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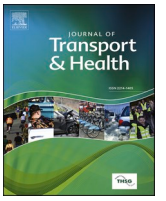

Driver vehicle crashes and mental health challenges among commuter college students

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ABSTRACT

Introduction: Previous research into the sociodemographic correlates of driver crashes has highlighted the variables of age, sex, and socioeconomic status, however, limited scholarship reports on the relationship between crashes and mental health.
Methods: As part of the baseline data obtained from a randomized controlled trial to study interventions to change commuter behavior, we gathered self-reported driver vehicle crashes from the past four months and self-reported mental health status over the past 30 days from a subset of commuter college students who drive.
Results: We found that the average number of mental health challenged days was 9.9 per month, and the rate of being in a driver crash within the past four months was 7.6%. We found that the number of days of mental health challenges was positively correlated with having been in a driver crash in the past four months in both bivariate and multivariate analyses.
Conclusion: We note that causality is feasible in both directions in this case, i.e., being in a crash could depress mental health, and having poor mental health may also increase the likelihood of being in a crash while driving, in a manner similar to distracted driving. This study supports previous research that struggles with mental health problems may have a relationship with the likelihood of being in a crash while driving.

1. Introduction

Motor vehicle crashes are a significant cause of mortality and morbidity in the United States, and they are among the leading causes of mortality among young adults. The National Highway Traffic Safety Administration (NHTSA) reports that in 2020, 38,824 people were killed and 2.28 million injured in motor vehicle traffic crashes (Stewart, 2022). Historically, fatalities from motor vehicle crashes per mile declined from 1975 to 2011, but since 2011 annual fatalities per 100 Million vehicle miles traveled (VMT) have remained about the same at 1.34 per 100 (VMT) (Stewart, 2022). Improvements to vehicle safety contributed to much of the decrease in the latter part of the 20th century. Still, safety experts are now looking for other means to improve safety outside of the vehicle, such as infrastructure improvements. Some primary causes of fatal and injury crashes in the United States include alcohol-impaired driving, failing to use one's seatbelt, and excessive speeds (Stewart, 2022).

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1.1. Young adults and vehicle crashes

Young adults (ages 16–35) are known to be a higher risk group for being in a crash while driving (Hasselberg and Laflamme, 2003; Kristensen et al., 2012; Mőller et al., 2021). Previous data have found that crashes per million miles are four times higher for drivers aged 16–19 than those aged 20 or older (Braitman et al., 2008). Over the ten years from 2011 to 2020, the 25–44 age group saw the most significant increase in driver vehicle crashes fatal crashes (+33%) (Stewart, 2022). Young adults were more likely to be in a driver vehicle crashes for several reasons, including inexperience with driving, driving under the influence of alcohol or other drugs, and a greater propensity to take risks while driving (Alver et al., 2014; Beck et al., 2013; Braitman et al., 2008; Kristensen et al., 2012; Mőller et al., 2021). The Insurance Institute for Highway Safety reported that teen drivers have crash rates nearly four times those of drivers 20 or older per mile driven and that alcohol is an exacerbating factor in teen crashes (Insurance Institute for Highway Safety, 2023).

