase in DWI in the present sample is consistent with evidence of continuously declining national prevalence of DWI among US high school students during approximately the past decade.[37] DWI prevalence among high school students is lower than in the past, creating a sort of ceiling effect. The decreased RWI from W1 to W2 and from W1 to W3 may be due to the fact that older students were more likely to be licensed to drive, but the persistently high rate of RWI is a concern. However, the combined DWI/RWI rates of 26% to 32% indicate that drinking and driving and riding prevalence remains high among adolescents.

In our study, 2 notable findings contribute to the DWI/RWI literature. First, we found that exposure to RWI is prospectively associated with the risk of adolescents' DWI. These findings are consistent with the social learning framework of behavior,[21,38] which emphasizes the influence of observing role models on the development of normative attitudes to certain behaviors (eg, DWI in the current study). The current study confirms previous prospective findings[26,27] and included the following unique findings: the

TABLE 2 DWI in the Past Month and RWI in the Past Year Among 10th-, 11th-, and 12th-Grade Students: NEXT Generation Study, 2009–2012

School Year	DWI ≥1 Day			RWI ≥1 Time			DWI ≥1 Day or RWI ≥1 Time		
	n	Weighted % (SE)	95% CI	n	Weighted % (SE)	95% CI	n	Weighted % (SE)	95% CI
2009–2010 (W1)	396	12.87 (3.57)	5.40–20.33	2509	32.31 (1.77)	28.62–36.01	2510	33.19 (1.87)	29.30–37.08
2010–2011 (W2)	844	12.53 (1.44)	9.53–15.52	2409	23.85 (2.45)	18.75–28.95	2410	26.63 (2.38)	20.67–30.58
2011–2012 (W3)	1208	14.31 (2.07)	9.98–18.63	2379	26.81 (1.65)	23.38–30.25	2379	28.21 (1.68)	24.69–31.73

There were 402, 880, and 1217 students who had independent driving licenses in W1, W2, and W3, respectively. Whole sample sizes were 2525, 2432, and 2408 in W1, W2, and W3, respectively.

TABLE 3 Bivariate Association Between W3 DWI in the Past Month and Its Correlates Among 12th-Grade Students: NEXT Generation Study, 2009–2012

	n	Weighted %	SE	OR	95% CI
Gender					
Female (ref)	584	12.36	2.55	1.00	—
Male	517	16.91	2.44	1.44†	0.92–2.26
Race/ethnicity					
White (ref)	768	14.58	2.66	1.00	—
Hispanic	147	14.10	5.19	0.96	0.35–2.64
Black	134	11.20	3.73	0.74	0.35–1.58
Other	48	21.52	8.55	1.61	0.51–5.04
Family affluence					
Low (ref)	184	9.07	2.99	1.00	—
Moderate	561	14.92	1.85	1.76	0.86–3.60
High	353	16.22	3.49	1.94†	0.88–4.27
Educational level (higher of both parents)					
Less than high school diploma (ref)	50	3.36	2.34	1.00	—
High school diploma or GED	198	14.23	3.61	4.77†	0.83–27.49
Some degree[a]	454	12.52	1.98	4.12†	0.91–18.67
Bachelor's or graduate degree	362	17.64	4.61	6.16*	1.46–26.03
Days driving in last 30 days	1110	—	—	1.03	0.99–1.07
Age	1100	—	—	1.11	0.74–1.68
Mother's monitoring knowledge (W1–W2 average)	1099	—	—	0.38***	0.26–0.56
Father's monitoring knowledge	1110	—	—	0.71**	0.57–0.88
Whether HED, W1 and W2					
Never	749	6.14	0.94	1.00	—
Yes at W1 or W2	348	28.59	5.34	6.12***	3.28–11.43
Whether drug use, W1 and W2					
Never	758	6.41	1.12	1.00	—
Yes at W1 or W2	343	28.45	4.59	5.80***	3.91–8.60
Driving licensure timing[b]					
W3 (ref)	351	13.98	3.07	1.00	
W1	335	18.75	3.00	1.42†	0.95–2.13
W2	415	11.70	2.19	0.82	0.49–1.35
RWI exposure timing[c]					
Never at all waves (ref)	530	1.12	0.54	1.00	—
W1	332	27.54	4.81	33.65***	10.25–110.49
W2	95	30.01	7.96	37.97***	13.40–107.55
W3	86	28.21	5.36	34.79***	13.07–92.65
RWI exposure amount					
Never at all waves (ref)	530	1.12	0.54	1.00	—
At only 1 wave	295	13.34	1.84	13.62***	5.37–34.58
At only 2 waves	138	33.74	8.28	45.08***	13.25–153.40
At all 3 waves	80	66.19	8.86	173.33***	44.92–668.90

* $P < .05$, ** $P < .01$, *** $P < .001$, † $0.05 < P \leq .10$. GED, general equivalency diploma; OR, odds ratio; ref, reference. —, indicates reference group for categorical variables and n/a for continuous variables.