1.2. Demographic and socioeconomic correlates of crashes

Compared with the voluminous literature on the built environment correlates of vehicle crashes, there is less literature on the demographic and socioeconomic correlates of such collisions (Merlin et al., 2019). Demographic correlates of crashes that have been relatively well established include gender, age, and socioeconomic status. Men are involved in significantly more driver crashes than women, across numerous studies (Alver et al., 2014; Hasselberg and Laflamme, 2003; Kristensen et al., 2012; Mőller et al., 2021). As mentioned in the previous paragraph, younger and less experienced drivers are more likely to be in crashes. Several studies in the US and other countries have investigated the relationship between socioeconomic status and driver crashes. Harper et al. (2015) examined all types of motor vehicle crash fatalities in the US from 1995 to 2010, examining mortality rates per population and mile of travel for those aged 25 and above. They noted a general decline in mortality of 15–25% but increasing inequality over time, with greater reductions among college graduates and no decreases among those with less than a high school diploma. Hasselberg and Laflamme (2003) examined socioeconomic background and road traffic injury among young car drivers in Sweden. Among younger drivers, injury risk was exceptionally high during the first years people are eligible to drive, and injury crashes are more likely among lower social classes, including unskilled workers, the self-employed, and farmers, as well as among the groups with lower educational attainment; however, they found no relationship between injury crashes and income quartiles. Moller et al. (2021) conducted the DRIVE study in Australia, following a cohort (n = 20,806) of young drivers for up to 13 years. Among their study subjects, they note that lower socioeconomic status (SES) was correlated with multiple crash types and crash outcomes, with significant inequalities for crashes requiring hospitalization, crashes in rural areas, and crashes on high-speed streets. Moller et al. (2021) noted that persons with lower SES may be more likely to be in crashes and injured in crashes due to poorer vehicle quality and poorer infrastructure quality in disadvantaged SES areas. Metzger et al. (2020) investigated the difference in vehicles among different age groups and census tract income quintiles in New Jersey. They found that younger drivers and drivers from lower-income areas are more likely to drive older vehicles, vehicles without electronic stability control, and vehicles without side air bags.

1.3. Mental health and driver crashes

Several researchers have investigated the link between driver vehicle crashes and mental health. It should be noted that all reviewed papers were cross-sectional, and therefore that causal relationships cannot be inferred from existing studies. However, past researchers have speculated that causality could flow in either direction in terms of the relationship between crashes and health; being in a car crash could lead to adverse mental health outcomes (Kenardy et al., 2015), and it is also plausible that suffering from mental health issues could increase the risk of being in a car crash. Williams et al. (2015) examined the first possibility of whether being in a car crash affects mental health outcomes in teens. With data collected using a single point-in-time survey, they asked whether teens have ever been in a serious motor vehicle crash while also asking about mental health issues experienced within the last 6 months. Their work finds bivariate associations between Post Traumatic Stress Disorder (PTSD), major depressive episodes, alcohol abuse, drug use, and crash history. However, when controlling for multiple variables within a logistic regression, they found that younger adolescents had only a higher incidence of depression after being in a crash. In comparison, older adolescents were more likely to abuse alcohol after being in a crash, with other associations being insignificant. Braitman et al. (2008), conducted a retrospective study among novice teen drivers in Connecticut involved in a crash. Data from police reports after these crashes were evaluated within 17 weeks of the incident; authors found that potential contributing factors to the crashes included inattention, distraction, and speeding. Rowden et al. (2011) examined life stress and driver stress with a series of self-reported surveys in a cross-sectional analysis and discovered that both are associated with unsafe driving acts. More specifically, they find that the self-reported negative affect factor from a Driver Stress Inventory is associated with reported driver lapses and errors. Generally, we found few studies examining the relationship between mental health and being in a driver vehicle crashes, and we uncovered none focusing specifically on the commuter college student population.

1.4. College student mental health Trends and the impact of COVID-19

The mental health struggles of college students have increased over the past several years (Duffy et al., 2019). For instance, in assessing two national datasets of college student mental health, Duffy et al. (2019) found doubling prevalence rates of mood disorders, anxiety, and suicidal ideation between 2007 and 2018. Additionally, Frazier et al. (2023) found a significantly higher increase in prevalence rates of depression and stress between spring 2017 to spring 2020. This increase in mental health struggles has not been met

with a similar increase in counseling treatment utilization for all students (Lipson et al., 2022). Furthermore, the stresses brought on by the COVID-19 pandemic and its aftermath have compounded these struggles.

Through the disease's effect on psychiatric symptoms and limitations on socialization, COVID-19 had a significant negative impact on the mental health of college students and young adults. For example, college students reported increased isolation, the need for relocation, distance learning, social distancing, anxiety and health-related stress, and the economic fallout of the pandemic all having an impact on their mental health (Liu et al., 2022). Loneliness and other mental health issues such as anxiety, depression, and post-traumatic stress symptoms, were reported at elevated levels by college students as the pandemic continued (Conrad et al., 2021). Furthermore, pre-existing mental health concerns (e.g., worry, grief, lower mental health quality of life, worse sleep) of college students were often exacerbated during the pandemic (Liu et al., 2020). Importantly, as students relocated away from college campuses, access to face-to-face mental health treatment was limited (or interrupted) as counseling centers made the conversion to online services (Liu et al., 2022). This interruption, coupled with decreased utilization, likely left many college students without adequate mental health support.

Empirical studies on the long-term consequences of the pandemic on mental health are not yet fully developed. However, Wathelet et al. (2022) reported that 15 months post onset of COVID-19 in France, the prevalence rate of suicidal ideation increased from 10.6% to 13.8%. During this same period, stress increased 2.5% and depression increased 22.2% among college students in this sample (Wathelet et al., 2022). Furthermore, Abrams (2022) stated that college students continued to mourn the loss of a traditional college experience throughout their matriculation if they started college during the height of the pandemic. The long-term toll of the pandemic on college students' mental health has not been documented completely in the literature.However, what is clear is that the pandemic interrupted the college experience of many young adults and that this experience likely impacted their mental health.

1.5. Research purpose and rationale

As part of a more extensive randomized-control trial research study, we gathered data on mental health and crashes for a commuter student population in South Florida. Our data gathering was primarily conducted in 2022, and therefore the context of the lingering COVID crisis and its impact on students looms over our study. The wider purpose of the research project was to understand how travel behavior influences student success at college, and if shifting travel behaviors to non-driving modes might support student success. Our general finding, published elsewhere, is that we were not able to shift students significantly to non-driving modes through our RCT intervention. However, we also discovered during this effort a high prevalence of self-reported mental health challenges among students and a high proportion of self-reported crashes. Students reported being in a crash while driving, while a passenger in a vehicle, while on transit, while biking and while walking, but only the crashes while driving were large enough for statistical analysis.

Our primary research question for this particular effort is whether there is a correlation between student mental health status and the student's likelihood of being in a vehicle crash while driving (i.e. a "driver vehicle crash"). This is because we know from personal experience that when students are in a vehicle crash it can be highly disruptive for their academic success and progress. Students attending commuter colleges are generally a more vulnerable population than the conventional student living full-time on campus in a dormitory. Commuter students are more likely to be lower income, to live at home, to be older or returning students, and to have other responsibilities outside of college such as parenting or taking care of adult family members. Therefore, the threat of a vehicle crash for these students can be particularly disruptive to their education at a critical time in their personal and professional development. If we can find cost-effective interventions to help students avoid being in a vehicle crash, we can ensure the academic success of a larger portion of students, consistent with the overall study goal. Mental health interventions or mental health services are conceivably one such potential intervention, if indeed student mental health status is linked with the likelihood of being in a driver vehicle crash.

We distinguish between a "motor vehicle crash" and a "driver vehicle crash" as follows. If a student is in a vehicle during a crash with another vehicle or a fixed object, then they have experienced a "motor vehicle crash," whether or not they were driving, i.e. including if they were a passenger. If a student is driving the vehicle while it experiences a crash, then they were in a "driver vehicle crash." For the purposes of this study, the vehicle involved can be any motorized vehicle, including car, SUV, truck or motorcycle. Moreover, for this study we have no crash severity information in our survey; we simply have binary information of whether or not the respondent was in a driver vehicle crash.

1.6. College student commuter drivers in South Florida and vehicle crashes

Our study population is defined as students who report that they commute by driving at least sometimes to a South Florida university campus. Vehicle crashes are particularly disruptive for this population for multiple reasons. Any time a person is involved in a vehicle crash, there is the risk of injury, monetary loss, and disruption to regular pattern patterns of travel. These disruptions are particularly stressful among the students who drive to campus because in general, these underserved students may be unable to pay the necessary car repairs or replacement in the wake of a crash (Klein and Smart, 2017). In addition, the public transit system in this area offers a limited network with infrequent service intervals (most lines run hourly during the day) and depending upon where the student lives and their course schedule, it may not be viable for them to commute to campus by transit. Lastly, the disruption of car crashes in terms of their impact on health, time, loss of income and increased expense can make it difficult for students to keep up with their coursework. Each of us has seen first-hand students derailed mid-semester due to a car crash, so our personal experience underlines the significance of these crash events on students' lives and academic performance. Students at commuter campuses such as the one under study are particularly vulnerable to the fallout from a driver vehicle crash, making this an appropriate population to study for this topic.