[a] Some college, technical school, or associate degree.

[b] Driving licensure timing indicates when the students received their driving license.

[c] RWI exposure timing indicates when the first RWI occurred among the 3 waves.

TABLE 4 Adjusted Logistic Regression DWI in the Past Month Among 12th-Grade Students: NEXT Generation Study, 2009–2012

	W3 DWI	
	AOR[a]	95% CI
Driving licensure time		
W3 (ref)	1.00	—
W2	0.89	0.53–1.52
W1	1.83*	1.08–3.08
RWI start time		
Never (ref)	1.00	—
W1	21.12***	6.07–73.42
W2	19.97***	7.43–53.68
W3	30.52***	30.52–104.56
RWI amount		
Never (ref)	1.00	—
At only 1 wave	10.89***	3.49–34.01
At only 2 waves	34.34***	10.10–116.77
At all 3 waves	127.43***	28.84–562.94

* $P < .05$, *** $P < .001$. ref, reference.

[a] Controlling for gender, family affluence, parental education, mother's and father's monitoring knowledge, whether HED at W1 or W2, and whether drug use at W1 or W2.

prospective association between RWI and exposure to alcohol/drug-impaired drivers, DWI was found in a shorter time span (ie, between 10th and 12th grades), and there was a dose-response association. Notably, all associations were independent of important confounders such as HED, drug use, and parental knowledge monitoring. Although the social learning framework is a plausible explanation, additional research is needed to prove it.

The other notable finding is that early driving licensure is independently associated with increased DWI; in other words, late licensure may protect against DWI. The effect of age on young driver crashes has been widely studied, with a consensus that the novice teenage drivers were more likely to engage in risky driving[39] and had higher crash rates than older teenage drivers.[28,39] However, it is unclear if early driving licensure will lead to risky driving such as DWI or if this association is simply a product of opportunity (eg, earlier licensure increases opportunities to drive and drink), or if there is something about those who get licensed early, such as a general pattern of precocious behavior or a lack of parental supervision, that also contributes to the likelihood of DWI.

We realize that our study is not without its limitations. First, our measures of driving while impaired and riding with an impaired driver did not distinguish between drinking and driving versus using drugs and driving. Thus, it is not possible to know the extent to which teenagers were using alcohol or drugs separately or in combination. Second, the RWI measure did not specify if the driver who was RWI was a teenager or adult or the respondent's parent. Third, we did not measure peer influence on teenagers' DWI and this could also be an area for future research.

Despite these limitations, our study has important developmental, educational, legal, and health policy implications. First, from a developmental perspective, earliness of exposure to risk factors such as RWI and early driving licensure is a particular problem because adolescents may be particularly impressionable, these early experiences can become "normal" behavior, and the earlier one is exposed to driving the greater the ultimate exposure, thereby increasing risk. Second, primary prevention of alcohol use in adolescents may be an important element in teenage DWI and RWI prevention. Therefore, the goal of primary prevention policies and programs is to reinforce the community disapproving of drinking and driving.[40,41] Third, role modeling of drivers in DWI could be 1 area in DWI prevention. Community- and/or school-based programs combining education, peer-to-peer persuasion, and parental monitoring should target both adult and teenage drivers by emphasizing a role model for safe driving. Fourth, delaying teenage driving licensure may be beneficial to both reductions in temporal driving crashes and less likelihood of future DWI. Previous research indicates that teenage drivers have noticeably higher crash rates than do older drivers, and crash rates in the first year of driving are substantially higher than in the second and third years, especially for adolescents.[28] Furthermore, states with policies that delay licensure may also have more strict laws about drinking and driving and may have stronger enforcement of those laws. Fifth, traffic safety and public health would benefit from multidimensional and multilevel interventions including educational, environmental, and policy measures that would delay underage drinking beyond the age of 21 years,[42] coupling the application of graduated driving licensing laws with use-and-lose laws (laws that allow for the suspension of a driving license for underage alcohol violations including purchase, possession, or consumption).[43]

CONCLUSIONS

The exposure to RWI and early licensure increase the likelihood of DWI among adolescents. Greater attention to RWI prevention is warranted.

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Pediatrics originally published online March 17, 2014;

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