This study examines relationships between students' self-reported mental health and their experience of being in a driver crash. While our data are cross-sectional, we can explore the strength of the association between self-reported mental health issues and being in a crash while driving. The paper adds to the sparse literature on crashes and mental health. It fills a notable gap concerning the association between driver crashes and characteristics of young adults with less driving experience and higher rates of mental health challenges. The report proceeds with a discussion of our data source and analysis methods, then a section on results, followed by a narrative placing these results into a broader context, including consideration of possible policy responses to this challenge. The goal is to understand those demographic and mental health characteristics associated with crashes in the hopes of helping commuter college students avoid such detrimental events through preventative interventions.

2. Methods

The data for this study emanate from a randomized controlled trial (RCT) protocol [redacted for blind review] with students observed over six months (one semester) in 2022. The RCT aimed to understand if information and marketing could influence student mode choice in their travel to campus. The study setting included multiple commuter campuses in South Florida, but limited responses narrowed the scope to a single commuter university campus in South Florida. For this paper, among the n = 427 who completed the baseline survey, we only include students who commute to campus as drivers, who respond to the question of whether or not they had been in a driver crash in the past four months, and who respond to mental health question(s) (n = 289).

Demographic data for the student body enrolled at FAU were most recently reported for the 2021-22 academic year, which corresponds with our study period of spring 2022. In the 2021-22 academic year, FAU had 36,703 students. The racial distribution of the FAU student body was 39.8% White, 27.4% Hispanic, 19.5% Black, 4.5% Asian, while international students made up 3.9%. The reported gender breakdown was 59% female and 41% male. As of Fall (2021), 83.9% of students lived off campus.

After providing informed consent, students then completed an online survey during the January–March period of 2022, with survey questions and responses gathered through Qualtrics. The first participant started completion of the baseline form on January 11, 2022, and the last completion date was March 13, 2022. The survey included background information about the students, their travel behavior to campus, obstacles to alternative travel, and questions about their physical and mental health.

The baseline survey (n = 427) gathered descriptive data on students' commuting patterns illustrated in Table 1, Commuting patterns for FAU students. Most students drive alone at least sometimes, with 86.5% reporting driving alone at least once per week and 35.5% reporting driving alone five days per week. However, many students exercise alternatives to driving alone. 12.7% of students reported carpooling at least once a week, 9.3% of students reported using ride-hailing services at least once a week, 18.1% of students reported taking public transit at least once a week, and 8.0% of students reported walking or biking at least once a week. 84.7% of students reported coming to campus from home, but the remaining students reported occasionally coming to campus from work or other locations. The average commute was 39.7 min, with a median of 35 min.

The precise wording of the questions we asked on mental health is in Table 2: Health Variables below. The mental health questions were all derived from the 36-Item Short Form Health Survey (SF-36)[1]

A description of our data waterfall is in Table 3 below. A total of 468 students provided consent. We acquired demographic information from FAU; therefore, only FAU students are included in this study. When we filtered out FAU students only, the count was reduced to 443 respondents. Removing duplicates reduced this number to 427. Out of these 427 respondents, only 289 provided information on whether they were in a driver crash in the past four months. The data available for the statistical analysis varied a bit further depending on the number of students who answered specific demographic questions.

Table 4 below summarizes demographic data for the 289 respondents. There were approximately twice as many females than males responding. The gender categories were provided by the University and did not include any non-binary options. About 1/3 of respondents were first-generation students, and about 5.5% were Pell Grant recipients. The university defines a first-generation college student as any student neither of whose parents have yet obtained a degree from a four-year college of university. First-generation students are known to face distinctive challenges as college students since they may be less familiar with college policies and bureaucracies. Pell grants are US federal grants offered to undergraduate students with exceptional financial need. Students apply for Pell grants by filling out a US Free Application for Federal Student Aid (FAFSA). Pell grants are notable for being grants rather than loans, as much financial aid offered to US college students comes in the form of deferrable loans. The top four racial categories among the students were Hispanic at 30.6%, White at 30.2%, Black at 17.9%, and Asian at 6%. Furthermore, international students made up 10.4% of the current sample. Ages cluster around the traditional college ages of 18–22 but span from 16 to 63.

We conducted bivariate and multivariate analyses to explore the relationship between mental health conditions and crashes. For the bivariate analyses, we correlated various demographic variables, academic variables, and reported health variables with crashes. Because much of our data is binary (crash/no crash), we use the Wilcoxon Rank Sum Test to examine correlations while also reporting the group means for the crash and no crash groups. We report the correlation coefficient and p-value for each bivariate correlation, noting which ones reach a 10% significance level.

We run negative binomial models for multivariate analysis with the binary crash variable as the outcome. Negative binomial models are appropriate for binary outcome data and perform more accurately than Poisson models by permitting overdispersion. In the negative binomial variables, we control for demographic variables with *a priori* and empirical correlations with crashes. These

[1] See: https://www.rand.org/health-care/surveys_tools/mos/36-item-short-form.html for more on the 36-Item Short Form Survey (SF-36).

Table 1
Commute patterns for FAU students.

Drive at least once per week	86.5%
Drive 5/days per week	35.5%
Carpool at least once per week	12.7%
Ride-hail at least once per week	9.3%
Public transit at least once per week	18.1%
Walk or bike at least once per week	8.0%
Mean Commute Time	39.7 min
Median Commute Time	35 min

Table 2
Health variables.

Variable Name	Survey Question Language
Poor Physical Health Days	Now thinking about your **physical health**, which includes physical illness and injury, for how many days during the past 30 days was your physical health NOT good?
Mental Health Days	Now thinking about your **mental health**, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health NOT good?
Pain Days	During the past 30 days, for about how many days did **PAIN** make it hard for you to do your usual activities, such as self-care, work, or recreation?
Depressed Days	During the past 30 days, for about how many days have you felt **SAD, BLUE, or DEPRESSED**?
Anxious Days	During the past 30 days, for about how many days have you felt **WORRIED, TENSE, or ANXIOUS**?
Insomnia Days	During the past 30 days, for about how many days have you felt you did **NOT get ENOUGH REST or SLEEP**?
Healthy Days	During the past 30 days, for about how many days have you felt **VERY HEALTHY AND FULL OF ENERGY**?
Days Constrained Activity	During the past 30 days, for about how many days did poor **physical or mental health** keep you from doing your usual activities, such as self-care, work, or recreation?

Table 3
Data waterfall.

Stage	Participants
Provided consent	468
FAU Only	443
Duplicates Removed	427
Drive Commutes and Provided Crash Data	289
Include Demographic Data	268–289

Table 4
Sample demographics.

Demographic	Count (n = 289)	Percent
Female	196	67.8%
Male	93	32.2%
First Generation	94	32.5%
Pell Grant Recipient	16	5.5%
Hispanic	82	30.6%
White	81	30.2%
Black	48	17.9%
Domestic Students	211	89.6%
International Students	28	10.4%
Asian	16	6.0%
Under 18	6	2.2%
Age 18-22	149	55.2%
Age 23-30	70	25.9%
Age 30+	45	16.7%

NB: Totals do not add to n = 289 due to missing data on some fields.

variables include the student being a Pell Grant recipient, first-generation student status, and age. Previous literature suggests that disadvantaged socioeconomic status may be associated with an increased probability of being in a crash. Pell grant recipients and first-generation status variables serve as proxies for socioeconomic disadvantage. Younger age is also generally associated with increased crash risk, especially for drivers under 25. We also planned to control for gender, with men usually demonstrating high crash rates; however, in our data set, the gender variable was not statistically associated with crashes, so we did not include it as a control.

3. Results

Out of 289 students who drive and reported their crash data, 22 informed us that they were in a vehicle crash in the last four months, comprising 7.6% of students completing the survey. The unexpectedly high frequency of crashes among students provided part of the impetus for pursuing the present study. As a matter of comparison, National Safety Council estimates[2] from 2018 that the average driver had a 10.6% chance of being in a crash each year, or about a 3.5% chance within a four-month window as the question asked. However, the same data show similar crash rates per year to our sample for drivers aged 16–19.

We also found exceptionally high rates of reported mental health issues among respondents ($n = 289$). The mean days stated (per month) not physically healthy was 2.1, not mentally healthy was 9.9, days depressed was 8.7, anxious days was 12.0, days with insomnia was 12.7, days with limited activity due to poor health was 7.7, days in good physical and mental health was 11.0.

Table 5 illustrates the results of the bivariate analyses. Multiple self-reported mental health variables related to adverse mental health conditions correlate with $p < 0.10$ with being in a driver crash. These include reported Mental Health Days, Insomnia Days, Poor Physical Health Days, Anxious Days, and Depressed Days. Meanwhile, the number of Healthy Days negatively correlates with being in a driver crash. Mental health variables not associated with $p < 0.10$ include Poor Physical Health Days and Days in Pain. Persons in the group reporting a vehicle crash have approximately five additional Mental Health Days, four additional Depressed Days, four additional Anxious Days, seven additional Insomnia Days, four additional Days Constrained Activity, and six fewer Healthy Days than persons who did not report a vehicle crash. Note that while many of the mental health variables have modest correlations with each other, strong correlations ($\rho > 0.70$) are only present between Mental Health Days and Depressed Days ($\rho = 0.83$), Mental Health Days and Anxious Days ($\rho = 0.78$), and Depressed Days and Anxious Days ($\rho = 0.75$).

Other non-health variables were also statistically significant at the 10% level. Students who cared for an adult were more likely to be in a driver crash ($p = 0.023$); meanwhile, students with a higher GPA were less likely to be in a driver crash (average GPA for the crash group: 2.82; for the non-crash group: 3.29). In most studies, men are more likely to be in a crash than women taken from the same population; however, in this case, the gender variable was not significant at $p = 0.10$ and displayed a slight negative association with crashes. Pell Grant and first-generation variables, considered proxies for socioeconomic disadvantage, were statistically significant at the $p < 0.10$ level. Students reporting Hispanic racial heritage were likelier to be in a vehicle crash at $p = 0.065$. Age was negatively associated with being in a crash, consistent with the hypothesis that older drivers are less likely to be in a crash. Still, it was not significant at the 10% level. Other non-significant variables include Black race, parental status, holding a full-time job, and driving time from home to the University.

In Table 6, we display marginal effects from negative binomial regression for variables found to be statistically significant in the bivariate regressions. The table is organized into mental health variables in the top section and other variables in the bottom section to display different marginal effects. The number of observations varies for each binomial regression because students did not answer all questions. In the regression results in Table 6, the control variables are Pell Grant status, first-generation status, and age. First-generation and Pell Grant status are thought to be proxies for socioeconomic disadvantage. We included age as a control variable because crash risk has been shown in the literature to decrease with age and driving experience.

All variables that suggest mental health challenges continue to show positive associations with crashes, while the reported number of Healthy Days demonstrates a negative association. Among the mental health variables, only Mental Health Days and Healthy Days are significantly associated with crashes ($p < 0.05$). For each additional day with poor mental health, the percentage increase of being in a crash over the past four months is 5.0%. Likewise, for each reported day feeling very healthy, the percent decrease of being in a collision over the past four months is 7.7%.

After adding the control variables, the “cares for adult” variable is no longer statistically significant. However, if the coefficient estimate is accurate, it suggests that students who care for an adult may experience more than double the crash risk. GPA remains statistically significant, and the coefficient can be interpreted as a 39% reduction in crash risk for every 1.0-point increase in GPA.

4. Discussion and conclusion

To reiterate our main argument, commuter students are particularly vulnerable to the fallout of a driver vehicle crash, which can have transportation, financial, and health impacts, all of which in turn can disrupt a student’s education. We have studied a population which is highly dependent on vehicle commuting, in part because of an inadequate public transit system in the south Florida area. We have found multiple positive correlations between self-reported mental health challenges and frequency of being in a driver vehicle crash. What we focus on now are the potential underlyng reasons or causes for this correlation, and what, if anything, can be done to address such causes.

As our data is cross-sectional, we cannot infer any causal relationship relative to the question of whether mental health challenges increase risk of crashes or whether being in a crash increases risk of mental health challenges. However, as we see a positive correlation between self-reported mental health challenges and driver vehicle crashes, a relationship is feasible. One plausible explanation for the observed association between mental health and crashes is that individuals with reports of anxiety or depression-like symptoms may be distracted and/or exhausted by negative thoughts or emotions that impair the ability to stay focused. For example, instead of remaining focused on the task at hand, an individual may have a mind that wanders onto other thoughts or emotions associated with a

[2] National Safety Council Injury Facts, https://injuryfacts.nsc.org/motor-vehicle/overview/age-of-driver/, accessed June 27, 2023.

Table 5
Bivariate analysis of factors associated with driver crashes (N = 289).

Variable	Crash Group Mean	No Crash Group Mean	Wilcoxon Rank Sum Test p-value
Mental Health Variables			
Mental Health Days (Q102)	15.26	9.72	0.007
Depressed Days (Q104)	12.00	7.64	0.017
Anxious Days (Q105)	12.40	16.25	0.060
Insomnia Days(Q106)	11.44	18.38	0.008
Healthy Days (Q107)	5.48	11.44	0.002
Days Constrained Activity (Q110)	11.38	7.17	0.027
Other Variables			
Cares for Adult	36.4%	16.9%	0.023
GPA	2.82	3.29	0.007
First Generation	50.0%	31.1%	0.069
Pell Grant	13.6%	4.9%	0.085
Hispanic	45.5%	27.0%	0.065

NB: Only variables with a p-value <0.10 are shown.

Table 6
Marginal effects from negative binomial regressions.

Variable	Pct Increase per Day	p-value	Observations
Mental Health Days	5.0%	0.039	242
Insomnia Days	4.3%	0.070	247
Days Constrained Activity	4.2%	0.082	202
Anxious Days	3.1%	0.144	245
Depressed Days	2.9%	0.227	242
Healthy Days	−7.7%	0.021	247

Variable	Multiplicative Effect	p-value	Observations
Cares for Adult	216%	0.10	268
GPA	61%	0.04	256

N.B.: (Controlled covariates include Pell Grant status, First Generation status, and age).

negative mood (Albert et al., 2022). Negative thoughts may include ideas that they did not do well on an exam, they let someone down, or feel hopeless about the future; thus, their focus is directed at these thoughts and the associated emotions. As a result, this distraction can interfere in areas where it is inconvenient to be distracted (i.e., in the classroom or while driving, among many other areas) and continued rumination may have a significant impact on functioning. This creates a feasible connection between impaired mental health and effective safe driving.

To highlight this, Albert et al. (2022) reported that young male drivers were 1.79 times more likely to have wandering minds when they reported negative mood comparted to those who did not report negative mood at follow-up. Likewise Alavi et al. (2017) found, in a sample of 800 Iranian drivers ages 24–81, that those reporting anxiety and depression were 2.7 and 2.4 times more likely to have crashs. Thus, the current study supports previous research that struggles with mental health problems may have a relationship with the likelihood of being in a crash.

Another plausible explanation of the association between mental health and crashes is that vehicle crashes can be quite devasting to the college student population and their academic performance, which can impact mental health. In addition to potential consequences for health, students may experience financial difficulties and an interruption of their ability to commute to classes. Our anecdotal experience is that being in a car crash is one of the most severe and frequent interruptions college students can experience. Crash episodes can threaten students' academic progress and on-time graduation.

Whether mental health challenges increase the likelihood of being in a crash or whether being in a crash exacerbates mental health challenges is unresolved by our study and an appropriate topic for future research.

Given these threats to students' well–being and educational success, it may make sense to prioritize on-campus housing for those students at the greatest risk for disruption – Pell Grant and first-generation students. These students presumably have the least financial cushion and are at the highest risk for academic trouble if they are in a crash. Prioritizing on-campus housing for students at the most significant risk may be one way to mitigate the potential risk of being in a vehicular crash for the commuter student population. Currently, this university prioritizes on-campus housing on a first-come, first-served basis with an early application window for incoming first-year students.

Secondly, campuses with many commuter students could offer free or discounted safe driver education programs as part of their support package. In our student sample, we found that 7.6% of students were in a crash where they were a driver within the past four

months. If we can extrapolate, that would generalize to about a 20% crash rate yearly. Although not all crashes are severe, this would appear to pose a significant risk to the commuter student population. Our sample may be biased downwards (understating crash risk) because students in a traumatic crash may have already dropped out and not participated in our survey. If universities can take a proactive approach to mitigate crash risks for commuter students, it could result in meaningful improvements to educational outcomes, such as graduation rates or higher GPAs.

Thirdly, campuses could offer improved transit access to campus, free or discounted transit passes, and information concerning housing along transit-friendly routes (Ralph and Brown, 2019; Rodriguez and Rogers, 2014). By providing transit alternatives for commuter students, colleges can help save students money and reduce the high costs of a student-involved vehicle crash. In addition, shifting students from driving to public transit also reduces campus-related greenhouse gas emissions.

Finally, the higher prevalence of crashes among students with mental health challenges suggests the need for providing accessible, affordable, quality mental health services and health care in general to students on college campuses. As discussed earlier, college student mental health is already a challenging issue worsened by the COVID crisis. The possible link between students experiencing mental health challenges and the potential heightened risk of a driver vehicle crash creates further urgency around addressing the mental health needs of commuter college students.

While the campus under study already provides free walk-in and by-appointment mental health access to students at the student counseling center, service expansions and improvements are possible. To accommodate the mental health needs of college students, some college counseling centers have transitioned to offering additional remote services to students in need. Hersch et al. (2024) described increased accessibility and convenience and higher adherence to treatment with remote mental health services to college students during the pandemic. Additionally, some colleges and universities in the United States found support from private mental health companies to meet the demand for counseling services for their students, which are available to students 24/7 (Matherly, 2024). If the availability of treatment providers increases with more remote treatment options the number of students who could be reached could grow.

The research is strengthened by its specific context – a commuter-oriented university in South Florida in 2021 (in the later stages of COVID) where most students drive to campus. Crashes may not be as much of an issue in settings where students are more likely to walk, bike, or take transit to reach campus. The high reports of mental health issues among our students seem to be a common phenomenon among United States college campuses in the post-social media era (Duffy et al., 2019). The results are limited by the relatively small sample size of about 289 respondents who reported their crash status. Also, notably, crash severity data are lacking in our sample. Lastly, and perhaps most importantly, the cross-sectional nature of the data limits the ability to make inferences about causality. In particular, panel data on college students and crashes would be helpful for inferring whether or not mental health plays a significant role in increasing the likelihood of student driver crash risk.

Research into this topic could be improved by including mental health questions when surveying young adults concerning the demographic correlates of crashes or by including questions about roadway crashes when conducting surveys concerning the mental health status of college students, such as the Healthy Minds Study (*Healthy Minds Study, n.d.*). The link between mental health and roadway crashes is a relatively unaddressed topic, so it is unclear at this time how significant the relationship between these two phenomena is. A prospective study that ascertained students' mental health status and then followed up around a year later to determine which students had been in driver crashes would be well suited to shedding some light on the possible causality between mental health and crashes.

CRediT authorship contribution statement

Louis A. Merlin: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **David A. Simpson:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis. **Katherine Freeman:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **John Renne:** Writing – review & editing, Writing – original draft, Project administration, Investigation, Conceptualization. **Serena Hoermann:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Investigation.

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Declaration of competing interest

Declarations of interest: none.

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